ON THE ROAD TO EVEN

CLEANER
ROAD TRANSPORT

A PACCAR COMPANY DRIVEN BY QUALITY

DAF

DAF is taking you on the road to an even

CLEANER FUTURE

Contents

"On the road to a cleaner future" means that we need to focus on reducing CO_2 emissions, which contribute to global warming. This is a global challenge. In addition, we need to take action regarding the air quality in our cities — this includes emissions such as nitrogen oxides (NO_x) and particulate matter (PM). This is a local issue.

Global CO_2 emissions and local air quality — these are social issues that concern all of us. Which means that they also concern DAF. That is why we are researching a number of new technological solutions and continuing to developing existing technologies on the road to even cleaner and more sustainable road transport. One thing is certain: Every type of transport requires its own approach.

In short, if cities only allow trucks that do not produce harmful emissions in their city centres, then the only option at present is fully electric power. However, when it comes to long-distance transport, electric power is not yet an option due to the limited range, the heavy weight and the charging times. For this purpose, the modern, efficient diesel engine continues to be the most appropriate choice. But if a truck has to drive long distances and also load and unload in the 'zero emissions' areas of cities, a combination of diesel power and an electric motor comes into play: hybrids. These vehicles offer maximum flexibility.

DAF and its parent company PACCAR are developing numerous alternatives to move from clean to sustainable, including electric, hybrid and, for the longer term, hydrogen. At the same time, the combustion engine will also become even cleaner and more sustainable in the future as new generations of renewable fuels become accessible.

DAF offers the best solution for every transport need. Now and in the future.

Ron Borsboom
Executive Director DAF Product Development

The future of DIESEL TECHNOLOGY

It is good to stop and reflect on the impressive steps that have already been taken in terms of reducing the emissions from diesel-powered trucks. Further refinements in the technology and, above all, the arrival of new generations of CO_2-neutral fuels also mean that the combustion engine has a golden future.

A modern truck with a Euro 6 diesel engine emits around 95% less nitrogen oxide than a truck from 25 to 30 years ago. Emissions of soot particles have been reduced by no less than 97% in the same period of time. To put it another way: one Euro 1 truck from 1994 emits as much nitrogen oxide as 20 trucks from the present day. If we look purely at emissions of soot particles, one Euro 1 truck from 1994 can be compared to 35 modern trucks from the present day.

Major steps in reducing CO_2

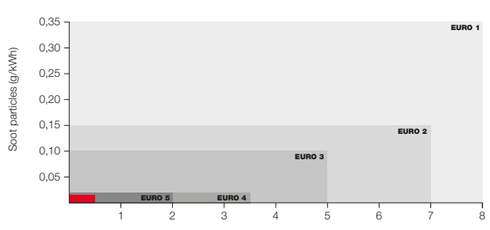
And what about CO_2? The latest generation of DAF trucks are up to 20% more efficient than their predecessors from 20 years ago. 20% less fuel consumption means that CO_2 emissions are directly reduced by 20% (tank-to-wheel). We can expect to see further improvements as new types of fuels become available. HVO is already on the market and can reduce CO_2 emissions by up to 90% (well-to-wheel). The future 'Power-to-Liquid' fuel is even completely CO_2 neutral to use and it offers great potential as it can be used by the entirety of the existing fleet.

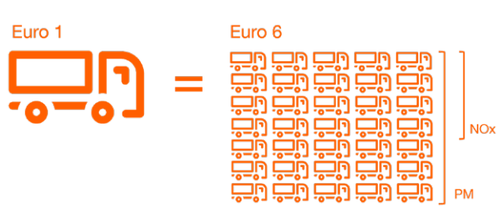
Hardly measurable

With innovations such as advanced injection techniques, new generations of turbos, the latest control technologies and intelligent exhaust after-treatment systems, modern diesel engines are already very 'clean'. You can barely measure what comes out of the exhaust anymore. DAF will continue to develop the diesel engine so that further progress can be made in terms of emissions from these engines as well.

The figures show that the biggest step that can be taken in the short term is replacing older trucks with the most modern Euro 6 vehicles.

EU emission legislation





Hydro-treated vegetable oil (HVO)

DAF's modern diesel engines in the LF, CF and XF ranges are already compatible with HVO. HVO stands for 'hydro-treated vegetable oil', a new generation of biofuels, which is made from vegetable oils and waste fats and is already available on the market.

The good thing about the synthetic fuel HVO is that DAF does not need to make any technological changes to the trucks and that it also does not impact on the service intervals.

Unlike previous generations of biodiesels, HVO production has no influence on food production. This was an important factor in DAF's initial reluctance to promote biodiesel.

