



# **NGC Fuel Cost Calculator Methodology (United Kingdom)**

**Version 2.0 – November 2016**

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# 1 Methodology overview

Fuel cost is calculated by multiplying a vehicle's fuel economy by fuel price and the distance driven. The Fuel Cost Calculator, which can be used for all vehicle types, provides two results – one based on official fuel economy data and the other representing real-world driving.

The calculation for vehicles powered solely by **petrol, diesel or electricity** is relatively straightforward as the official test data is widely published in the public domain by the UK Vehicle Certification Agency (VCA)<sup>1</sup> which provides data for all new cars available in the UK expressed in litres/100km and miles-per-gallon or, for electric vehicles, kWh/100km.

**Real-world fuel economy** data (as measured using vehicles on real roads) is also now available for many newer models, and is used for calculating fuel costs when available – as described in the next section. Where measured fuel economy is not available, real-world correction factors for petrol and diesel vehicles are used which are sourced from large scale studies of national fleets.

The data sourcing and calculation for **plug-in hybrid electric vehicles** is more complex, as they can be simultaneously powered by electricity and petrol or diesel. For the real-world estimate of fuel costs for PHEVs, the calculation assumes that the vehicle is driven for half the distance in EV-mode and half using a conventional fuel.

## 2 Real-world fuel economy

It is widely accepted that the official data for fuel economy (MPG) is far from accurate, measured as it is in the laboratory. The NGC Fuel Cost Calculator therefore uses **Real-world MPG** where this data is available.

Next Green Car has partnered with **Emissions Analytics** to improve the NGC Fuel Cost Calculator through the use of model-specific Real-world MPG data. This data is measured using portable testing equipment during real-world driving. Real-world MPG is based on the EQUA MPG Index as provided by Emissions Analytics.<sup>2</sup>

In cases where no measured real-world MPG data is available, **real-world fuel economy** is estimated by applying 'mpg factors' published by the International Council on Clean Transportation (ICCT)<sup>3</sup> which quantify the discrepancy between test and on-road data for petrol and diesel cars.

These 'conformity' factors vary by year from 1.07 in 2000 to 1.39 (estimated) in 2015. This means for example that the fuel use and CO<sub>2</sub> emissions for a petrol or diesel car registered in 2015 are typically 39% higher than the official test figures.

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<sup>1</sup> Vehicle Certification Agency. URL: <http://www.dft.gov.uk/vca/>

<sup>2</sup> To find out more about Emissions Analytics' EQUA database, or to view the EQUA Indices for specific UK models, visit the Emissions Analytics website: <http://equa.emissionsanalytics.com>.

<sup>3</sup> International Council on Clean Transportation. URL: <http://www.theicct.org/>

### 3 Fuel cost methodology

A vehicle's fuel cost is calculated by multiplying its fuel economy (using units of litres or kWh per 100 km) by fuel price (in pence per litre or kWh) and the distance driven (in kilometres). Inputs and results are shown in imperial units (miles-per-gallon, pence per mile and miles) using appropriate conversion factors.

For **vehicles solely powered by petrol or diesel**, fuel cost is calculated by multiplying the fuel economy (in litres per 100 km) by fuel price (in pence per litre) and the distance driven (in kilometres or miles). The official fuel cost is calculated using test-derived figures ('official combined') for fuel economy as published by the VCA and manufacturers. The real-world fuel cost is estimated using factors as published by Emissions Analytics or the ICCT which quantifies the discrepancy between test and on-road data for petrol and diesel cars.

For **vehicles powered solely by electricity**, fuel cost is calculated by multiplying the fuel economy (in kWh per 100 km) by fuel price (in pence per kWh) and the distance driven (in kilometres or miles). The official fuel cost is calculated using test-derived figures for fuel economy as published by the VCA and manufacturers. The real-world fuel cost is estimated using a correction factor derived from comparing the official EV range with independent test data. Where no real-world range estimates are available, a factor of 0.8 is used implying the real-world range is 80% of the official figure.

For **plug-in hybrid vehicles powered by electricity and petrol or diesel**, fuel cost *for both fuels* is calculated multiplying the fuel economy (in litres and kWh per 100 km) by fuel price (in pence per litre and kWh) and the distance driven (in kilometres or miles). The official fuel cost is calculated using test-derived figures ('weighted combined') for fuel economy as published by the VCA and manufacturers. The real-world fuel cost is estimated using the assumption that the vehicle is driven for half the distance in EV-mode ('Condition A') and half using a conventional fuel ('Condition B'); real-world correction factors are then applied for the electric and conventional fuel element of the calculation as already described.

The fuel cost calculator allows users to enter alternative values for real MPG and/or kWh and mileage where these are known and differ from the starting values provided. For PHEVs, users can also select the proportion of the mileage driven on electric or petrol/diesel.

