

## **Kenworth Truck Company Offers Advice on Spec'ing for Natural Gas Power**

Ready to seriously explore the purchase of natural gas trucks for your operation? So, where do you begin in the effort to specify for natural gas power?

"Start with two primary considerations when spec'ing natural gas-powered trucks – first, the type of natural gas available in your operating area, and second, the operating range your trucks typically travel," recommended Andy Douglas, Kenworth Truck Company's national sales manager for specialty markets, who leads Kenworth's green truck initiatives.

For the past five years, Douglas has traveled extensively to work closely with officials from fleets, non-profit organizations, municipalities, ports and government agencies interested in purchasing fuel-efficient, low-emission trucks or helping to aid the advancement of green trucks into the marketplace. For his efforts on Kenworth's behalf, Douglas was named one of just 40 Sustainability All-Stars by Green Fleet magazine recently.

### **Kenworth Natural Gas Trucks**

"Kenworth offers an excellent choice of natural gas trucks to meet the specific application needs of truck fleets and operators," Douglas said.

Kenworth offers four natural gas models. The Class 8 Kenworth T800 – which is available only for liquefied natural gas (LNG) use – can be ordered in a gross combination weight (GCW) of up to 80,000 lb. for over-the-road operation with additional ratings exceeding 100,000 lbs. available for certain applications.

The Kenworth T440, T470 and W900S are available to run either LNG or compressed natural gas (CNG). These three models can be ordered with ratings up to 66,000 lbs. GCW. The T440 and T470 can also be spec'd as a heavy Class 7 at 33,000-lb. (GCW) Class 7 truck. Models with the versatility to span Class 7 and Class 8 ratings can offer operators the widest array of truck choices to help meet their operational needs, Douglas noted.

### **Natural Gas Availability and Expanding Infrastructure**

Before choosing CNG or LNG, it is important for fleets and operators to take inventory of natural gas stations in their area and along their operating routes.

"Currently, many local transit and government agencies use CNG to power trucks and buses, so that fuel source may be easier to find," Douglas said. "Meanwhile, the natural gas infrastructure available to the public is expanding at an accelerated rate across the United States and Canada along well-traveled transportation routes."

For example, natural gas engine manufacturer Westport Innovations in Vancouver, B.C., and Shell have agreed to launch a co-marketing program in North America aimed at providing customers with a better economic case for adopting natural gas-powered vehicles by addressing fuel supply and customer support.

Chesapeake Energy announced this past summer that it will invest \$150 million in Clean Energy Fuels Corp. over the next three years to help underwrite approximately 150 LNG publicly accessible fueling stations for heavy duty trucks along major interstate highway corridors.

"It's amazing the amount of infrastructure activity that's happened in the past five years," Douglas said. "It may not be too long before we'll see enough natural gas stations along key interstate corridors for trucks to be able to travel from Los Angeles to New York and back."

## **Operating Range**

Besides natural gas fuel availability on your route, take into account operating range. "In general, if your operating range is over 400 miles, it's usually best to go with LNG. Under 400 miles, CNG can be an option. CNG can be used up to 66,000 pounds GVW with some severe duty applications going up to 80,000 pounds GVW," said Douglas.

## **Fueling**

In addition to available fuel type, be sure to check each station's ease of truck accessibility, and capability to fill commercial truck volumes. Most CNG stations compress the gas into onsite storage cylinders, which can then dispense the natural gas fuel into truck fuel tanks as quickly as diesel fuel. LNG can be dispensed at 20 to 40 gallons per minute, so fueling a truck with 120-gallon tank capacity may typically take less than five minutes.

"Drivers can refuel CNG-powered trucks without needing to go through special training," said Douglas. "LNG is a cryogenic fuel and so those vehicles must be refueled by properly trained individuals."

Some CNG stations are lower volume, or time fill, and fill fuel tanks more slowly. The slower, time-fill system is often used to fuel fleets whose vehicles sit overnight or for several hours, he said.

## **Fuel Tank Selection and Placement**

As far as fuel tank selection, there is sometimes a tendency to overspec when choosing natural gas tanks since operators are in the habit of carrying a two-to-three day supply of fuel on their diesel trucks. "In many cases, it's often impractical to carry much more than a day's supply of natural gas. Natural gas fuel tanks also can be expensive, so consider carrying only enough fuel for a full-day's work, plus a 10 percent reserve," said Douglas.

Douglas recommended specifying Type 4 CNG cylinders, which are the lightest weight, but also the most expensive option. Type 4 tanks have a plastic core and are fully wrapped with a composite, such as carbon fiber. Other less expensive options are Type 2 and Type 3 CNG tanks, which have a steel or aluminum core and are composite wrapped. All CNG tanks are high-pressure vessels.

