

DAF Sustainable Road Transport Solutions



DAF is taking you on the road to an even cleaner future



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'On the road to a cleaner future' means that we need to focus on reducing CO₂ emissions. 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.

Someone once said we have not inherited the earth from our ancestors but are borrowing it from our children. We all need to share the responsibility for caring for our beautiful planet so that we can pass it on to our children and future generations.

When we zoom in on the transport sector it is clear that all parties, including truck manufacturers and transport companies, are doing their utmost to reduce CO₂ emissions and lessen their effect on the environment, including the air quality in our cities.

DAF and its parent company PACCAR are focused on introducing and developing new solutions for clean and sustainable road transport. Because there is no one-size-fits-all solution for all transport applications, we are developing several different avenues: from fully electric to hybrid, and from hydrogen engines to hydrogen fuel cells. At the same time, the internal combustion engine will become even cleaner and more sustainable, especially when powered by waste-stream harvested HVO or, in the more distant future, renewable so-called e-fuels.

Whichever technology is most suitable for your operations, DAF is your energy transition partner of choice, ready to partner with you to develop your sustainable transport solutions. This includes offering a full suite of EV chargers, dedicated driver trainings and a comprehensive consultation on how to optimally plan and integrate new technologies into your transport operations and planning.

DAF. Your trusted partner in the energy transition. Now and in the future.



LEADING THE WAY in battery electric vehicles

Several cities have announced that in the coming years they will only allow zero-emission vehicles into their city centers in order to improve local air quality. This means that fully electric trucks have a bright future. DAF offers a full range of vehicles and dedicated affiliated services to support you to make the transition.

DAF is leading the way in Battery Electric Vehicles, or BEVs. In 2018, DAF was the first to have introduced a full battery electric CF truck on the market, of which many are in daily operations with customers.

In the meantime, DAF has introduced a full range of Battery Electric trucks, providing the right zero emission solution for a suite of applications. 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 1,000 electrical kilometers per day. This illustrates the significant steps that are made regarding battery capacity and ranges.

DAF XD and XF Electric

The advanced DAF XD and XF Electric trucks (GCW's up to 42/52 tons*) are powered by the efficient and reliable PACCAR EX-D1 and PACCAR EX-D2 permanent magnet e-motors, which offer outputs from 170 kW/230 hp to 350 kW/480 hp. To perfectly tailor these electric vehicles to your needs and application, DAF offers a wide choice of battery capacities (from 2 to 5 packs), capable of delivering zero emission ranges of over 500 kilometers

on a single charge. By applying fast charging, even the largest battery pack can be charged from empty to 100% in less than 2 hours.

DAF XB Electric

The DAF XB Electric (GVW 12 – 19 tons) is ideal for zero emission city distribution. Its e-motor provides 250 kW of nominal power and its battery pack has a gross energy contents of 141, 210 or 282 kWh (254 kWh effective). This offers the XB Electric a range of no less than 280 ultra-quiet zero emission kilometers.

The application of fully electric trucks requires a specific way of planning and operations for our customers. DAF makes this conversion as easy as possible, including advise how an electric truck delivers the highest return on investment in the daily operation. This includes tailor-made vehicle specification through DAF's TOPEC sales system, full route calculations, dedicated driver training and also a full range of top quality PACCAR charging stations for the most optimal integration of truck and charging equipment.



*) Depending on national regulations

Are you ready to charge?

As part of its full 'zero emission' service offering, DAF provides a full range of high-end solutions to charge the batteries. These include mobile chargers with power levels from 24 kW up to 40 kW to provide maximum flexibility. Fixed charging stations are available with power levels from 20 kW up to 360 kW, of which the latter represents an ultra-fast solution that can charge vehicles at full rated power in less than two hours or fast charge two vehicles simultaneously.

