Natural gas: Do the numbers add up?
Projecting total cost of ownership is by no means yet a simple calculation

Jun. 5, 2013  David Cullen

Fleet owners figuring to slice operating costs by switching to natural gas-fueled trucks are wise to do a lot of figuring first. Unfortunately, for some time to come, doing that will also require some estimating—if not outright guessing.

To forecast how much money will potentially be saved over a new truck’s lifetime by burning natural gas—be it compressed (CNG) or liquefied (LNG)—instead of diesel fuel, a fleet owner would expect to start by gathering projections on what will be the vehicle’s total cost of ownership (TCO).

However, TCO figures for each of the handful of natural gas truck applications typically seen in the U.S are not as easy to come by as those for diesel-fueled trucks of every imaginable description.

To be sure, TCO projections are certainly available from truck makers and leasing companies and firms that track and analyze fleet costs. But it appears no authoritative source yet has a complete handle on TCO for all natural gas trucks.

The biggest part of the problem is the technology featured in natural gas trucks—and thus the trucks themselves—is still so new to the marketplace that even experts find it difficult to project hard and fast numbers on what their ownership costs will turn out to be.

On the other hand, the main argument for converting fleets to natural gas power (environmental sustainability aside) is to cash in on the huge price spread between CNG/LNG and diesel that exists today and that many experts expect to remain in place for the foreseeable future.

It’s difficult not to get excited about projected fuel savings. But having fuel, an undeniably major cost factor, nailed down does not a complete TCO projection make. Truck OEMs and lessors can lay out the current price premiums and the expected maintenance and service costs for new natural gas trucks vs. diesel rigs as well as the cost of fueling infrastructure with reasonable confidence. However, no one can yet speak fully to what residual values will be assigned these vehicles once they ultimately arrive on the secondary market.

“There is a lot of unverified information—speculation—on [operating] natural gas trucks,” advises John Flynn, CEO & president of Fleet Advantage, which provides cost-analytics solutions to fleets including ones operated by Fortune 500 firms. “So, I’d caution anyone to give wide berth to TCO projections.”

According to Scott Perry, Ryder’s vice president of supply management, there are a number of variables to take into account to try and arrive at a TCO projection for a given natural gas truck.

“The traditional model—diesel power—is very deep,” he points out. “On the other hand, we also don’t have a full picture of the costs associated with running EPA ’07 and ’10 engines yet, either. But there is a pool of knowledge to draw on for making assumptions, and TCO can be looked at scientifically.
“Right now, it is Ryder’s view [that payback] will be driven by the number of miles traveled and the fuel consumed,” he continues. “Typically, a fleet that utilizes natural gas for Class 6-8 trucks that run 70,000 mi. or more a year will see a savings. Less than that, the advantage will erode and may fall so far that converting will end up costing the fleet money.”

PUMPING IT

The single biggest factor in the TCO mix is the price spread between diesel fuel and CNG/LNG. Note that cost comparisons for both CNG and LNG vs. diesel are typically expressed via the measure “diesel gallon equivalent” (DGE).

According to Robert Carrick, sales manager-natural gas for Freightliner Trucks, factoring the fuel-cost differential into TCO “totally depends on how much fuel you are consuming, how many miles you are operating annually, and the cost difference of the fuel.

“From what we’ve seen for CNG,” he continues, “the sweet spot for success is at 50% of the diesel cost with trucks running in the 80,000-plus mi. per year range. For example, if you’re utilizing trucks that use about 15,000 gals. a year with a $2 per DGE price difference, that will equal $30,000 per year in fuel savings, which is a $150,000 savings over a five-year truck lifecycle.”

It is the difference in the cost of natural gas fuel vs. diesel fuel over the vehicle lifecycle that is “the primary driver for the customer’s ROI and the determining factor in providing a reduced TCO compared with a diesel-powered truck,” reasons Roy Horton, Mack Trucks’ manager of powertrain product marketing.