For its LNG-powered T800s, Kenworth uses a Dewar flask (or cryogenic tank) system that is like a large Thermos® bottle inside a metal cylinder. The LNG fuel tank, which is designed to keep the fuel in its liquid state at minus 260 degrees Fahrenheit, can hold between 56 and 80 diesel gallon equivalent (DGE) gallons per tank.

Kenworth offers a number of tank options for order on its natural gas trucks. Fuel tank placement depends on the type of truck, chassis configuration, equipment specification choices and how much fuel is needed to be carried, Douglas said. "It's important to carefully consider the possible impact of tank placement choices on wheelbase length, weight distribution and turning radius," Douglas said.

## **Engine Recommendation – Westport HD**

Douglas also offered engine recommendations for spec'ing natural gas trucks.

"If you choose LNG, the 15-liter Westport HD engine is a good choice for Class 8 applications, including regional haul, line haul, port and drayage with loads requiring more power and torque. That engine can be specified on the Kenworth T800," he said. Kenworth was the first truck manufacturer to offer an LNG fuel system as a Class 8 factory-installed option several years ago, and more than 500 Kenworth T800 LNG trucks are in operation.

The Westport HD engine uses approximately 95 percent liquefied natural gas, and 5 percent diesel as the pilot ignition, thus requiring the use of selective catalytic reduction (SCR) technology and a diesel particulate filter (DPF). For the T800, the HD engine is available in power ratings from 400 to 475 hp and torque ratings from 1,450 to 1,750 lb-ft, and uses high-pressure direct injection technology to achieve that horsepower and torque.

For a regional or line haul operation, Douglas recommends an LNG truck with two tanks. "If you specify, say a 120-gallon and a 70-gallon tank, that configuration provides about 100 DGE for an operating range in the neighborhood of 500 miles – without severely impacting wheelbase," he said.

### **Engine Recommendation – Cummins Westport ISL G**

If your route is less than 400 miles, Douglas suggests considering the CNG route with the 8.9-liter Cummins Westport ISL G natural gas engine. The engine uses a maintenance-free, three-way catalyst and is 2010 EPA- and CARB-compliant without the use of SCR / DEF system. "The three-way catalyst offers customers less weight and complexity and can result in lower running costs," noted Douglas.

The ISL G is rated at 320 hp and 1,000 lb-ft of torque for the Kenworth T440 and Kenworth W900S for local and vocational applications, and has a torque curve closely matching that of its diesel counterparts. The ISL G is spark-ignited and can operate on either LNG or CNG. Combined with the use of an automatic transmission, which improves throttle response and torque management, superior pulling power is provided to get the job done. The ISL G is recommended for tractors with a GVW of 66,000 lbs. or less. In addition, for vocational straight truck applications such as mixers, a GVW of up to 80,000 lbs. is available.

For CNG, Douglas recommends specifying either two saddle tanks or four vertical back-of-cab headache tanks. "That gets you about 76 to 81 DGE, which equates to up to 400 miles travel with CNG," said Douglas. "Vocational applications, such as a mixer, would also be better served with the choice of CNG because of the more local nature of the application. The ISL G also can be set up to run LNG, if you decide to go that route," added Douglas.

For LNG, customers can consider a single 63 to 80 DGE tank or dual tanks for greater range.

The ISL G is also 5-1/2 decibels quieter than comparable diesel-powered 2007 Cummins engines at peak torque and load and nearly 10 decibels quieter at idle, according to Cummins Westport. The company reports it has produced 10,000 ISL G natural gas engines, mostly for the school bus and commuter bus markets, since the engine's launch in 2007.

### **Diesel vs. Natural Gas Prices**

According to recent figures from the U.S. Energy Information Administration, the average cost of diesel in the United States reached \$4 in November. That's up just over 25 percent from the same period a year ago.

"The price of natural gas over the past three years has been consistently lower than diesel, in some cases by as much as \$2 per diesel gallon equivalent," said Douglas. "It's no wonder why natural gas has drawn increasing interest among truck and fleet operators," Douglas said.

"The fuel savings, coupled with the longer trade cycles that some vocational operators already experience with their trucks, can make a positive return on investment (ROI) attainable now, even without government incentives," he said. "The business is changing as the trend moves toward greener trucks."

To help determine if that savings can provide a high enough ROI, Douglas said the Clean Cities Alternative Fuel Price Report offers a comparison of CNG, gasoline, diesel and biodiesel fuels on a straight price comparison basis and an energy-equivalent basis. The report is updated every three months.

