All you need to know about CNG

Compressed Natural Gas

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Today's energy environment poses a large number of major challenges: sweeping changes in the global energy supply, issues related to global warming and reducing our energy footprint, tighter regulations designed to bring about the energy transition. It's therefore essential that we investigate, explore and test new forms of energy.

> **Various initiatives and tests are currently underway, worldwide and at numerous Group subsidiaries, in the field of alternative energy: first-, second- and (soon) third-generation biofuels; hydrogen; liquefied natural gas (LNG) and compressed natural gas (CNG); even electromobility.**

Currently, conventional fuels still account for a significant share of the transport energy mix and will continue to do so over the medium term. However, it is clear that **the percentage of alternative fuels used in new vehicles will keep rising at a steady pace.**

With that in mind, **we decided it was essential to offer some simple, practical and comprehensive information** about these energies and markets of the future.

"CNG: All you need to know" provides the information and data you need in order to gain a thorough understanding of CNG technology and explain it to others.

Enjoy your read!

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What is CNG?

Natural gas is a blend of light hydrocarbons consisting primarily of methane.
It is naturally present in certain porous rock.

The various applications for natural gas

Natural gas is an energy source that has long been used for various purposes:

- RESIDENTIAL (cooking, heating)
- INDUSTRIAL (fuel)
- POWER GENERATION (gas power plant)
- FUEL (boats, lorries)

CNG? CNG is an acronym for **Compressed Natural Gas**, which is natural gas stored at high pressure (between 200 and 250 bars). **As a result, it takes up less room and is easy to transport.**

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CNG: a special type of fuel

States of natural gas

METHANE IN AIR
20°C / 1 bar
1L of diesel fuel = 900L of methane

CNG
20°C / 200 bar
1L of diesel fuel = 5L of CNG

LNG
-120°C / 10 bar
-162°C / 1 bar
1L of diesel fuel = 1.8L of LNG

? How is CNG stored?

CNG is stored in one or more cylinders under high pressure (between 200 and 250 bars).

? What vehicles run on CNG?

Any type of vehicle can operate on CNG: lorries, commercial vehicles and even light passenger vehicles.

? Are there different grades of CNG?

There is only one grade of CNG fuel. Its ingredients may vary slightly depending on the region and the time of year, but it must always comply with the EU's EN16726 standard to guarantee its quality.

! Products not to be confused with CNG

- **LPG:** Liquefied Petroleum Gas - composed of different chemicals (propane and butane)
- **LNG:** Liquefied Natural Gas - same composition as CNG, but cooled to about -162°C so it can be stored in liquid form
- **NGV:** Natural Gas for Vehicles - a term that encompasses both natural-gas fuels: CNG and LNG

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Producing CNG

Natural gas is extracted from **geological reserves** all over the world (Russia, United States etc.) and transported to France via ship or pipeline over a distance of several thousand kilometres.

It then travels through an **underground network** of pipelines that supply service stations directly.

Once at the station, the gas is compressed to between 200 and 250 bars of pressure, then stored. It is then available for filling vehicles.

Did you know?

Once its impurities have been removed, biogas can be injected directly into the pipeline network at specific points.
This renewable gas, still largely undeveloped, could make its way into the tanks in the future!

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Gasoline, diesel or CNG: which is best for my vehicle?

Each technology has its advantages and drawbacks in terms of cost, noise, pollutant emissions and so on. It is therefore up to customers to choose, based on their needs and preferences.

Cost

A vehicle that runs on CNG is more expensive to purchase but can prove more cost-efficient than its diesel or gasoline equivalent, depending on the price of fuel, the number of kilo-metres covered annually, and prevailing tax laws.

Noise

The engine technology for natural gas reduces noise levels in CNG vehicles quite substantially compared to diesel lorries. This is a real advantage for urban or night transport.

Driving range

CNG-powered vehicles have a limited driving range of 350-400 km, so they are primarily for urban and regional use. Light vehicles are always equipped with a gasoline tank as well, so they have a very comfortable driving range (between 600 and 1000 km).