“With fracking technology, there’s plenty of natural gas supply and therefore the variation in the price at the pump should not fluctuate as much as diesel fuel, which is impacted by oil prices,” observes Elissa Koc, manager of communications for Navistar. “Over the life of the vehicle, it is expected that this lack in major fluctuation will create savings.”

It’s all about the fuel, says Alan Fennimore, Kenworth’s vocational marketing manager. “Fuel savings is the fleet’s return on investment for converting to natural gas,” he stresses. “This should be calculated from the fleet’s annual usage. It’s pretty simple math, really. And it should be enough to get a fleet to consider that natural gas power is worth looking at.”

In full agreement is Volvo Trucks’ Ed Saxman, product manager–alternative fuel products. “The price of fuel will have a very positive impact on the TCO of natural gas trucks,” he asserts. “One can’t imagine that the price of diesel will fall below its current high level vs. where natural gas is.”

UPFRONT
There are barometers to factor in the impact the higher acquisition cost for a natural gas truck will have on TCO. For example, according to Kenny Vieth, president & senior analyst for ACT Research, if the purchase price premium is $30,000, the payback will come at about 156,000 mi. By the same token, he says if the up-charge is $75,000, it will take 450,000 mi. to attain payback on the investment.

“There is a significant savings to be found [with natural gas],” remarks Paul Rosa, vice president-supply & planning for Penske Truck Leasing. “The question is, will that offset the initial investment [for the trucks]? There is more economic value to be received with higher mileage usage.

“The incremental costs are considerable,” he continues, “but they will be worth it if the company can pay those off in a couple of years. And it is important to secure state and federal funds [for natural gas conversion] to help offset the fleet’s investment.”

According to Mack’s Horton, “there’s nothing established or forecasted to date for the reduction over time [of the acquisition cost premium]. We do expect that with volume increases over time, fuel tank pricing will be significantly reduced.”

Navistar’s Koc says there is “not yet a formula for premiums [for natural gas trucks] as price is driven by volume. In addition, there will continue to be cost challenges for the industry until we see more suppliers providing the necessary fuel tank and engine technologies.”

“The incremental cost of our natural gas trucks selling today are very close in cost to trucks we sold four years ago, so in effect, [there is now] a reduction in price taking into account inflation,” says Freightliner’s Carrick. “This cost is expected to come down over the long term as demand increases because of broader product coverage.”

**FILL 'ER UP**

As for natural gas fueling infrastructure, Carrick advises that “the rule of thumb for success we’re seeing is that if a fleet has 40 natural gas vehicles that are using 15,000 gals. of fuel annually, they can justify [building] their own fueling station.

“If you establish your own station,” he continues, “the fuel cost delta between natural gas and diesel becomes even greater. Over time, that helps offset the cost of building the station. In most cases, a fleet will still need to have publicly available, truck-friendly natural gas fuel stations nearby or along its routes.”

“The value of in-house fueling depends on the quantity of fuel needed,” points out Navistar’s Koc. “For example, for waste applications, natural gas is becoming the primary fuel source and the investment required for in-house may be well worth it based on the amount of fuel used. However, for smaller fleets, a public facility is likely the better solution based on the investment dollars.”

“Establishing in-house fueling is extremely expensive to set up,” says Penske’s Rosa. “Over a long stretch of time a company will see value in going in-house. It takes a longer period of time to fuel a CNG unit, so that has
to be factored in when locating an outside network of fueling facilities. [Bear in mind] the industry is still having issues with the availability of fueling stations.”

“Fueling is definitely a consideration for many customers,” says Mack’s Horton. “This is especially so for those considering whether to open their natural gas station to the public, by which they can earn additional revenues to help balance the initial investment.”

**SHOP TALK**

The cost of maintenance facility upgrades can vary quite a bit depending on the type of fuel being selected—CNG or LNG—and the condition of the shops to begin with,” says Freightliner’s Carrick. “We’ve seen everything from no upgrades needed—zero incremental cost—to $80,000 per bay.”

