

GREEN CARS EXPLAINED

In these austere times, investing in a "green car" has never made more sense. You can avail of the government car scrapage scheme, pay lower road tax, enjoy lower running costs... the list of benefits goes on!

But what does the term "green car" really mean? The biggest environmental gains often come from simple, common-sense means and what is green car technology?



But, even more complicated green cars, such as hybrids, are constructed as simply as possible - to be serviceable, reliable and cheap to produce.

What's more, there are often welcome side effects.

Refined electric cars

Electric cars, for example, are among the most refined models you can buy, as there is no noisy engine to break the silence.

Some hybrids have impressive pull off the line, thanks to the electric motor they use to assist the conventional engine.

Simple stop-start systems makes stopping at traffic light more peaceful.

More complicated green-car technologies are under development, but makers admit building cars that perform keenly and reliably isn't a problem. Fuelling them, though, may be.

Here, we look at the technology that is - and will be - used to turn our cars greener.

Hybrid cars

Conventional cars are driven by either a petrol or diesel combustion engine.

What hybrid cars do is to add an electric motor to this engine - an extra drive source, which, through intelligent energy management, can support or even substitute for the combustion engine.

Parallel hybrid cars



The Honda Civic IMA is a 'parallel' hybrid

There are two types of hybrid system. The first, a 'parallel' hybrid (such as the Honda Civic Hybrid), uses both the engine and the electric motor together to power the wheels.

The electric motor assists the engine, allowing the carmaker to fit a smaller and more economical combustion unit than they might otherwise have done.

Because the motor does some of the work, there's less load on the engine, which improves fuel consumption, and the motor works as both a starter and an alternator, shutting the engine down while the car is stationary.

Batteries power the electric motor, but they don't have to be plugged into the mains to recharge. Instead, every time the car slows down or the brakes are applied, the electric motor reverses, turning into a generator to recharge the batteries.

However, a key failing of parallel hybrids is that, as the electrical source is a combined motor and generator, it cannot power the car on its own.

This means 'zero-emissions' running, without using the combustion engine, is not possible.

Series hybrid cars

The alternative is the 'series' hybrid car, which gets its name from how power flows to the wheels.

This uses the engine to drive a generator, and the electricity created by it drives an additional electric motor, which then drives the wheels.

The engine is not directly connected to the wheels, and can always operate at the maximum efficiency for the best fuel consumption.

The most effective hybrid cars combine the benefits of both these systems in a series/parallel system.

The Toyota Prius is the most well-known example of this, and it is able to run using its electric motor alone. This can happen at low speeds, for genuine zero-emissions driving in city centres, though the range is very short.



Parallel hybrids use the engine as their main power source, operating it far more than the electric motor.

Series hybrid cars, which use the engine to drive the electric motor, have an even split between the two, but

series/parallel hybrids swap continuously between them - with times when they use just the electric motor, just the engine, plus a large period when they work together.

This is because they adapt to the conditions, so they can always find the most efficient solution - when engine efficiency is low, the electric motor is used, and vice-versa.

Diesel hybrid cars

The benefit of hybrids over petrol cars is not as great in Europe as it is in Japan and the US. That's because we have embraced diesel cars, which are up to a third more efficient than petrol models anyway.

This puts them on a par with current hybrids for overall economy - and they're often more efficient at motorway speeds, not to mention much cheaper to buy.

Diesel hybrid



Peugeot's diesel hybrid was launched in 2010

The obvious next step was the diesel hybrid, and Peugeot launched this earlier in the year a 308 family hatchback, which will see returns of 83mpg and emit 90g/km CO₂, while remaining a full five-seater.

Its Nickel hydride batteries have been packaged into the spare wheel well, so there is no loss of boot space (a common problem with hybrid cars), while the electric motor has been incorporated in the engine bay.

The emphasis has been on simplicity, to keep production costs down. The key gain is in driving around town, where the ability to drive on battery power alone reduces fuel consumption by 58%.