Flawless communication

The integration with the DAF fully electric trucks, the charging hardware and the network software is being taken care of by DAF and its partners, who have up to ten years of experience in the advanced charging industry. Where needed, we will conduct site assessments, energy modeling and engineering at your premises. We will also maintain the charging equipment. This ensures a flawless communication between the trucks and the chargers.



DAF's 4 step approach to move to Electric

- 1 Define your needs based on your specific situation
- 2 Assess how new technologies fit in your logistical operations?
- 3 Define the optimal vehicle specification and charging equipment
- 4 Support you in implementation and operations

DAF Electric Truck Assembly

DAF has expanded its production facilities with a new Electric Truck Assembly factory in Eindhoven for the production of the New Generation DAF XD and XF Electric.

Production starts with the build of a chassis with cab on DAF's main truck manufacturing line, after which it is delivered to the Electric Truck Assembly for an eight step process to install and fully validate the operation of the electric drivetrain. Consequently, the all-new XD or XF Electric truck is ready for transport to one of the Electric-certified DAF dealerships.

Two assembly lines

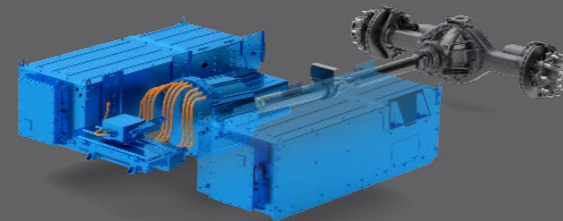
The new factory actually has three assembly lines. Battery packs and Electric Drive Modules are assembled in their own dedicated sub-assembly lines, feeding into the main electric assembly line. This flexible process ensures DAF is ready for electric truck production to rise to thousands of vehicles per annum over the next few years, in line with the increasing demand for fully electric trucks.

Batteries with environmental power

DAF applies batteries utilizing a Lithium Ferro Phosphate (LFP) chemistry on all its fully electric vehicles. These are batteries of the very latest generation, containing no cobalt, in the interests of sustainability.

LFP batteries also offer important operational benefits. They are optimally packaged – resulting in a high energy density per liter – and the chemistry of the battery ensures the highest thermal safety and a longer service-life. This is also the result of the capability to handle higher numbers of charging cycles.

The LFP batteries come with a 6 year warranty, illustrating DAF's confidence in terms of performance, reliability and durability.



“DAF LFP battery cells offer several advantages compared to other battery chemistries, including lower cost, longer life, and enhanced safety.”



HYDROGEN

A promising alternative

What about hydrogen (H₂)? Hydrogen-powered trucks are certainly a promising alternative, especially for medium and long distance road transportation. 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 hydrogen engine. In both cases, CO₂ can be reduced by 100%. Hydrogen delivers operational value through its fast refuel times, while it can be easily via tank or pipeline.

Hydrogen-powered trucks are under development. DAF's parent company PACCAR – together with Toyota and Shell – has comprehensive experience with hydrogen via a fleet of fuel cell trucks, operating in and around in the port of Los Angeles.

joint efforts to develop and produce zero emission, hydrogen fuel cell (FCEV) Kenworth and Peterbilt trucks. These will be powered by Toyota's next-generation hydrogen fuel cell modules. Initial customer deliveries are planned for 2024.

PACCAR and Toyota Motor North America, Inc. (Toyota) have announced an expansion of their



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Hydrogen Engine

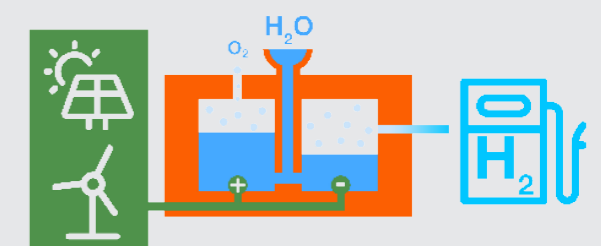
Also DAF is building comprehensive experience with hydrogen technology. A great example is the New Generation DAF XF with hydrogen internal combustion engine (ICE), which was honored with the prestigious 'Truck Innovation Award 2022'.