“The facility typically needs methane detectors, an exhaust system, and some electrical work to cut off electricity as well as heating system modifications,” says Drew Cullen, vice president-fuels & telecommunications for Penske Truck Leasing. “This is driven by the local municipalities and their codes. If you elect to perform tank inspections in-house, you will need to get a technician certified.”

“The cost of natural gas vehicles varies from diesel-powered units primarily because of the specific facility needs to support natural gas vehicles,” notes Navistar’s Koc. “Natural gas requires that facilities be equipped with the proper heating and ventilation systems to protect against possible fuel leaks. Once these systems are in place, the cost of maintenance is similar [to diesel trucks].”

Carrick advises that fleets consult with their local fire marshal and refer to National Fire Protection Assn. (NFPA) Regulation 30A, Sec. 7.4 for specifics as well as review a guideline paper by the Clean Vehicle Education Foundation that clarifies the regulations outlined in NFPA 30A. “As for fuel tanks, it’s recommended they be inspected every 36,000 mi., or every three years, at a cost of about $250 per inspection.”

“The cost to upgrade a facility will differ depending on the fuel type used [CNG or LNG], with LNG being more expensive to accommodate,” says Mack’s Horton. “How much work is needed to upgrade will also depend on the condition and age of the facility.”

According to Ryder’s Perry, when the lessor upgrades a maintenance facility for natural gas trucks, it can spend $300,000 to $500,000 to meet NFPA and electrical codes.

Perry says the “emissions systems technology of natural gas engines is a little less robust than that of an EPA10 or GHG14 diesel engine. They also have shorter oil change intervals than diesels.

“In addition,” he continues, “extra training is needed to work on CNG/LNG engines, and fleets must maintain a secondary supply of dedicated oil and filters. Those are exceptions to standard practice that add fractions of a percentage to costs, and they do add up to a differential.”
Freightliner’s Carrick reports that “on average we’re seeing a $0.02/mi. increase in maintenance costs [for running natural gas trucks]. With the spark-ignited engines we use—the Cummins Westport ISL G and ISX12 G—you need to account for spark plug changes and an increase in PM intervals of every 15,000 mi. for the ISL G and every 18,000 mi. for the ISX12 G. On the plus side, fleets don’t have to worry about maintenance of any diesel aftertreatment devices, such as particulate filters.”

Penske’s Cullen points out that “to effectively perform in-house maintenance,” some facility up-fitting will need to be done as well as technician training, which will add to the TCO.

“The degree of training needed will depend on how much work you want to perform on the fuel system itself,” he says. “The biggest differences in normal maintenance for a CNG vs. a diesel unit are use of a different motor oil and fuel system filters, shorter oil drain intervals, and [the need for] spark plugs and a few ancillary items. Other than that everything else is very similar to diesel power.”

“Overall,” Cullen adds, “the yearly maintenance cost will be more for a CNG unit vs. a comparable diesel. Exactly how much will depend on the truck’s application and duty cycle.”

According to Michael Spence, senior vice president of fleet services for Fleet Advantage, the major maintenance cost difference for natural gas engines is racked up by “oil that is more expensive and spark plugs that need to be changed. Also, the ISL9 G engine [typically] needs valve adjustments. But there are no aftertreatment issues as with diesel engines.”

All told, Spence figures that the maintenance cost differential is “a wash between the two. Maybe it is a couple thousand dollars or 0.02/mi. higher than diesel over 100,000 mi.”

**QUESTION MARK**

Regarding residual values, there isn’t much data available at this point,” says Navistar’s Koc. “However, residual values will likely be good in areas where natural gas is prevalent due to strong infrastructure support.”

Volvo’s Saxman contends that there “needs to be more trucks reaching the age of trade-out for resale values to be known.” He says this is “particularly the case with Class 8 LNG-powered trucks as there are so far very few of these on the road.”

Fleet Advantage’s Flynn sees one key issue being engine longevity. “The cost to rebuild or replace an engine could be $20,000 to $40,000,” he says. “We know that clean diesel 13L and 15L engines have a B50 life in excess of 1.2 million mi. and the ‘salvage value’ on these trucks at time of engine rebuild at 10 years is 12 to 15% of original cost.”