#### Terminology used for describing fuel economy

'Official combined' – The so-called New European Drive Cycle is the current set of test cycles which are used to generate the official fuel economy figures. The NEDC test is conducted on a rolling-road (chassis dynamometer) and consists of two cycles: an urban cycle to represent driving in towns/cities; and an extra-urban cycle to represent highway/motorway driving. The results of the two cycles are combined to produce the overall official combined figure.

'Weighted combined' – For plug-in hybrid electric vehicles which use two fuels (electricity and petrol or diesel), the vehicle is tested in two fuel modes: first using primarily electric power starting with the battery fully charged (also known as 'Condition A'); and then with the battery fully depleted ('Condition B'). These figures are then weight-averaged using the battery range plus 16 miles to produce the official weighted combined figure.

## 4 Worked examples

### 3.1 BMW 3 Series 316d SE – Diesel, 1496cc (2.0 litre)

Vehicle fuel economy and fuel price data

Description	Metric	Imperial
Official CO2 tailpipe emissions	109 g/km	
Official combined fuel economy	4.1 litres/100km	68.9 MPG
Real-world fuel economy (estimate)	5.7 litres/100km	49.6 MPG
Diesel price (typical UK average)	117.3 p/litre	
Distance travelled (1 mile=1.61km)	16,100 km	10,000 miles

Official fuel cost =  $(4.1 \times 1.61 \times 117.3 \times 10,000) \div (100 \times 100) = \text{£}770$  or 7.7 p/mile

Real-world fuel cost =  $(5.7 \times 1.61 \times 117.3 \times 10,000) \div (100 \times 100) = \text{£}1,080$  or 10.8 p/mile

Record published: <http://www.nextgreencar.com/view-car/35425/bmw-3-series-saloon-316d-se-diesel-manual-6-speed/>

### 3.2 Nissan LEAF Acenta – Battery Electric

Vehicle fuel economy and fuel price data

Description	Metric	Imperial
Official CO2 tailpipe emissions	0 g/km	
Official energy use	15.0 kWh/100km	168.5 MPG equivalent
Real-world energy use (estimate)	18.8 kWh/100km	134.4 MPG equivalent
Electricity price (typical UK average)	15.6 p/kWh	
Distance travelled (1 mile=1.61km)	16,100 km	10,000 miles

Official fuel cost =  $(15.0 \times 1.61 \times 15.6 \times 10,000) \div (100 \times 100) = \text{£}377$  or 3.8 p/mile

Real-world fuel cost =  $(18.8 \times 1.61 \times 15.6 \times 10,000) \div (100 \times 100) = \text{£}472$  or 4.7 p/mile

Record published: [http://www.nextgreencar.com/view-car/49677/nissan-leaf-electric-car-acenta-80kw-auto-electric-\(av-uk-mix\)/](http://www.nextgreencar.com/view-car/49677/nissan-leaf-electric-car-acenta-80kw-auto-electric-(av-uk-mix)/)

### 3.3 Mitsubishi Outlander 2.0 GX3h Auto PHEV – Plug-in Hybrid

Vehicle fuel economy and fuel price data

Description	Metric	Imperial
Official CO2 tailpipe emissions	44 g/km	
Official fuel economy (Condition A)	1.9 litres/100km	148.5 MPG
Official electricity use (Condition A)	13.6 kWh/100km	185.8 MPG equivalent
Real-world electricity use (Condition A) (est.)	17.3 kWh/100km	148.7 MPG equivalent
Official fuel economy (Condition B)	5.8 litres/100km	48.7 MPG
Real-world fuel economy (Condition B) (est.)	8.1 litres/100km	35.0 MPG
Petrol price (typical UK average)	116.9 p/litre	
Electricity price (typical UK average)	15.6 p/kWh	
Distance travelled (1 mile=1.61km)	16,100 km	10,000 miles

$$\text{Official fuel cost} = (1.9 \times 1.61 \times 116.9 \times 10,000) + (13.6 \times 1.61 \times 15.6 \times 10,000) \\ \div (100 \times 100) = \text{£700 or 7.0 p/mile}$$

$$\text{Real-world fuel cost} = 0.5 (8.1 \times 1.61 \times 116.9 \times 10,000) + 0.5 (17.3 \times 1.61 \times 15.6 \times 10,000) \\ \div (100 \times 100) = \text{£979 or 9.8 p/mile}$$

Fuel cost calculator on model-specific pages (for 80% miles on electric):

$$\text{Real-world fuel cost} = 0.2 (8.1 \times 1.61 \times 116.9 \times 10,000) + 0.8 (17.3 \times 1.61 \times 15.6 \times 10,000) \\ \div (100 \times 100) = \text{£652 or 6.5 p/mile}$$

**Record published:** [http://www.nextgreencar.com/view-car/51537/mitsubishi-outlander-  
phev-2.0-gx3h-auto-plug-in-petrol-hybrid-automatic/](http://www.nextgreencar.com/view-car/51537/mitsubishi-outlander-phev-2.0-gx3h-auto-plug-in-petrol-hybrid-automatic/)