Compared to the application of hydrogen for fuel cells, the internal combustion solution requires less cooling capabilities and no batteries, and is robust to any impurities in the hydrogen fuel that exist if the hydrogen is transported via pipeline, a likely distribution method.

Through a technology demonstrator we have gained extensive knowledge and the expectation is that the hydrogen engine will be ready for commercialization within the coming years.

The hydrogen engine also benefits from the efficiency, reliability and durability provided by the proven foundation of internal combustion technology. Next to this: let's put more value in the fact that we in Europe have an extensive labor force, knowledge and a full manufacturing footprint dedicated for engine development and production.

There are several ways to produce hydrogen. First of all, by cracking fossil fuels. This is called grey hydrogen because CO₂ is always released when fossil fuels are processed. A second and much cleaner way to create hydrogen is through electrolysis. Electricity is generated from renewable sources passed through water to produce oxygen and hydrogen: green hydrogen for a 100% carbon-free well-to-wheel solution.



THE FUTURE OF

The internal combustion engine

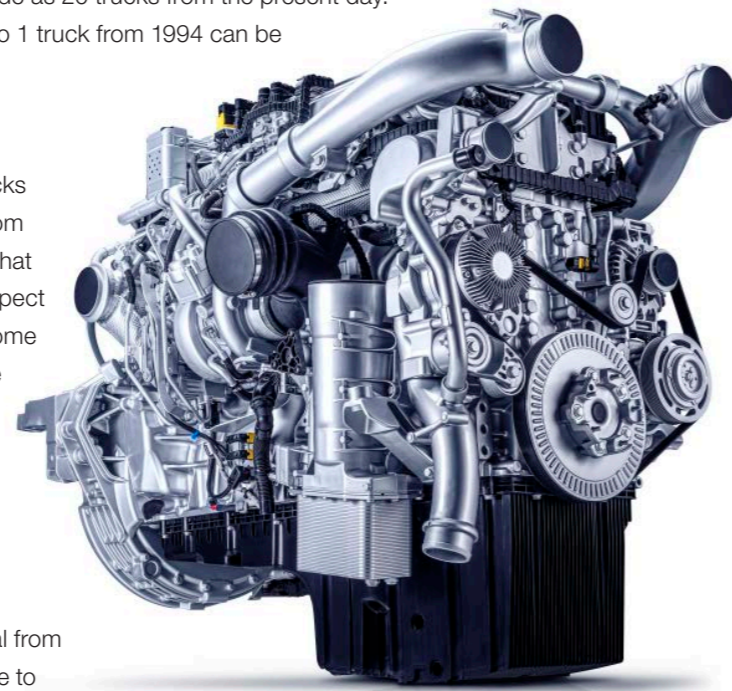
It is good to reflect on the impressive steps that have already been taken in terms of reducing the emissions from diesel-powered trucks. Further refinements in the technology and, above all, the arrival of new generations of CO₂-neutral fuels mean that also the reliable and efficient internal combustion engine still has a clean 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.

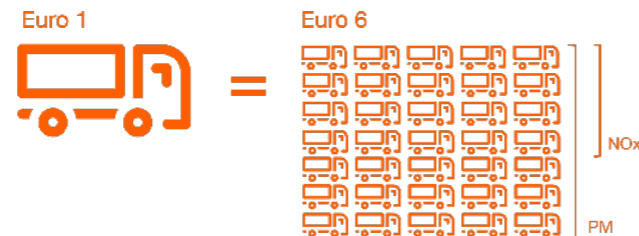
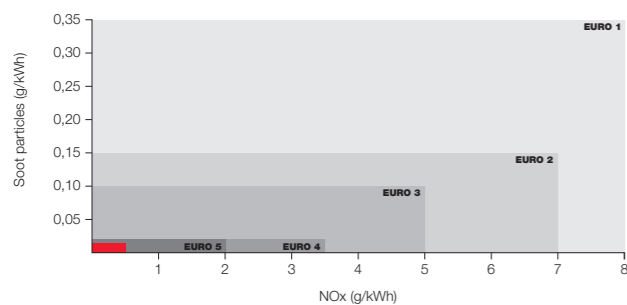
Major steps in reducing CO₂

