Fuel's gold

Do 'super fuels' offer any real benefits over normal petrol and diesel? We've put them to the test to find out

We're all feeling the effects of rising fuel prices. Regular unleaded petrol (95 Ron) costs around 40p/litre more than it did in January 2002, according to the AA. That means the cost of covering 12,000 miles has risen by around £660, based on a typical car's economy figure of 33 miles per gallon (mpg).

Fuel companies make bold claims for 'super fuels', but can they really benefit your car, or the environment?

Super fuels are more expensive at the pumps but often boast that they can boost your engine's economy or performance. To test these claims, we used two petrol cars and a diesel model as our 'lab rats' (see below) – feeding the petrol engines with five commonly available unleaded fuels:

- Esso Unleaded 95 Ron
- Shell Unleaded 95 Ron
- Shell V-Power Unleaded 99 Ron ['super fuel']
- Tesco Unleaded 95 Ron
- Tesco Super Unleaded 99 Ron ['super fuel']

Fuel companies make bold claims for more costly super fuels

We ran the diesel Renault Mégane on:

- BP Ultra-Low Sulphur Diesel
- BP Ultimate Diesel ['super fuel']

Big Ron

Crucial to defining the grade of petrol – and therefore to this test – is its 'octane rating', known as Ron (Research Octane Number). High-octane fuels are less prone to pre-ignition, which causes engine 'knocking'. The diesel equivalent is a cetane rating. You've probably seen these numbers on forecourt pumps.

Our test included three 'normal' petrols (regular 95 Ron, sometimes confusingly known as 'premium') and a standard diesel. We compared their performance with three 'super fuels' – two high-octane 'super' petrols (99 Ron) and a BP 'super' diesel.

Although we found a clear chemical difference between normal and super fuels, their effect on economy and performance isn't as marked as you might expect – as shown below.

PETROL CAR 1

Ford Focus 1.6 petrol (98bhp)

This Focus uses a normally aspirated (non-turbo) engine – typical of many mainstream petrol-powered cars, which is why we chose it for our tests. If you don't drive a 'sporty' petrol car, you can probably expect similar results to this.

Interestingly, while Shell V-Power super petrol showed a slight power increase over regular Shell 95, Tesco Super 99 actually produced slightly less power than normal Tesco 95 (although economy did improve by 0.41mpg, or 1.2%).

VERDICT Despite the marginal power increase offered by Shell's V-Power petrol, there seems little justification for using super fuels over their regular counterparts – especially as filling the Focus on V-Power for 12,000 miles will cost you £115 (6.5%) more than using Shell or Tesco 95 Ron unleaded.

FORD FOCUS	ESSO UNLEADED 95 RON	TESCO UNLEADED 95 RON	TESCO SUPER UNLEADED 99 RON	SHELL UNLEADED 95 RON	SHELL V-POWER UNLEADED 99 RON
Cost per litre[a]	£1.119	£1.109	£1.157	£1.107	£1.187
Tested economy (mpg)	33.7	34.1	34.5	34.0	34.3
12,000-mile fuel cost	£1,811	£1,777	£1,832	£1,776	£1,892
Measured Ron	95.6	97.0	99.0	95.7	99.6
CO2 output (g/km)	195.1	192.9	192.4	193.2	193.7
Measured power output at front wheels (bhp)	81.5	82.5	82.0	82.0	84.4
Power increase over standard fuel	n/a	↳	-0.6%	↳	2.9%

PETROL CAR 2

VW Golf 1.4 TSI (168bhp)

We selected this Golf for the test for its sophisticated 1.4 petrol engine – it's potentially more demanding than that in the Ford Focus.

It produces a similar output to much larger petrol engines via 'forced aspiration' (turbocharging and supercharging). Volkswagen claims it's also more efficient than a similarly powerful conventional engine – although it also recommends drivers run it on 98 Ron petrol (or higher). Expect to see more engines like this in the near future.

The Golf's engine recorded a higher power output with Shell's V-Power, although it's debatable whether the average motorist would notice a 5.3% gain. Tesco's Super 99 produced smaller gains over standard Tesco 95, suggesting that engine power is influenced by more than octane rating alone.

VERDICT Again, there's little to choose between fuels on economy and emissions, but the Golf's hi-tech engine responded well to V-Power.