When you consider the entire chain—from the production of HVO to what comes out of the exhaust—using HVO in vehicles can reduce CO_2 emissions by up to 90%. For further information, please ask your fuel supplier.

Power-to-Liquid

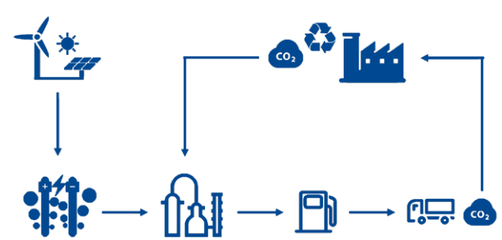
If we look a little further in the future, there are fuels on the horizon that are 100% CO_2 neutral from production to combustion.

For these fuels known as 'Power-to-Liquid fuels', hydrogen is generated via electrolysis, using green electricity. This hydrogen is combined with recycled CO_2 to produce a synthetic fuel that can be used in diesel engines.

Filters that are being developed to capture and store CO_2 are central to the principle of 'Power-to-Liquid' fuels. Collecting the CO_2 released during combustion and combining it with hydrogen completes the cycle. In fact, CO_2 that leaves the exhaust is used to create new fuel.

The future 'Power-to-Liquid' fuels can be distributed via the existing network of petrol stations and could already be used in a modern diesel engine. Using these fuels is completely CO_2 neutral from 'well-to-wheel', provided that the hydrogen is produced using solar, water or wind energy.

'Power-to-Liquid' fuels are currently being produced on a small scale in laboratory environments and at high prices. It is expected that these fuels will become more widely available between 2025 and 2030.



FULLY ELECTRIC in the city

Several cities have announced that in the coming years they will only allow emissions-free vehicles into their city centres in order to improve local air quality. This means that the fully electric truck has a bright future. As a transport operator, you will need to invest in such vehicles to be able to operate in these city centers.

DAF is leading the way in BEVs or Battery Electric Vehicles. After all, DAF was one of the first truck manufacturers to use fully electric trucks in a field test with customers to gain practical experience. The CF Electric is now available for sale in several countries.

Intelligent planning

Of course, an electric power train still has its challenges. Electricity is not always generated in a ‘green’ way; public charging infrastructure still leaves a lot to be desired and batteries are expensive, heavy and still have limited capacities. However, by planning intelligently and by recharging the batteries when the opportunity arises—sometimes as little as half an hour is enough—it is already feasible to cover 500 electrical kilometres per day.

Order now

The DAF CF Electric operates fully electrically thanks to VDL’s E-Power Technology. At the heart of the drive line is a 210-kilowatt electric motor that draws its energy from a lithium-ion battery pack with a total capacity of 350 kWh (315 kWh effective). The latest generation of the CF Electric has an increased range of approximately 200 kilometres, depending on the application. Your DAF dealer will be happy to provide a bespoke calculation based on your usage and will help you determine the optimal way in which to use your trucks.

The first electric, three-axis CF Electric refuse collection trucks have now also been delivered for collecting waste products in ‘zero emissions’ urban areas.

Electric road transport:
DAF is ready.

Eveline Manders, Tinie Manders Transport:

“Planning and driving an electric truck requires a different mindset. You have to make sure that the route fits the truck — not the other way around. To get the most out of the truck, it is important to be able to charge the batteries during loading and unloading. The electric truck can be a great alternative for urban distribution.”

HYBRID
is the best of both worlds

HEV—hybrid electric vehicles—combine the best of both worlds: fully electric driving in urban areas and using clean diesel technology elsewhere. This results in unprecedented flexibility. DAF is gaining vast experience with this promising hybrid technology, which has the crucial advantage of being able to be seamlessly integrated into all types of applications.

Marcel Pater, Peter Appel Transport:

“Alongside our client Albert Heijn, we are constantly looking for opportunities to further reduce our CO_2 footprint. In cities we drive the DAF CF Hybrid fully electrically and because it has a diesel engine we have no problem driving between the various distribution centres in the Netherlands and abroad.”

The DAF CF Hybrid Innovation trucks, which are currently part of a field test, are equipped with a 10.8-litre PACCAR MX-11 diesel engine (up to 330 kW/450 hp) and a ZF electric motor (75 kW/100 hp, peak: 130 kW/175 hp) integrated into a ZF TraXon gearbox that is specifically designed for hybrid drive lines. The electric motor is powered by a battery pack (85 kWh), which is charged by the diesel engine when driving. When the battery is fully charged, the truck—depending on weight—has a fully electric range of approximately 50 kilometres, which is more than enough for driving into and out of urban areas.