This also removes one concern over diesel cars - namely, their higher emissions of certain pollutants in city centres - as, naturally, emissions when running on electric power only are zero.

Lower consumption

For urban driving, Peugeot claims 94mpg and CO₂ emissions of 80g/km. Overall fuel consumption is reduced by 38%.

The diesel engine is Peugeot's excellent 110bhp 1.6-litre unit, coupled to a 22bhp electric motor.

It complies to the new Euro V emissions standards, and the hybrid model is said to be faster during in-gear acceleration than the standard diesel-powered car, as the electric motor boosts power by 31bhp.

Hydrogen hybrid cars



BMW has a hydrogen model in production

Hydrogen - which produces only water when burned - is a potential future fuel, but not yet a practical choice.

It is made by a process called hydrolysis, which requires energy from power stations, so for now it's no more carbon-neutral than producing fuel from oil.

In the future, however, scientists envisage green production of hydrogen, with the power for the process supplied by renewable means.

BMW has led the world in hydrogen technology, and has even put a model fuelled by hydrogen into production.

The Hydrogen 7 is based on the existing 7 Series, but its conventional petrol engine has been converted to use hydrogen as well as petrol.

The result, when running on hydrogen, is exhaust emissions of only water. Performance suffers a bit compared with the standard car, and the tank range isn't great, but the company still sees the Hydrogen 7 as a viable step towards zero-emission vehicles.

Hydrogen hybrid concept

Mazda has gone one stage further and developed a hydrogen hybrid concept. This uses a rotary engine that, as in the BMW, will run on hydrogen.

But it also has an electric motor, which is powered by lithium-ion batteries and boosts the power of the hydrogen engine by 40%. As with today's hybrids, running the electric motor in reverse turns it into a generator, recharging the batteries.

The Mazda system is a parallel one, like the Honda Civic Hybrid's, which means that running under electric power alone is not possible: the electric motor assists the constantly running engine, rather than substituting for it.

But Mazda still sees this as a 'green' way of overcoming the lower power outputs associated with hydrogen, as well as ensuring that no harmful emissions come from the exhaust.

Hydrogen fuel cell cars

A fuel cell car powered by liquid hydrogen is the zero-emission car of the future that many carmakers envisage.

It's a simple premise: take an electric car, powered by batteries and an electric motor, and install a hydrogen fuel cell (which generates electricity from the chemical reaction between hydrogen and oxygen) that can extend the range when the batteries go flat.

The thinking is little different to that behind the Toyota Prius, except that here it is the fuel cell adding to the range of the electric motor, rather than a combustion engine.

Zero emissions



This is a prototype of Renault's Grand Scenic ZEV H2

Earlier this year, Renault showed the Grand Scenic ZEV H2 concept, a fuel cell version of today's Grand Scenic.

A compact fuel cell sits below the front seats, with batteries installed in the floor below the rear passengers.

The electric motor is under the bonnet, with the hydrogen tank occupying part of the boot. The car always runs on electric power, so it is silent and creates, literally, zero emissions.

As the batteries flatten, the hydrogen fuel cell recharges them, thanks to the process of electrolysis. The only by-product of this is water.

Renault says that, even today, this gives a total range of 250 miles on a tankful of hydrogen. In the future, the company says that this will be nearer to 400 miles.

The attraction of the system is mechanical simplicity, plus controls that will be familiar to current car drivers.

Also, as the technology becomes more compact, it will be possible to install it in smaller models. However, there are plenty of problems to overcome before such a dream can become a reality.

Production costs remain prohibitive, for a start, and a hydrogen refuelling infrastructure is crucial for a hydrogen-powered car to be viable.

It is also important that a renewable means of making the hydrogen is developed. Nevertheless, the fuel cell is still an avenue many carmakers are investigating.

Stop-start systems



Stopping the engine usually shuts down car electronics

The simplest ideas are often the best. For instance, when a car is stopped, there's no need for its engine to be running, so why not turn it off?