Other emissions

As well as fuel economy, engine power output and CO2 emissions, we logged other harmful emissions, including:
CO (carbon monoxide) A poisonous, odourless gas. CO is a product of incomplete combustion and can be one measure of combustion efficiency.
NOx (nitrogen oxides) Smog-forming pollutants associated with breathing disorders. NOx is produced under the high temperatures found in the engine (up to 2,500°C).
HC (hydrocarbons) Unburnt fuel and combustion by-products.
PM (particulate matter) 'Sooty' output said to aggravate breathing disorders, such as asthma, especially in urban areas. Diesel cars emit more PM than petrols.

Each fuel had a marginal effect on the emissions of each pollutant. For the petrol cars, Tesco 99 Ron tended to produce less CO and HC, although the same isn't true of the other super petrol, Shell V-Power. However, V-Power did

What the manufacturers say

We investigated the claims fuel companies make for their super fuels

Shell V-Power petrol

'Shell V-Power is formulated with Friction Modification Technology (FMT) [reducing] friction [in the engine]. In this way FMT help[s] the engine turn more freely, and [more efficiently]. Shell V-Power is a high octane fuel (99 Ron) designed to help maximize the performance of many modern engines.'

Tesco Super unleaded 99

Tesco's 'super' petrol claims to be a 'cleaner' fuel, leading to 'cleaner' engines: 'To remove existing deposits and help the engine to run more smoothly, Tesco 99 Octane contains an enhanced additive package with twice the protective power of typical 95 octane fuel,' and 'it contains [fewer] compounds which lead to [deposit formation].'

BP Ultimate diesel

BP claims its Ultimate diesel fuel has 'up to four times the cleaning strength of ordinary diesel', and an 'average 2.8% increase in power', and 'average 1.0% reduction in fuel consumption'.

Interestingly, BP also says: 'Ultimate diesel has a cetane number of 55 minimum, significantly higher than the standard 51 cetane for diesel fuels in this market.'

Our analysis showed BP's standard diesel actually had a cetane number of 54.0, while Ultimate diesel had 54.8 – marginally less than the 55+ promised in the advertising.

VW GOLF	ESSO UNLEADED 95 RON	TESCO UNLEADED 95 RON	TESCO SUPER UNLEADED 99 RON	SHELL UNLEADED 95 RON	SHELL V-POWER UNLEADED 99 RON
Cost per litre[a]	£1.119	£1.109	£1.157	£1.107	£1.187
Tested economy (mpg)	33.5	33.3	33.6	32.9	33.6
12,000-mile fuel cost	£1,822	£1,821	£1,879	£1,840	£1,929
Measured Ron	95.6	97.0	99.0	95.7	99.6
CO2 output (g/km)	197.1	198.5	198.0	201.6	198.5
Measured power output at front wheels (bhp)	143.6	146.4	149.5	144.2	151.9
Power increase over standard fuel	n/a	↳	2.1%	↳	5.3%

DIESEL CAR

Renault Mégane 1.5 (86bhp)

This 1.5-litre dCi direct-injection, turbocharged diesel engine is found in many current Renault and Nissan vehicles, with outputs varying from 68bhp to 106bhp – we used the mid-powered 86bhp version for our tests. It's equipped with a diesel particulate filter (DPF) to help remove harmful soot emissions from the exhaust – this works very effectively.

However, running the Mégane on BP's Ultimate diesel was a real disappointment compared with filling it with BP's regular low-sulphur diesel. We could see no economy or performance benefits from using it – indeed, both were actually slightly worse using Ultimate diesel.

VERDICT Of all the super fuels we tested, BP Ultimate appears to be furthest from the marketing claims – in this short-term study at least. So if you drive a diesel, you can save yourself £84 every 12,000 miles by just using regular diesel.

RENAULT MEGANE	BP ULTRA-LOW-SULPHUR DIESEL	BP ULTIMATE DIESEL
Cost per litre[a]	£1.229	£1.294
Tested economy (mpg)	44.1	44.0
12,000-mile fuel cost	£1,522	£1,606
Measured cetane number	54.0	54.8
CO2 output (g/km)	173.1	174.4
Measured power output at front wheels (bhp)	73.4	72.7
Power increase over standard fuel	↳	-1.0%

a Fuel prices stated are the average of four locations, at the time of purchase in May 2008

emit less NOx in both the Ford Focus and the VW Golf.

