

Background

The railroad industry is exploring the use of natural gas in liquid form (LNG) and in a compressed gas form (CNG) as alternative and supplemental locomotive fuels to diesel for environmental and economic benefits.



The Federal Railroad Administration's (FRA) Office of Railroad Safety (RRS) promotes innovative technologies including use of alternative fuels. RRS also regulates safety throughout the nation's railroad industry. RRS executes its regulatory and inspection responsibilities through a diverse staff of railroad safety experts.

More Information

For more information on LNG and CNG, visit the following websites:

LNG

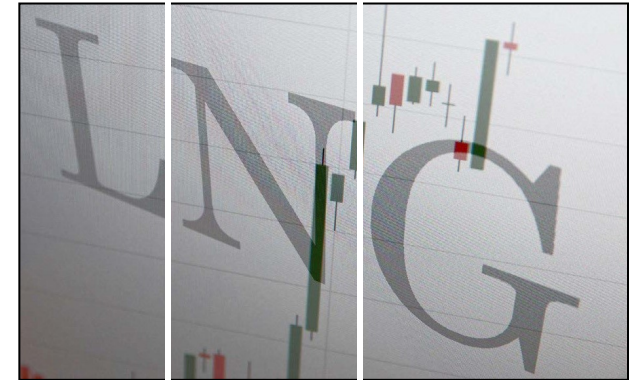
- Department of Energy, [Natural Gas](https://www.energy.gov/natural-gas) (<https://www.energy.gov/natural-gas>)
- Center for Liquefied Natural Gas, Cool, [Clean Fuel](http://www.lngfacts.org/) (<http://www.lngfacts.org/>)
- California Energy Commission, [Frequently Asked Questions](http://www.energy.ca.gov/lng/faq.html) about LNG (<http://www.energy.ca.gov/lng/faq.html>)
- [LNG Tenders/Locomotives](https://www.fra.dot.gov/Page/P0714) (<https://www.fra.dot.gov/Page/P0714>)

CNG

- California Energy Commission, Transportation [Natural Gas in California](https://www.energy.ca.gov/almanac/transportation_data/cng-lng.html) (https://www.energy.ca.gov/almanac/transportation_data/cng-lng.html)
- [LNG Tenders/Locomotives](https://www.fra.dot.gov/Page/P0714) (<https://www.fra.dot.gov/Page/P0714>)



Liquid and Compressed Natural Gas as Locomotive Fuels



How it Works

- Liquefied natural gas (LNG) results when natural gas (NG) is cooled to very low temperatures at atmospheric pressure. LNG is stored in highly insulated, double-walled tanks. LNG, as a liquid, provides significant reduction in shipping and storage volumes when compared to NG of the same mass in a gaseous state at atmospheric temperature and pressure conditions.
- LNG when spilled, or vaporized in vaporizers, is converted into NG.
- LNG spills and leaks lead to the formation of a cold NG cloud. This vapor cloud is visible due to water vapor in the air condensing into the LNG cloud as a fog.
- The NG cloud formed by LNG vaporization, when mixed with air, is flammable; but it will ignite only when the gas-air mixture is within a specific concentration range.
- Compressed natural gas (CNG) used as a locomotive fuel is stored at high pressures (>250 atmospheres) and ambient temperatures in cylinders. These cylinders are carried either on the locomotive or on a tender behind the locomotive.
- Locomotives using alternative fuels (LNG or CNG) have engines that burn NG and diesel fuel (dual-fuel operation).

- Normally, a locomotive uses the alternative fuel as the predominant source; however, diesel is used at very low engine loads, and as an igniter of the alternative fuel in the engine.
- A dual-fuel engine will burn diesel-only in the event of NG-fuel feed failure or in the event of deliberate NG fuel feed shut off or interruption.

Safety

- Dual-fuel NG locomotives have safety systems designed to protect railroad personnel and first responders in case of an accident.
- FRA requires a comprehensive safety analysis before the initiation of alternative locomotive fuel projects.
- FRA is continuing to research safety issues related to LNG and CNG.

Benefits


- Greenhouse gas emissions from the combustion of NG are much lower than those of diesel for the same energy output. This results in less carbon dioxide and other pollutants being released into the atmosphere.

- NG is widely available in the United States, and historically, has been cheaper than diesel fuel. Therefore, switching to LNG could save money in fuel costs.



Contact Us

Dr. Phani Raj
General Engineer
Hazardous Material Division

 (202) 493-6306

 Phani.Raj@dot.gov