### **Other Benefits**

"Natural gas is also a cleaner burning fuel, which provides an environmental benefit through lower greenhouse gas emissions. Since it can be produced domestically, natural gas also has the potential to significantly reduce dependence on foreign oil," Douglas added.

A number of federal, provincial, county, and municipal grant programs and financial incentives are available to help truck operators purchase natural gas vehicles. "Kenworth and Kenworth dealers can assist truck operators interested in pursuing such funding. Kenworth requires its dealers to make certain that service technicians are properly trained to work on natural gas trucks, prior to selling these trucks to customers. Kenworth dealers can also assist customers in helping to spec natural gas trucks," said Douglas.

"Natural gas represents a tremendous future for our industry. Knowing how to choose the right model, fuel, tanks, and engine is important for truck fleets and operators looking at adding natural gas units to their operation," Douglas concluded.

For more information, contact your Kenworth dealer.

### **Additional Resources**

Here are additional resources of interest:

Argonne National Laboratory and the Great Plains Institute: ([greet.es.anl.gov/carbon\\_footprint\\_calculator](http://greet.es.anl.gov/carbon_footprint_calculator)): Developed a carbon and petroleum footprint calculator to help calculate a fleet's petroleum and greenhouse gas footprint. Fleets can also compare different alternative fuels and vehicle technologies for a future medium duty, heavy duty or off-road vehicle purchase.

Clean Cities Alternative Fuel Price Report ([www.afdc.energy.gov/afdc/price\\_report.html](http://www.afdc.energy.gov/afdc/price_report.html)): Provides a comparison of CNG, diesel, biodiesel and other fuels on both a straight price comparison and an energy-equivalent basis every three months.

CNG Now ([www.cngnow.com/en-us/Pages/default.aspx](http://www.cngnow.com/en-us/Pages/default.aspx)): Offers information on natural gas, including updates on federal legislation, such as the NAT GAS Act, designed to increase the use of natural gas as a vehicle fuel. The site is sponsored by companies in the natural gas industry, including Chesapeake Energy, Cummins Westport and Clean Energy.

International Association of Natural Gas Vehicles ([www.iangv.org](http://www.iangv.org)): Features a natural gas vehicles knowledge database, which includes an overview of all the types of vehicles powered by natural gas from three-wheelers and motorcycles to heavy-duty trucks, trains and aircraft. The site also includes

information about fueling stations — where they're located and the differences between a fast filling fuel station and a slow one.

Natural Gas Vehicles for America ([www.ngvamerica.org/incentives/stateNGV.html](http://www.ngvamerica.org/incentives/stateNGV.html)): Provides information on states incentives available for natural gas vehicles.

The Center of Liquefied Natural Gas ([www.lngfacts.org](http://www.lngfacts.org)): Provides a clearinghouse of educational and technical information compiled by this trade association of LNG producers, shippers, terminal operators and developers, and energy trade associations.

U.S. Department of Energy Alternative & Advanced Vehicles Data Center ([www.afdc.energy.gov/afdc/about.html](http://www.afdc.energy.gov/afdc/about.html)): Offers basic information about alternative fueled vehicles, including medium duty and heavy duty natural gas-powered trucks. Federal and state incentives and laws related to alternative fuels and vehicles, air quality, fuel efficiency, and other transportation-related topics are covered ([www.afdc.energy.gov/afdc/laws](http://www.afdc.energy.gov/afdc/laws)).

Westport Innovations ([www.westport.com](http://www.westport.com)): Offers useful information on its natural gas engine offerings, including the Westport HD 15-liter and Cummins Westport ISL G, and provides information on alternative fuels.

Kenworth Truck Company is the manufacturer of The World's Best® heavy and medium duty trucks. Kenworth is an industry leader in providing fuel-saving technology solutions that help increase fuel efficiency and reduce emissions. The company's dedication to the green fleet includes aerodynamic trucks, compressed and liquefied natural gas trucks, and medium duty diesel-electric hybrids. Kenworth is the only truck manufacturer to receive the Environmental Protection Agency's Clean Air Excellence award in recognition of its environmentally friendly products. In addition, the fuel-efficient Kenworth T700 equipped with the low-emission PACCAR MX engine was named the 2011 Heavy Duty Commercial Truck of the Year by the American Truck Dealers. Kenworth is also the recipient of the 2011 J.D. Power and Associates award for Highest in Customer Satisfaction for Heavy Duty Truck Dealer Service. Kenworth's Internet home page is at [www.kenworth.com](http://www.kenworth.com). Kenworth. A PACCAR Company.