Often, the reason is because it's inconvenient, disruptive and means the radio, sat nav, heater, lights and other controls will also shut down.

Stop-start systems get round this by automatically turning the engine off when they sense it is worthwhile to do so - and, of course, automatically restarting it again.

Crucially, though, the system leaves all the car's ancillaries undisturbed.

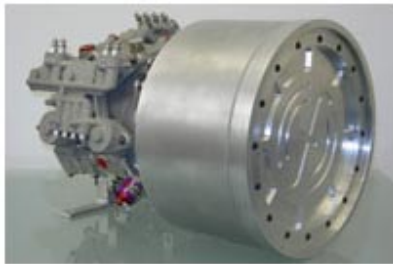
In a manual car, the driver primes it by selecting neutral when the car comes to a standstill. The engine then shuts down, and starts up again - seamlessly - when the driver pushes the clutch.

Official figures claim the saving on overall fuel consumption by doing this is 5%, with up to an 8% saving possible in town.

Stop-start isn't new - VW introduced it on its 'Umwelt' Golf back in 1991.

But, more recently, the BMW Group has popularised such systems, selling over half a million stop-start BMWs and Minis since 2006, and many more makers are now bringing the technology to market.

Brake energy regeneration



The 'KERS' system is also used in Formula 1 racing

When a car is moving, it has what is known as kinetic energy, but when you slow down, you lose some of that.

The theory behind brake energy regeneration is to harness the energy lost when lifting off the throttle or pressing the brake pedal, and to convert it into electricity.

Electric and hybrid cars already use such systems to recharge their batteries: their electric motors 'reverse', turning into generators which convert kinetic energy into electrical current. This is fed into the batteries, extending their range free of charge.

BMW has a more subtle form of brake energy regeneration: the alternator is only connected to charge the battery during braking.

Reduced engine load

This does not harness kinetic energy as such; but, because the alternator only draws current when there is no other demand for power on the engine, it reduces the load on the engine overall. BMW says this reduces CO2 emissions by 3%. Audi will also introduce a similar 'intelligent energy management' system on newer models.

This isn't just for road cars, either. Kinetic energy recovery is also used in F1 motor racing.

The 'KERS' system will take excess energy and store it either electrically or in a flywheel, to provide extra performance for limited periods.

Gearbox and aero tweaks

'Intelligent' gearchange indicators



Small add-on tweaks have aerodynamic benefits

The idea here is to 'tweak' conventional cars to be as green as possible, without the high cost of futuristic technology.

Longer gearing is the most obvious trick. Volkswagen, for example, stretches the ratios on third, fourth and fifth gears in its BlueMotion models, meaning their engines are spinning more slowly at a given speed than similar cars'.

Lower engine speed translates directly into lower emissions. A Renault engineer told us that, even if there is no load on the engine, 'less rpm always means better fuel consumption.'

The engine calibration is usually modified, too, so the car runs better with these altered gear ratios.

Also, many companies fit a gearchange indicator to encourage early upshifts. Such devices, a Ford engineer told us, are 'intelligent', responding to engine load, rather than being rev-based indicators. So they are well worth adhering to.

Tweaking aerodynamics

The car's aerodynamics are massaged as well, creating a more 'slippery' shape that takes less effort - and therefore less fuel - to push through the air.

Many cars have special flat underbodies, like a race car, to ensure the airflow is not disturbed, and the suspension is often lowered to reduce drag.

Rear spoilers also help smooth the flow, while tiny add-on tweaks here and there have subtle, but tangible, benefits in the wind tunnel.

Other detail changes, such as closing up the front grille (on some BMWs, this is done electronically, according to how hot the engine is) and fitting flush aerodynamic wheel trims, mean the car passes along the road with minimum air resistance.

For similar reasons, low-rolling resistance tyres can be fitted, and these are often specified with a higher pressure, to further cut down friction.

Many cars even use low-friction oils, to ensure the mechanical parts encounter as little resistance as possible, too.

Information provided by Which Magazine