And what about CO₂? The latest generation of DAF trucks are over 25% more efficient than their predecessors from 20 years ago. Over 25% less fuel consumption means that CO₂ emissions are directly reduced by 25%. We can expect to see further improvements as new types of fuels become available. HVO is already on the market and can reduce CO₂ emissions by up to 90%. Within the years to come the internal combustion engine will also be able to operate on hydrogen, resulting in 100% CO₂ reduction.

Looking into the further future, next to hydrogen, there are more fuels on the horizon that are 100% CO₂ neutral from production to combustion and that are perfectly suitable to



EU emission legislation

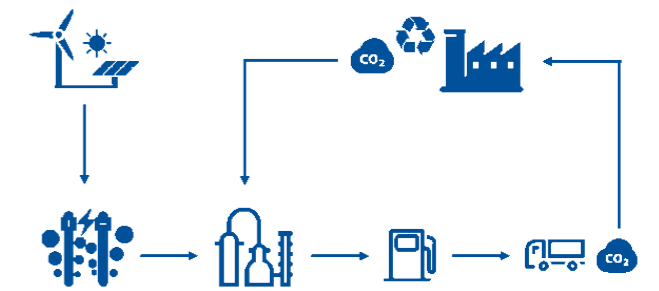


The illustration on the right shows that the biggest step that can be taken in the short term to reduce emissions is by replacing older trucks with the most modern Euro 6 vehicles.

power the internal combustion engine. An example are the so-called renewable 'Power-to-Liquid fuels' or so-called e-fuels, whereby hydrogen is generated via electrolysis, using green electricity captured from wind and solar energy. This hydrogen is combined with recycled CO₂ to produce a synthetic fuel. Filters that are being developed to capture and store CO₂ are central to the principle of 'Power-to-Liquid' fuels. Collecting the CO₂ released during combustion and combining it with hydrogen completes the cycle. In fact, CO₂ that leaves the exhaust is used to create new fuel.

The future 'Power-to-Liquid' fuels can be distributed via existing fuel distribution networks and could already be used in the modern combustion engine. Using these fuels is completely CO₂ neutral, provided that the hydrogen is produced using for instance solar, water or wind energy.

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



To create e-fuels, hydrogen is generated via electrolysis, using green electricity captured from wind and solar energy. This hydrogen is combined with recycled CO₂ to produce a synthetic fuel.

Hydro-treated vegetable oil (HVO)

DAF's modern diesel engines ranges are already compatible with 100% HVO, which stands for 'Hydro-treated Vegetable Oil' and is a new generation of biofuels. It beautifully supports the circular economy because it is made from vegetable oils and waste fats and is already available on the market and of which use is growing rapidly.

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 the service intervals.

In addition, HVO can be blended with regular diesel at any percentage, which importantly means you can simply top up with diesel, if HVO is ever unavailable. Unlike previous generations of biodiesels, HVO production has no influence on food production. This is an important factor for DAF to promote HVO.

When you consider the entire chain – from the production of HVO to what comes out of the exhaust – using certified HVO in vehicles can reduce CO₂ emissions by up to 90%. For further information, please contact your fuel supplier.





Now is the time to save CO₂ and costs!

Don't wait to save the environment. Now is the time to save CO₂. And the great thing is that you'll also save money right away.

Drivers who have received DAF EcoDrive driver training consistently use 3 to 5% less fuel and emit the same amount less CO₂.



