

# NGVs 101

## Basic Questions about Natural Gas as a Vehicle Fuel

### What is natural gas?

Natural gas primarily consists of methane (around 90%), with small amounts of ethane, propane and other trace gases. Methane is a simple gas molecule made up of one carbon atom and four hydrogen atoms (CH<sub>4</sub>). It is lighter than air and burns almost completely, leaving carbon dioxide and water as combustion by-products.

### Why use natural gas as a fuel?

- Urban combustion engine and greenhouse gas emissions are inherently lower than emissions from gasoline or diesel fuel.
- Natural gas use decreases our reliance on foreign fuel sources as more than 98% of the natural gas used in the U.S. comes from North America.
- Natural gas costs less per unit of energy than gasoline or diesel.

### How is natural gas used as a vehicle fuel?

Compressed natural gas, or CNG, is the most common form of natural gas used in vehicles. Heavy-duty vehicles often use liquefied natural gas or LNG. CNG is stored on the vehicles at around 3600psi (in gaseous form) while LNG is stored at -260°F (in liquid form).



### Who provides the natural gas?

In the case of CNG, local utilities provide the natural gas, which is piped to the location where the gas is compressed before being dispensed into the vehicle. In the case of LNG, the fuel typically is trucked from the plant that produces LNG and is delivered to the location in a specially designed tanker truck and put into cryogenic storage on-site.

### Do NGVs operate differently than gasoline or diesel fueled vehicles?

NGVs operate on the same basic principles as gasoline-powered vehicles. When the engine is started, CNG flows from a storage tank into a fuel line. The CNG then passes through a regulator that reduces the pressure of the gas. The gas then enters a fuel-injection system which introduces the fuel into the cylinders. Computers with sensors adjust the fuel-air mixture so a spark plug can ignite the gas, burning it cleanly and efficiently. For LNG, the liquefied natural gas is simply heated, converting back to its gaseous form. From there on, the process is the same as with CNG engines.

Since natural gas is a gas rather than a liquid when at “room” temperature and pressure, modifications are required to make an NGV work efficiently. These changes are primarily in the fuel storage, fueling receptacle/fill-nozzle and engine. Specially designed tanks that hold the CNG or LNG are heavier and take up more space than their gas/diesel cousins.



### What kinds of vehicles use natural gas?

Natural gas vehicles are available in all classes of personal and commercial vehicles in both dedicated and bi-fuel models. Vehicles are available from original equipment manufacturers as well as small volume manufacturers that convert existing vehicles to run on natural gas. Vehicles converted by small volume manufacturers meet all government safety and emission requirements.

Available vehicles range from light-duty compacts to heavy-duty buses, refuse trucks and semis. More than 50 different light-duty sedans, vans and pick-ups are available. Factory-built natural gas options are available from all the major refuse truck chassis manufacturers and bodyoutfitters, most of the transit and shuttle bus builders, two of the top three school bus builders, major street-sweeper manufacturers, and leading truck builders Freightliner, Peterbilt and Kenworth.

### How is the fuel stored in the vehicle?

Most NGVs operate on CNG to save space. CNG is stored on the vehicles under high-pressure (3,600 pounds per square inch) in cylinders attached to the rear, top or undercarriage of the vehicle. Made of high-strength materials designed to withstand impact or puncture, these cylinders meet or exceed rigorous safety standards. In the event of a fire, pressure relief devices provide controlled venting of the stored gas rather than allowing the pressure to build in the tank.



In other NGVs, natural gas is stored on-board in a liquefied state known as liquefied natural gas, or LNG. The gas is cooled to -260°F creating a big advantage in space requirements over CNG. LNG requires only 30% of the space CNG requires for an equivalent amount of stored energy. LNG is stored in thermal storage tanks to keep it cold.

## How are NGVs fueled?

NGVs are fueled similarly to other vehicles. The dispenser looks about the same but with a different fill-nozzle. It's easy for drivers to learn how to fill an NGV. Because natural gas is under pressure, the storage systems are designed so no fuel escapes while fueling the vehicle. The fill-nozzles lock securely onto the storage tank receptacles forming a leak-free seal similar to that of an air compressor.



The storage tank receptacles are designed to prevent gas from escaping when the nozzle is removed.

## How long does it take to fill an NGV with natural gas fuel?

There are basically two types of fueling options for CNG vehicles: fast-fill and

time-fill. With fast-fill, the combination of a large compressor coupled with a high-pressure storage tank system called a cascade, an NGV's tank can be filled in about the same time it takes to fuel a comparable gasoline or diesel vehicle. Time-fill systems do not have the complex storage systems and have much smaller yet less expensive compressors. Time-fill systems typically refuel CNG vehicles overnight at about one gallon per hour. Time-fill systems work best for NGVs that remain idle overnight such as refuse trucks and school buses.

There are also home refueling options for individuals who own CNG-powered vehicles and want the convenience or fueling at home. These units connect to a residential gas line and are typically mounted on a garage wall, fueling a single vehicle at a rate of slightly less than a half a gallon per hour.

## Are NGVs safe?

Absolutely! Compressed natural gas is stored on board vehicles in tanks that meet the most stringent safety standards in the world. Some of the tests these tanks must pass are the drop test, the bonfire test and the gunshot test.

## REFERENCES

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### America's Natural Gas Alliance

[www.anga.us](http://www.anga.us)

### Clean Energy

[www.cleanenergyfuels.com](http://www.cleanenergyfuels.com)

### CNG Now!

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### CNG Prices

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### East Tennessee Clean Fuels

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### Natural Gas Vehicles for America

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### NGV Community

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### NGV Forum

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### Tennessee NGV Task Force

[www.tnngv.org](http://www.tnngv.org)

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[http://www.afdc.energy.gov/afdc/vehicles/natural\\_gas.html](http://www.afdc.energy.gov/afdc/vehicles/natural_gas.html)

### Centralina Clean Fuels Coalition

<http://www.4cleanfuels.com>

### Triangle Clean Cities Coalition

<http://www.trianglccleancities.org>



MLGW  
[www.mlgw.com](http://www.mlgw.com)

# Natural Gas Vehicles



With proven reserves of domestic natural gas soaring (100+ years) and our dependence on foreign oil as burdensome as ever, it only makes sense to start using clean, inexpensive and abundant natural gas as a vehicle fuel. Natural gas vehicles (NGVs) are good for our economy, our environment and your bottom line. Whether you're an individual or a fleet manager, never before have there been so many natural gas products and services available, spurred by unprecedented industry investment and government incentives.

Read on to learn more about the many benefits of NGVs!