Flynn says he’d place a “slightly lower” percentage on natural gas power due to its many unknowns. “The greatest unknown is how long the natural gas engine will operate before needing a rebuild. If it is only five to six years, it will be worth 10 to 12% of its original cost. Diesel in the same time frame in today’s market is worth about 30%. In addition, the natural gas truck comes with a higher initial cost of [at least] $40,000.
“Still,” Flynn adds, “residual values are a difficult projection because there are so many unknowns. As for a comparison of fixed costs—depreciation and interest only—over a five-year period, I’d make an educated guess that it would be $50,000 to $60,000 higher than diesel for a natural gas truck.”

Freightliner’s Carrick observes that “some of the original ISL G-powered equipment sold in 2008 needs to start entering the used market. It’s tough to gauge what resale values will be without any units actually having been resold.

“A lot will depend on the price of oil and diesel fuel vs. the cost of natural gas fuel [at the time],” he continues. “At the bottom end, some are predicting a low of 25% below value vs. a comparable used diesel up to a high of 20% over a comparable diesel in a situation where the fuel price gap continues to increase.

“We also expect an increase in resale values as the availability of natural gas fuel infrastructure continues to increase and becomes available in more locations,” Carrick adds. “We would expect [to see] demand for used equipment in those locations that didn’t previously have natural gas fuel.”

“As more and more engines that are capable of providing the needed performance and reliability/durability of their diesel counterparts are introduced,” says Mack’s Horton, “we expect that the residual values will follow. This is very much a volume-related aspect.”

Penske’s Rosa is confident the market will set the resale value over the next few years. “It will depend on engine durability,” he contends.

“There are so many questions in the early stages of this technology, and I believe these questions will get answered as more of these units go into service,” he adds.

“Traditional thinking would suggest perhaps a 20% residual value,” remarks Ryder’s Perry. “Still, it is extremely difficult to set the residual value now. We’re writing leases now on this equipment looking out five to six years based on the best available knowledge we have.”

A specific aspect Perry says fleets should bear in mind is that natural gas-fueled tanks have a 15- to 20-year life, but chassis and powertrains typically last 8 to 10 years. “We’ve not figured out yet how to install them on a second chassis [as will be] needed for a second buyer.”

THE UPSHOT

The biggest misperception about converting from diesel to natural gas is that the fleet will not see the total revenue benefit from the fuel cost delta,” points out Mack’s Horton. “There still is enough of an incentive to drive the investment despite the additional costs for service and more frequent service intervals, etc.”

“A number of the ancillary costs for natural gas trucks can cause misconceptions [for buyers],” observes Navistar’s Koc. “Fleet owners need to evaluate their vehicle applications to determine if natural gas is the right avenue. Fueling needs and facility modifications are among those costs that should be considered.”
According to Volvo’s Saxman, the most important thing fleet owners new to natural gas trucks can do is to “first understand their operation and therefore know what operating range will be needed from the trucks to fit their applications.”

“One of the biggest misconceptions among fleets is that natural gas trucks have to be able to run any and all routes they service,” says Freightliner’s Carrick. “These fleets understandably want to standardize their equipment. With natural gas trucks, that’s just not realistic.

Carrick says the OEM “encourages customers to consider whether they truly need to spec the maximum amount of fuel. Can they get away with 140 DGE? Or 100 DGE? Or even less? Are there routes more optimal for natural gas than others?

“Considering all this will help a fleet save weight on their vehicle, allowing it to haul more payload and, most importantly, save it from unnecessary costs,” he adds.

The upshot to all the prognosticating? To be sure, the savings to be had in fuel dollars and the environmental laurels that will be collected are at this point the results to be most counted on from switching to natural gas.

As for the other factors that will ultimately influence TCO, keep the pencil and the thinking behind it sharp. Very sharp. Indeed, the smartest thing a fleet owner can do for the foreseeable future is to not assume the numbers will add up without thoroughly researching the latest data on each and every one of them.