CO_2 emissions

It's difficult to distinguish CNG vehicles from other vehicles, since CO_2 emissions vary signi-ficantly based on each vehicle and its use. But like biodiesel and bioethanol, any use of biogas in CNG reduces the vehicle's impact on the environment.

Pollutant emissions

Both diesel and CNG lorries comply with the European Union's EURO VI standard. That standard, which took effect on 1st January 2014, defines permissible pollutant emis-sion levels for heavy-duty vehicles. Light vehicles comply with the EURO 6 standards, whether they run on gasoline, diesel or CNG.

Did you know? When applied to lorries, the EU standard is written as EURO VI. When applied to light vehicles, it is written as EURO 6.

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A heavy-duty CNG engine: how does it work?

Whether they run on diesel or natural gas, combustion engines operate by burning a mixture of air and fuel. For a diesel engine, the air/diesel mix ignites by itself (auto-ignition) when the temperature and pressure are sufficiently high within the combustion chamber.

In a natural gas engine (one that runs on CNG or LNG), the blend of air and natural gas is ignited by the spark produced by the spark plug in the centre of the combustion chamber... just like in a gasoline engine!

Did you know?

CNG and diesel technology can be combined within a single engine. These so-called **Dual-Fuel** engines can operate on 100% diesel or a mixture of diesel and natural gas. However, Dual-Fuel engines do not yet comply with the EURO VI standard. Stay tuned...

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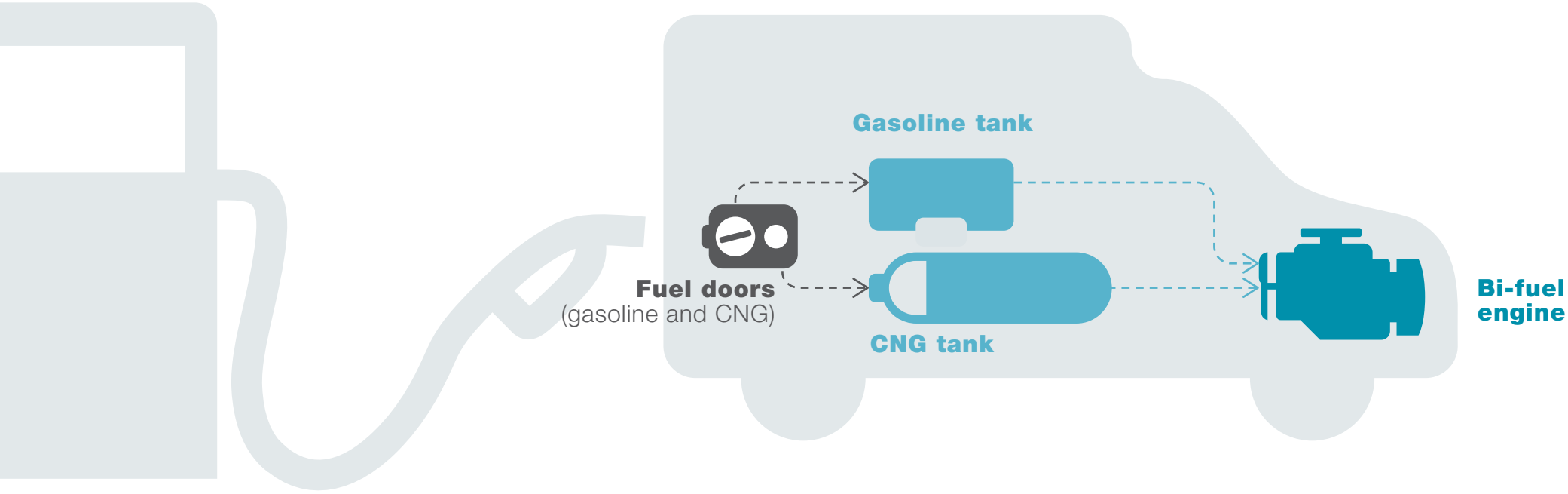
A CNG engine in a commercial or light vehicle: how does it work?

Under the bonnet, CNG vehicles run just like gasoline-fuelled vehicles, except that they are **equipped with two tanks for just one engine.**

Often referred to as **bi-fuel**, this engine is designed to be able to burn either gasoline or natural gas.