As in our power and fuel economy tests, the benefits of BP Ultimate diesel weren't clear cut. It produced less CO and HC, but more NOx and particulate matter. The latter is possibly as a result of it having a higher sulphur content.

If you're worried about your car's emissions, it's better to drive less and more economically – not to switch fuels.

Who buys super fuels?

So, given the uncertainty over their benefits, how many people buy super fuels? Where do they get them – and what are their reasons for paying extra?

We asked 2,382 Which? online panel members in January about their fuel-buying habits. Roughly two thirds were petrol buyers, with a third using diesel.

The majority (95%) mainly use standard fuel (95 Ron petrol or regular diesel). But 18% have used super fuels in the past (12% petrol and 6% diesel), suggesting that fuel marketing has an influence on our buying habits.

Of those who have used super fuels, nearly half (45%) did so because they believe they are better for their car.

A quarter (24%) of super-petrol and a third (34%) of super-diesel users thought it offered better fuel economy.

Another 18% of super-petrol users have bought it because their car is designed to run on high-octane petrol. Just 1% of super-diesel users bought it due to the carmaker's recommendation.

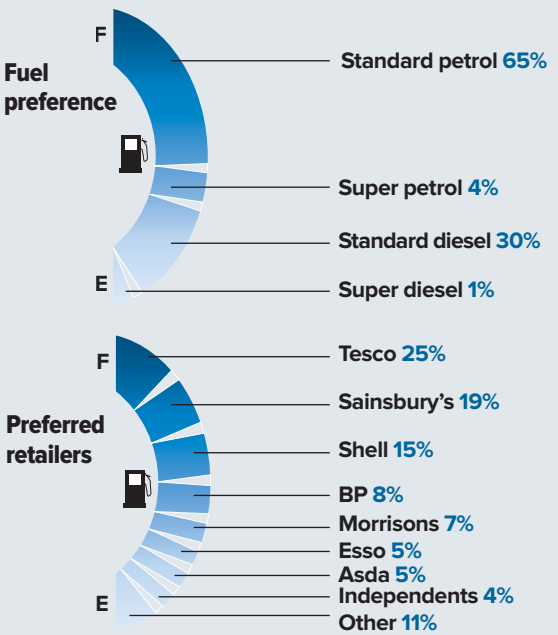
Finally, 56% of those asked bought fuel from a supermarket, perhaps using 'money off' vouchers, or filling up the car during the weekly shop. The top destination was Tesco (25%) followed by Sainsbury's (19%). Of the 'branded' retailers, Shell was most popular (15%).

Fuel quality scares

The fuel scare of February 2007 showed the chaos that contaminated fuel can cause when it enters the supply chain. An error at a major supplier's terminal meant thousands of motorists bought fuel with excess silicon in it, sometimes leading to engine damage. Such scares are very rare, so shouldn't affect where you normally decide to buy fuel.

What fuels your car?

We asked 2,382 Which? readers what type of fuel they mainly buy and where they buy it from



How we test

Testing differences between fuels is a logistically difficult and expensive process – here's how we tackled it

Rolling road lab

In addition to three 'guinea pig' cars, we used a sophisticated specialist laboratory, which includes a rolling road. We were able to vary rolling resistance to simulate 'duty cycles' – typical journeys that can be repeated to give comparable results.

We ran two types of test: the New European Driving Cycle (NEDC, used for the 'official' fuel consumption figures) and the 'Artemis' cycle, which is closer to real-life driving. Our results are the average of both cycles.

We captured and chemically analysed exhaust gases to measure CO2 (carbon dioxide) and other emissions, while the rolling road also allowed us to calculate engine power (brake horsepower, or bhp) in each car when run on different fuels.

Buying fuel

We bought fuel directly from public forecourts. If we were buying 'wholesale' there was a risk the fuel could be 'doctored' to optimise our results. To minimise any risk of anomalies, each fuel was sourced from four different forecourts of the same fuel company.

Preparing the cars

To ensure we were testing the fuel we'd bought and not the fuel already in the car, we drained each car's fuel tank completely and added 45 litres (about 10 gallons) of test fuel. We then carefully ran each car until the low-fuel warning icon lit up.

At this point we drained the remaining fuel, and topped up with bought fuel – ready for testing. On our diesel Mégane, we also changed the fuel filter each time we drained the tank.

