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## **U.P.S. Finds a Substitute for Diesel: Natural Gas, at 260 Degrees Below Zero**

By [MATTHEW L. WALD](#)

United Parcel Service U.P.S. is about to add 48 trucks powered by liquefied natural gas and would like to deploy more.

The final frontier for alternative motor fuels, powering big tractor-trailers, has been crossed.

The alternative is natural gas, but not in the now-familiar form of compressed gas. Instead, a growing number of the biggest trucks are running on [liquefied natural gas](#). Burdened by diesel prices that topped out at over \$5 a gallon in 2008 and mindful of the sustained collapse of natural gas prices, trucking companies are expressing new interest in liquefied natural gas for their thirstiest trucks, the over-the-road 18-wheelers.

“It’s the only long term viable option to diesel,” said Michael G. Britt Sr., director of maintenance and engineering at United Parcel Service, which is about to [add 48 L.N.G. trucks](#) and would like to deploy many more, if the fueling infrastructure is in place and if truck production volume rises enough to bring down costs. Many other companies are running test fleets.

Compressed natural gas is not a practical substitute for diesel with these tractor-trailers, because they burn so much fuel on a trip, consuming 20,000 to 30,000 gallons a year. From an energy and environmental standpoint, they are a prime target because collectively they account for three-quarters of the fuel used by commercial vehicles. By one estimate, switching to liquefied natural gas could reduce oil imports by more than a million barrels a day.

According to Rich Kolodziej, the president of [NGV America](#), a trade association, the amount of diesel fuel currently used annually for highway travel would work out to six trillion cubic feet of natural gas. (Current national natural gas demand over all is in the range of 22 trillion cubic feet a year.) Prices are depressed because of the recession and because the government has sharply raised its estimate of gas reserves as a result of the expansion of a drilling technique known as hydraulic fracturing, or fracking.

Natural gas prices per million B.T.U., the standard unit for gas, rose to over \$12 before the recession began, but are now in the range of \$4 to \$4.50.

Scientists and engineers are working on another alternative for these trucks, diesel fuel made from some renewable source, but have not found a formula for commercial success. So the best alternative appears to be liquefied natural gas.

L.N.G. requires only about 70 percent more space than diesel fuel. Compressed gas, in contrast, needs about six times as much space as diesel, even when squeezed down to 3,000 pounds per square inch.

U.P.S. plans to begin adding 48 liquefied natural gas trucks to its hubs in Ontario, Calif., and Las Vegas in the next few days. These will be 15-liter, 450-horsepower diesel engines, the biggest in common use on the highways. Like engines running on diesel fuel, they work without spark plugs, igniting the fuel through compression. Compression-ignited engines are more efficient than spark-ignited engines, so they get more work out of a given amount of fuel.

Upon start-up, they will use a few squirts of diesel to get going; a computer will also add diesel fuel when it senses that the engine needs it for lubrication. But over all, diesel use will be cut by about 95 percent.

U.P.S. runs a virtual menagerie of alternative vehicles using propane, batteries or hydrogen fuel cells. Some are hybrids that use [hydraulic pressure instead of electric batteries](#).

But natural gas chilled to 260 degrees below zero and squeezed down 600 times in volume is the company's choice, Mr. Britt said. His 450-horsepower tractors need so much energy to tow two trailers over mountainous terrain that "the first trailer would have to be all batteries," he said.

U.P.S. received \$5.5 million for the project from the state of California that was allocated by the federal Energy Department. The company used \$4 million to pay for the extra cost of the trucks and funneled \$1.5 million to Clean Energy of Seal Beach, Calif., to build a fueling station.

U.P.S. is not alone. Kenworth, the truck manufacturer, reports several orders in the last few weeks for L.N.G. trucks. Eighteen went to Enviro Express, a company in Bridgeport, Conn., that uses them to haul trash and recyclables. And the truck maker Peterbilt said in January that a trucking company in British Columbia had ordered 50 L.N.G. trucks.

The ports of Los Angeles and Long Beach, Calif., run about 1,000 trucks on liquefied natural gas, but outside of that, only about 300 others are running around the country, according to Clean Energy, a company that supplies compressed and liquefied gas.

But [Westport Innovations](#) of Vancouver, British Columbia, which makes engines that are certified by the United States Environmental Protection Agency to run on liquefied natural gas, said it had orders for 230 engines in the next 12 months. It has not

announced total orders for its past fiscal year, but in the first three quarters it sold fewer than 30.

Chilling the gas into a liquid costs energy, but Clean Energy says that a lot of gas is already being liquefied anyway. Natural gas refineries chill the gas that drillers take out of the ground to separate naturally occurring molecules like pentane, ethane and propane and to make a product that meets the specifications needed for gas pipelines, said James N. Harger, the company's chief marketing officer.

Clean Energy, which was founded by T. Boone Pickens, is selling an amount of natural gas that is equivalent to a gallon of diesel for \$1.25 less, a major consideration in vehicles that use hundreds of gallons a week. But then there's the \$1.5 million cost of building an L.N.G. fueling station with several bays for trucks, Mr. Harger noted.

A spokesman for Westport, the engine company, said the fueling problem was "your classic chicken and egg."

"The incumbent petroleum-based fuels have this continental network of fueling stations, and natural gas has that as well, but it's going through a pipeline to feed people's homes and the power industry," he said. The challenge is to furnish it in a form that vehicles can use in the same sort of ubiquitous way that trucks use diesel, he explained.

"The key is to get the number of trucks up," he said.

U.P.S. has about 17,000 big tractor-trailers and would like to switch 1,000 of them to liquefied natural gas, but cannot do so now because the fuel is available in only a handful of places. Production volumes of the trucks are so low that their cost remains high, about \$200,000, compared with only about \$100,000 for a standard diesel truck, according to Kara Gerhardt Ross, a U.P.S. spokeswoman.

But the company's demonstration fleet, 11 vehicles shuttling between Ontario, Calif., and Las Vegas, has shown that the trucks can handle the most demanding situations, like hauling multiple trailers over mountain ranges, U.P.S. says.