This ensures a **very comfortable driving range** (from 600 km to over 1000 km) and prevents the likelihood of running out of fuel.



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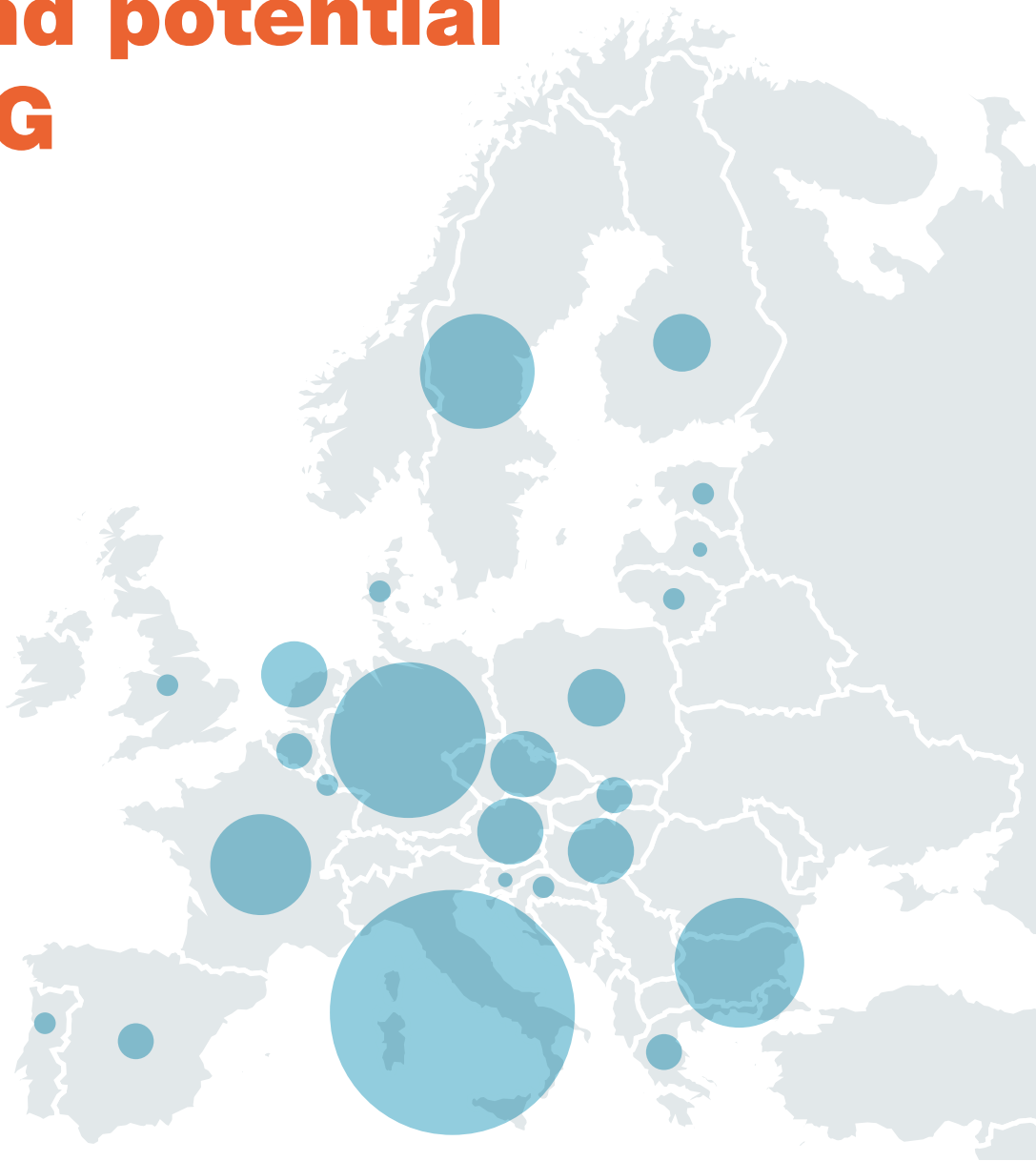
The current and potential market for CNG

Currently, within Europe, CNG is primarily used in **Italy**, **Germany** and **Sweden**.
It is beginning to emerge in France, along with Belgium and the Netherlands, for use in commercial vehicles and lorries for urban or regional transport.
However, the public distribution infrastructure is still poorly developed.

