



## Environmental Benefits of Natural Gas Vehicles

**NGV BENEFITS:** Energy security, fuel diversity, reduced emissions, and lower long-term costs are reasons why encouraging greater use of natural gas as a transportation fuel is a smart choice for fleets and consumers. The U.S. is the world's top producer of natural gas and given this abundance, it will soon be a net exporter, helping other countries increase their energy security. It makes sense to build on the many benefits that this domestic resource provides by expanding its use in transportation. The transportation sector is heavily reliant on petroleum fuels and with respect to heavy duty applications, there are few viable alternatives to power fleets other than natural gas.

**KEY POINTS:** Natural gas facts with regard to emissions include:

- Natural gas **reduces tailpipe carbon dioxide (CO<sub>2</sub>) emissions relative to gasoline and diesel fuel by 26 – 27%**, respectively, simply because it is less carbon intensive than gasoline and diesel. Natural gas consists mostly of methane (CH<sub>4</sub>) with a chemical makeup that is 4:1 hydrogen to carbon (gasoline has 8 carbon atoms and diesel has 16).
- On a well-to-wheels basis (WTW), natural gas **reduces overall GHG emissions by 15 to 23%** compared to diesel or gasoline (see below).
- Today's natural gas engines emit significantly less particulate matter and nitrogen oxides (NO<sub>x</sub>) than engines produced just a few years ago. New natural gas engines entering the marketplace this year will reduce ozone-forming NO<sub>x</sub> emissions even further – **as much as 90%** lower than the current EPA standard.
- Renewable natural gas (RNG) is increasingly being used by fleets who wish to reduce their emissions even further. RNG is produced by landfills, waste-water treatment facilities, and through animal and crop waste systems. RNG is classified by the EPA as an advanced biofuel and a cellulosic biofuel under the Renewable Fuel Standard. RNG can **reduce WTW GHG emissions by as much as 80 – 125%** depending on the source compared to petroleum fuels.

## DISCUSSION

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Well-to-wheels comparisons of emissions related to natural gas versus gasoline and diesel vehicles can produce varying results given a variety of complex factors, including assumptions concerning upstream methane emissions and fuel efficiency of the particular vehicles being considered. Recent WTW analysis such as that conducted by the California Air Resources Board (CARB) indicates that NGVs when fueled with conventional natural gas, provide about at least a 15% reduction compared to diesel fueled vehicles (assumes 25 GWP factor for methane, 100-year time-frame, 10% fuel economy penalty for natural gas).

Upstream natural gas emissions contribute to the overall GHG benefit of NGVs. The Environmental Defense Fund has publicly stated that for compressed natural (CNG) vehicles to be viable, upstream emissions from gas wells, pipelines, etc. must be kept below 1.6% of total natural gas produced and near 1% for heavy-duty vehicles to be “immediately” beneficial. According to a report published by the America Gas Association, the natural gas leakage rate is about 1.3%. Overall emissions from the natural gas system have declined, in absolute terms, 15% from 2005 levels. These emissions continue to decline largely due to voluntary industry practices that include upgrades to transmission and distribution pipelines and new wellhead technologies.

Recent studies and analysis suggest that additional reductions from the natural gas system can be cost-effectively implemented and that much of the emissions that is occurring is the result of super emitters or outlier sources. EPA has proposed a number of new regulatory requirements that will also further reduce upstream natural gas emissions.

New technologies and innovation are also bringing advancements in natural gas engines. Cummins Westport recently announced its plan to install closed-crank cases on newer model year engines which will further reduce vehicle methane emissions by 70%. NGVs operating in Europe already use this technology and it is expected to be adapted to most heavy duty natural gas engines in the near future. Manufacturers of light duty natural gas vehicles can further reduce GHG emissions by taking advantage of natural gas’s near 130 octane rating and optimizing engines to fully benefit from these properties. Optimized natural gas engines could provide efficiency advantages that exceed gasoline and even diesel engines in the future.

As mentioned earlier, renewable natural gas (RNG) is growing in the NGV marketplace. Today, it is estimated that about 20% of all natural gas used for on-road transportation fuel is RNG. Based on this estimate, natural gas used in transportation is already providing an overall reduction in GHG emissions by about 28% (assumes CA LCFS LFG CI numbers, 10% fuel economy penalty, and 100-year GWP timeframe).

## **CONCLUSION**

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### **Natural Gas Vehicles Deliver Reduced Emissions for Fleets and Consumers**

- Today’s natural gas vehicles fueled by conventional natural gas deliver between 15 and 23% lower GHG emissions than similar diesel and gasoline powered vehicles.
- Considering that 20% of the fuel used in natural gas vehicles is renewable natural gas, this benefit grows to 28 – 35%.
- Future efforts to optimize natural gas engines and vehicles will increase efficiency and deliver additional emission reductions by taking advantage of natural gas’s superior attributes.
- Medium and heavy duty natural gas vehicles will provide the most significant benefits because solutions are available today to address greenhouse gas emissions in a market segment where few other options exist.
- Increasing the use of natural gas vehicles will help the U.S. meet its commitments under COP21, including achieving greenhouse gas emission reductions of 26-28% below the 2005 level in 2025.
- Renewable natural gas provides a pathway to significantly greater emissions offsets. Today, fleets already have the option of contracting to displace a portion of the conventional natural gas they use, or they can go 100 percent renewable natural gas. Fleets using 100 percent RNG can offset greenhouse gas emissions by 80 – 125%.