Shell Diesel Extra, **smaller fuel bills** and **lower emissions** for your fleet

Engine combustion and emissions: what actually happens?

When air and fuel are mixed in the engine, the result of the combustion of carbon, hydrogen and oxygen is CO_2 (carbon dioxide) and water. The CO_2 emissions are directly related to the amount of fuel the vehicle uses, so if you reduce your fleet's fuel consumption, you'll automatically cut your CO_2 emissions by the same percentage.

How much CO_2 is produced from a litre of fuel?

Standard diesel fuels generally contain around 87% carbon by weight, the rest being hydrogen and other very minor components. The amount of carbon in a litre of diesel fuel varies, but this only affects the total CO_2 production slightly. Diesel biofuel blends may contain at present up to 5% of a bio-derived component and this can introduce about 0.5% oxygen into the overall blend.

The relationship between CO_2 emissions and fuel consumption works like this:
• 1 litre of diesel typically weighs 0.83kg (the density range is 820-845kg/m^3 in Europe and up to 860kg/m^3 elsewhere)
• about 87% of this is carbon, so one litre of diesel contains 0.83 x 87% = 0.722kg of carbon
• each atom of carbon weighs 12 atomic units. When it combines with two atoms of oxygen in the combustion process it becomes CO_2, which weighs 44 atomic units. The 0.722kg of carbon in the original fuel then becomes 0.722 x 44/12 = 2.65kg of CO_2
• so one litre of diesel fuel produces about 2.65kg of CO_2.

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How much CO_2 does a vehicle produce?

Individual vehicles consume fuel at different rates, thereby producing different amounts of CO_2 – this chart shows typical fuel consumption for some commercial vehicles:

Vehicle	Fuel consumption (litres/100km)
Light van	10
Medium truck	25
Heavy truck	40

It's easy to work out how much CO_2 is typically produced by commercial vehicles. The table below shows the CO_2 emitted and fuel consumed by different vehicle types over every 10,000km travelled, on the basis that one litre of fuel produces about 2.65kg of CO_2:

Vehicle	Fuel used (litres/10,000km)	CO_2 produced (kgs/10,000km)
Light van	1,000	2,650
Medium truck	2,500	6,625
Heavy truck	4,000	10,600

For example, a heavy truck covering 100,000km annually will produce 10 x 10,600 = 106,000kg (106 tonnes) of CO_2 over twelve months.

How much CO_2 could you save by reducing fuel consumption by 3%?

Using the example of the heavy truck producing 106 tonnes of CO_2/year, a fuel consumption saving of 3% will result in 0.03 x 106 = 3.2 tonnes less CO_2 produced. In other words, approximately the same amount of CO_2 as produced by a medium-sized diesel car in a year (20,000km at 6 litres/100km).

So improving the fuel economy of a single truck by 3% in a year returns the same benefit as cancelling out the CO_2 produced by a medium-sized passenger car over a year.

So where do biofuels fit in with all this?

Biofuels have the potential to cut CO_2 emissions because the plants they're made from absorb CO_2 as they grow. This is released again when the biofuels are burnt. Further CO_2 is created as part of the process of growing, harvesting, processing – and distributing the end result, the biofuel. This means that the CO_2 benefits of biofuels must be assessed by "life cycle assessments" – in other words, by "well (or fields)-to-wheels" studies.

The net CO_2 emitted is calculated from the growing of the plant right through to the vehicle exhaust emissions in these studies. A bio-ester made from rapeseed produced in Europe with limited fertiliser use, for example, could reduce well-to-wheels CO_2 production by around 50% compared to conventional diesel fuel. An additional 5% blend of this type of bio-ester would therefore reduce well-to-wheels CO_2 emissions by around 2.5%.

Further issues on fuel usage and emissions

This topic is rapidly expanding and developments are taking place all the time. Keep an eye on the latest findings by logging on to **www.shell.com/fuels** where you can download our fuelling mobility booklets. Our Annual Report at **www.shell.com** also has details of our sustainability report.