Some companies are choosing to invest in private stations, either alone or with partner companies.



Density of CNG stations in Europe

Source: NGVA Europe (2015)

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CNG IN PRACTICE

Filling up with CNG

The 4 essential steps

1. **Visit a CNG station.** These stations use special equipment, with customised dispensers and couplings.
2. **Unhook the CNG nozzle and connect it** to the vehicle receptacle.
3. **Lock the coupling.** Depending on the system, you need to rotate the handle or set the trigger lock.
4. **Fill your tank.** The pump stops automatically when the tank is full.
   Bear in mind that CNG is dispensed by the kilogram, and filling a car takes 2 to 3 minutes.
   Filling a lorry will take less than 10 minutes.

...and drive! The remaining mileage and CNG tank level are displayed on the indicator panel or can be obtained from the onboard computer.

Good to know! The connection between the dispenser nozzle and the vehicle is airtight, with no evaporation or projection possible.
Moreover, you cannot fill the tank unless the nozzle is properly locked in place.

Where can I find a CNG station?

Currently, the network of service stations in Europe is sparse.

The following website regularly updates its list of stations currently operating in Europe: **NGVA Europe http://www.ngvaeurope.eu**

CNG IN PRACTICE

Precautions to take

When filling the tank

CNG is no more hazardous than gasoline or diesel fuel. All of the connections are airtight, with no risk of fumes or projection.

At the service station, you should follow the same safety guidelines as you would for gasoline or diesel fuel:

- **Do not smoke** and do not bring a heat source near the vehicle
- **Do not use your phone**

When parking

Driving on CNG does not entail any restrictions on parking, including underground parking.

It is also worth noting that natural gas is no more explosive than LPG or gasoline.

If you detect a leak

Leaks of CNG can be identified by the accompanying sulphur smell, similar to that of mains gas.

The first thing you need to do is define a safety perimeter around the leak (because of the risk of inflammation from a heat source).

Next, notify the fire brigade and onsite safety personnel.

In most cases, the tank should be allowed to empty completely.

CNG IN PRACTICE

Summary of maintenance tasks

I drive a lorry

EURO VI Diesel	EURO VI CNG
• Fill the AdBlue® tank on a regular basis • Perform regular maintenance on the AdBlue® (SCR) system • Inspect the particulate filter and SCR systems	• Replace spark plugs • Regularly inspect the special parts in the CNG engine • Verify that the gas circuit and CNG tank are airtight

I drive a bi-fuel car or commercial vehicle

Apart from special inspections of the gas circuit and CNG tank, maintenance for your vehicle is very similar to that of a conventional-fuel vehicle. Your dealer will point you to authorised garages.

AdBlue® is a registered trademark of the German Association of the Automotive Industry (VDA).

Did you know?

For most heavy-vehicle manufacturers, the lubricants used in CNG lorries are currently the same as those used with diesel engines.

The oil change intervals are very similar or even identical to those for diesel vehicles. Certain uses (such as urban trips) will require shorter oil change intervals.

! Important

Maintenance must be performed by an authorised garage that is certified by your CNG vehicle's manufacturer.

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CNG IN PRACTICE

Driving a Gasoline/CNG bi-fuel vehicle

Does your vehicle have a gasoline tank and a CNG tank?

- The engine uses gasoline to start up
- It automatically switches to CNG in less than a minute, as soon as the optimal conditions are reached
- If the supply of CNG runs out, the engine automatically switches to gasoline mode
- The supply levels in the gasoline tank and CNG tank can be monitored from the driver's seat
- A button is available to tell the engine to switch to gasoline mode, even while driving
- Bi-fuel systems are completely transparent for the driver, and the fuel source can be changed seamlessly
- No space is lost in the boot: the gas tanks are located in the vehicle floor

And what about lorries? Is driving any different?

Given the same size engine, driving a vehicle that's running on CNG is no different from driving a diesel vehicle.


All you need
to know about
CNG
I'm all clued in!

Energy is our future,
save it!

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