Regenerative energy

Outside of urban areas, the CF Hybrid is powered by the efficient PACCAR MX-11 diesel engine, which gives it a great range. Energy regenerated during braking is used by the electric engine to support the diesel engine. This has extra benefits in terms of fuel consumption and therefore CO_2 emissions when driving with the diesel engine.

Plug-in

Plug-in technology means that you can ‘fill’ the battery pack via a charging station, so that you can drive electrically as much as possible, without CO_2 emissions.

Fully electric in the city for the sake of local air quality. Out of town, the efficient diesel engine produces low levels of CO_2 emissions.

HYDROGEN

A look into the future

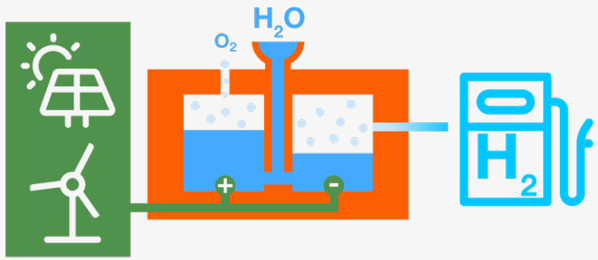
What about hydrogen? Hydrogen-powered trucks are certainly a possibility in the longer term. There are even two options: the first in which a fuel cell uses hydrogen to generate electricity to drive the electric motor, and secondly where hydrogen is used directly as fuel for the internal combustion engine. In both cases, CO_2 emissions can be reduced by 100% when using green hydrogen.

We cannot forget that hydrogen-powered trucks are still at the experimental stage. Moreover, hydrogen is available only in limited quantities; and green hydrogen even more so. It has to be compressed under very high pressure (700 bar) and at very low temperatures (-253°C). Not to mention that there is barely any distribution infrastructure.
According to DAF, it will take some time before hydrogen can be used for transporting goods by road on a larger scale.

Practical experience

DAF's parent company PACCAR—together with Toyota and Shell—already has experience with hydrogen. The first trucks with fuel cells are already being tested in the port of Los Angeles. We need to take steps now if we want to achieve a breakthrough with this new technology. And that's what we're doing.

There are several ways to produce hydrogen. First of all, by cracking fossil fuels. This is called grey hydrogen because CO_2 is always released when fossil fuels are processed. A second and much cleaner way to create hydrogen is through electrolysis. Electricity is passed through water to produce oxygen and hydrogen: green hydrogen.



What about GAS?

Why doesn't DAF offer LNG or CNG engines? This is a question that we are asked regularly.

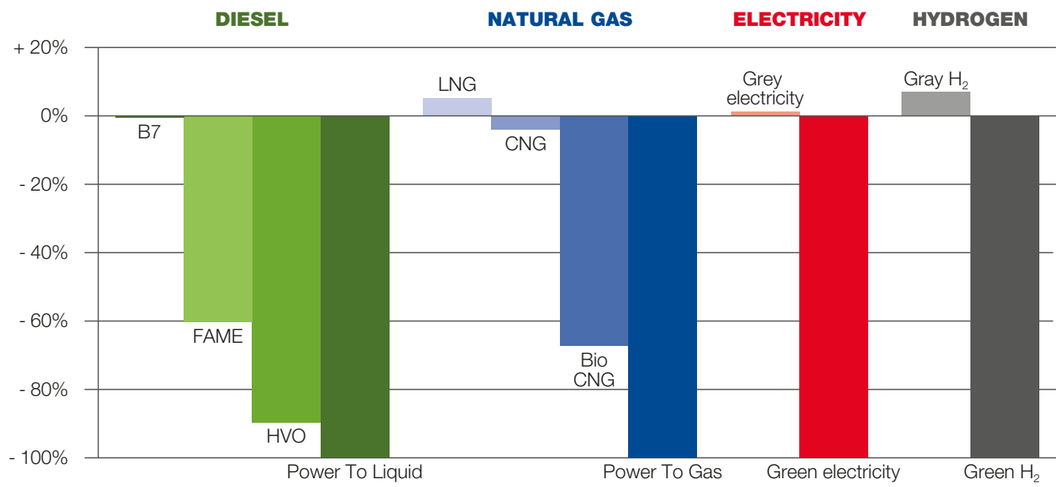
In general terms, burning gas emits 15% less CO_2 than burning the same amount of diesel fuel. However, this effect is balanced out by the greater efficiency of the diesel engine. To put it another way, more gas than diesel is required for a truck to travel the same distance. This makes the difference in CO_2 emissions from 'tank to wheel' negligible.