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 CO₂ emissions.



Selecting tires with the lowest rolling resistance (A or B types) will add to highest fuel efficiency. Moving to a category with even lower resistance will result in some 2 - 2.5% fuel and CO₂ savings, depending on the application.

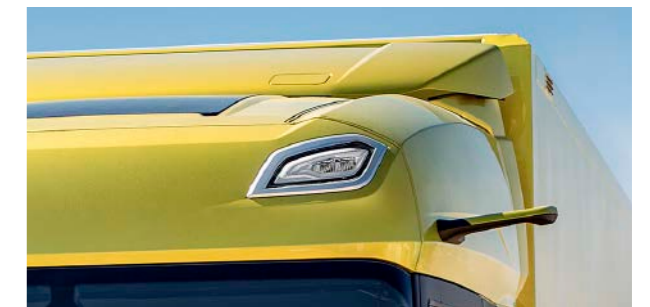


If you order a boxed body for the DAF XB, consider the Aerobody. Its aerodynamic design is up to 8% more efficient at cruising speeds of 85 km/h, which means an 8% reduction in CO₂ emissions as well.

Reducing maximum speed from 89 to 85 km/h when transporting goods internationally lowers CO₂ emissions by 3 to 4% and saves fuel.



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 CO₂ by 2% in daily practice.



The right deflector setting can save up to 10% fuel and CO₂ emissions. DAF Digital Vision System provides the perfect indirect view for optimal safety and thanks to its aerodynamic design, 1.5% fuel and CO₂ emissions can be realized.



Do you still have Euro 5 or early Euro 6 vehicles in your fleet? Exchange them for the latest generation of DAF truck models. These come with many benefits and they are in many cases up to 10% more fuel efficient and produce less CO₂ emissions. They also reduce NO_x emissions by 80% and soot particles by 66%, when traded in for Euro 5 vehicles. This gain is even greater if you replace a Euro 4, Euro 3 or even older vehicle of the New Generation DAF trucks.

On the road to 2030

The European Union has targeted the transport industry to reduce CO₂ emissions from trucks by 15% by 2025 and proposes a 45% reduction by 2030 compared to the year 2019. A big challenge for society.

To meet the European Union's requirements, fully electric vehicles will become increasingly important. That is why DAF is already offering a comprehensive range of efficient battery electric vehicles, backed by dedicated services to allow you to perfectly make the transition. Tailor-made sales advice and route planning, energy and training support and reliable and efficient charging stations make DAF your trusted partner in business.

To fulfil the objectives for 2030, we will have to apply all available options to reduce emissions. And DAF will take its responsibility by further building on the New Generation DAF vehicles that have been launched recently and that make optimal use of the new European Masses & Dimension Regulations. Optimal aerodynamics, advanced driver assistance systems and sophisticated driveline enhancements add to class-leading fuel efficiency and lowest CO₂ footprint.

DAF will continue to invest in new technologies that will further benefit the environment. These include innovations to the efficient, reliable and durable internal combustion engine, as new types of fuels like hydrogen and 'Power-to-Liquid' will become available in near future to come to real zero emission road transport operations.

We are borrowing the earth from our children. As we want to pass it on in good health to our children and future generations, we will use all feasible opportunities available.

DAF. Your trusted partner in the energy transition. Now and in the future.

Vecto CO₂ 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 'CO₂ certificate'.

European regulations require all newly delivered 4x2, 6x2, 6x4 and 8x4 medium and heavy-duty trucks to have a CO₂ emissions certificate. The emissions certificate values are generated using the industry-wide, standardized and certified Vecto tool. This means that you, as a transport operator, can compare the CO₂ emissions values of different truck models and brands.

As a factory we are obliged by EU law to provide a CO₂ 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 a truck. Our unique TOPEC sales tool allows your DAF dealer to inform you about the CO₂ values of your future vehicle before purchase. For maximum clarity and transparency.



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