Chemical analysis

On top of all this, we chemically analysed each sample of fuel to check its composition and grade. We also measured sulphur content – the super petrols contained markedly less sulphur than their normal counterparts, but the super diesel had almost double the sulphur levels of regular diesel.

This may explain super diesel's higher particulate matter (PM) emissions. However, all sulphur concentrations (for petrol and diesel) were within legal limits.

PHOTOGRAPHY MATT FOWLER

DOES AN SLK NEED SUPER?

Melissa Challinor *30, Which? training and development manager*
When Melissa bought a 2001 Mercedes SLK 3.2 AMG in July, her dealer told her the car would run better using higher octane 'super' petrol.

Having covered 800 miles, using various fuels, Melissa says: 'So far, I've filled it once with "super" 99 octane petrol and the rest with regular petrol and I've not seen any difference.'

Officially, Melissa's SLK will happily run on normal 95 Ron petrol but, as it uses a supercharger, it may benefit from the use of super fuels more than a normally aspirated model would.

Costly super fuel may help to keep the engine free from harmful deposits (see below), but filling it with regular petrol is unlikely to cause problems.

Checklist

Follow these tips to save money on fuel

- **Shop around** Use the **www.petrolprices.com** website. It's free and will show you the cheapest filling stations near you. A typical price variance in a 10-mile radius is 5p a litre – so going to the cheapest can save £3 on an average 60-litre tank.
- **Use supermarkets** The supermarket petrol we tested was equivalent to Esso and Shell 95 Ron fuels in performance and economy terms.
- **Use special offers** Supermarkets often offer incentives to encourage you to shop and fill up with them – such as 5p a litre off fuel if you spend £50 in store. Again, for a typical 60-litre fill, this can save you £3.
- **Don't panic buy** Fill up when you still have several litres left, so you have time to choose a cheaper filling station.
- **Drive better** Keep your car (and tyres) in good nick, don't carry excess weight, and follow our eco-driving tips (*Which?*, April 2008, p75).

Insider knowledge: fuel chemistry

We asked Jon Andersson, a top chemist at leading UK automotive consultancy Ricardo, for his opinion on 'super' fuels. Here's what he told us

Q Does the use of super fuels offer any long-term benefit to motorists?
A It is likely that long-term usage of [super] fuels will deliver the greatest benefit. However, it's very difficult to quantify, since benefits will vary with driving style, [engine type], vehicle age and condition.

Q Is the extra cost of super fuels recouped in reduced repair bills?
A Any break-even point would take many years to reach. It would be very difficult and expensive to demonstrate.

Q What are the components in super fuels that set them apart from regular fuels?
A Components can include detergents, dispersants, deposit reducers and/or friction reducers. Some diesel super fuels may contain antifoaming agents, and ignition and combustion improvers. They may also contain lubricants to reduce fuel-pump wear.

These are expensive chemistries, so the main difference between normal and super fuels will be the effectiveness and technology level of the additives, and their [levels of] concentration.

Q What vehicles might benefit most from the use of super fuels?
A No two cars will respond to fuels in the same way, which is why fuel companies won't tell you this – they want to sell super fuels to everybody. If a carmaker recommends a certain fuel, it might be for economy, cleanliness and/or performance gains.

Q Is it worth filling up on super fuel every time – or indeed ever?
A If you have a car that you intend to keep for a long time, then it could be worthwhile to always fill with a super fuel.

If you aren't intending to keep a new car for its lifetime, it's possible you might experience smoother running and additional power from occasional use. Older cars may also benefit from occasional use (improved power and feel). Try a few tankfuls of 'super' to check for any fuel economy benefit.

Check whether super fuels affect your mpg

'Super' may have fewer benefits in old cars

Older cars with poor service histories that have consistently used poor-quality fuels may have accumulated substantial deposits. The stronger detergents present in 'super' fuels could free these deposits, improving engine efficiency. But those freed deposits could end up causing unforeseen engine problems. However, fuel companies would test for this, so any problems are unlikely.

Q Are there specific problems that can be fixed with 'super' fuels?
A The high cetane content of 'super' diesels helps cold starting, and high octane in 'super' petrol resists knocking (pre-ignition). Good-quality fuels can keep engine components clean, enabling the engine to maximise power and minimise emissions. And the driver may notice reduced engine noise.