In fact, if you consider the whole cycle from 'well to wheel', using LNG results in higher CO_2 emissions than diesel. Something to think about.

Practical challenges

In addition, gas engines unfortunately still come with a number of practical challenges. CNG and LNG must be stored under very high pressure and this involves complicated installations. CNG also has a limited range. In addition, there is limited refuelling infrastructure and residual values are much lower than for diesel trucks.
For all of these reasons, DAF does not see a role for gas-powered trucks in the near future; especially given that the diesel engine has taken huge steps forwards in recent years and will only become cleaner with each new generation of fuels.

Well-to-wheel CO_2 emissions from various fuel alternatives



Source: CO2emissiefactoren.nl

How to save **CO_2 AND COSTS** today!

Do you think that environmental issues are important? Then now is the time to do what you can to save the environment. And the great thing is that you'll also save money right away.

Reducing maximum speed from 89 to 85 km/h when transporting goods internationally lowers CO_2 emissions by 3 to 4% and saves fuel.

The correct tyre pressure improves rolling resistance and saves fuel. If the tyre pressure for a combination is 20% too low, it can result in a rolling resistance that is 8% higher and a 2.5% increase in fuel consumption, which means 2.5% higher CO_2 emissions.

If you order a boxed body for the DAF LF, consider the Aerobody. Its aerodynamic design is up to 8% more efficient at cruising speeds of 85 km/h, which means an 8% reduction in CO_2 emissions as well.

Drivers who have received DAF EcoDrive driver training consistently use 3 to 5% less fuel and emit the same amount less CO_2.

DAF Connect—the online fleet management system that allows you to monitor the performance of your fleet and drivers in real time—has been shown to save fuel and reduce CO_2 by 2% in daily practice.

The right deflector setting can save up to 10% fuel and CO_2 emissions.

Do you still have Euro 5 vehicles in your fleet? Exchange them for the latest generation of LF, CF and XF models. These come with many benefits and they are in many cases over 10% more fuel efficient and produce less CO_2 emissions. They also reduce NO_x emissions by 80% and soot particles by 66%. This gain is even greater if you trade in a Euro 4, Euro 3 or even older vehicle.

On the road to 2025

The European Union has ordered the truck industry to reduce CO_2 emissions from trucks by 15% by 2025 and by 30% by 2030 compared to the values in 2019. A big challenge.

Over the last 20 years, the truck industry has made enormous efforts to reduce CO_2 by an average of 1% per year. We are now faced with the target to achieve a 15% reduction in 6 years' time — an average of 2.5% per year! A target to achieve a 30% reduction by 2030 means an average of 3% per year between 2025 and 2030! That's huge!

Investing in many different routes

To meet the European Union's requirements, hybrid electric and, to an even greater extent, fully electric vehicles will become increasingly important. That is why it is important that we start investing heavily in and gaining experience with these technologies now. At the same time, we will continue to develop the diesel engine and study the possibilities of hydrogen.

New legislation

If we are to fulfil the objectives for 2025, we will have to examine all available options. Where can we gain in terms of fuel efficiency and CO_2 emissions? Where can we make engines and drive lines even more efficient? Can tyres with lower rolling resistance play a role? What improvements can we make to the systems that assist both the driver and the vehicle, such as Predictive Cruise Control and EcoRoll? New legislation on vehicle dimensions and weight, which allows longer and therefore more aerodynamic trucks, will also play a major role in this.

Entire cycle

The decisive factor in achieving the European Union's objectives is what is emitted from the exhaust, not what is used to produce the required 'energy', whether this is fuel or electricity. However, this is set to change after 2030. From then on, there will be a shift from 'tank to wheel' to 'well to wheel' so that the whole chain is taken into account and we can see the complete picture!

VECTO CO_2 CERTIFICATE

As a leader in transport efficiency and environmental care, DAF was ahead of European legislation demands requiring all trucks that leave the factory to have a 'CO_2 certificate'.

Since January 2019, European regulations require all newly delivered 4x2 and 6x2 Euro 6 heavy-duty trucks (16+ tons) to have a CO_2 emissions certificate. This requirement continues to be rolled out to other truck configurations in stages. These emissions certificate values are generated using the industry-wide, standardised and certified Vecto tool. This means that you, as a transport operator, can compare the CO_2 emissions values of different truck models and brands.

As a factory we are obliged by EU law to provide a CO_2 value for every newly delivered truck. But at DAF we believe that it is important that you already know this value in advance; specifically, when you decide to purchase the truck. Our unique TOPEC sales tool allows your DAF dealer to inform you about the CO_2 values of your future truck before purchase. For maximum clarity and transparency.

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