A ReAlistic View of cNG Vehicles iN the U.S.

By Rohan Nath, Guillaume Aubert, and Alex Dewar

As U.S. natural-gas prices have fallen and supplies have increased in recent years, compressed-natural-gas (CNG) vehicles are garnering renewed attention. Major automakers, such as Ford and General Motors, have announced plans for a half-dozen different vehicle models powered by CNG. Cummins Westport is introducing a full range of medium- and heavy-duty engines that run on either compressed or liquefied natural gas. Clean Energy Fuels, backed by longtime natural-gas proponent T. Boone Pickens, has opened almost 500 CNG truck-refueling stations as part of its America’s Natural Gas Highway network. Companies that operate large vehicle fleets have also embraced CNG. Waste Management, for example, has said it plans to convert most of its refuse trucks to run on CNG.

Many of the benefits of CNG, however, have not lived up to the publicity. While the market is growing, CNG vehicles are not the revolutionary transportation solution that they often are portrayed to be. Instead, they are likely to emerge as an important and growing niche market that addresses specific needs of particular industries.

As the CNG market develops, it raises some long-term questions:

- What are the true costs of CNG-vehicle ownership compared with the alternatives?
- Will a consumer market ever develop, or will natural gas remain a fuel used primarily in fleet vehicles?
- How can the infrastructure problems be solved?

To answer those questions, BCG examined the benefits and shortcomings of the emerging market for natural-gas vehicles.

CNG-Vehicle Adoption

The interest in natural gas as a transport fuel has grown in part because of its ability to reduce greenhouse-gas emissions and improve air quality, as well as because of
its cost savings. Natural gas emits 30 percent less carbon dioxide per BTU than oil, 90 percent fewer particulates than conventional fuels, and fewer pollutants such as sulfur dioxide and nitrogen oxide.

The quarterly average for natural-gas prices set at Henry Hub has fallen by half since early 2008, driven by the boom in shale-gas production in the United States. The decline has widened the price gap between CNG and diesel fuel to about $1.60 per gallon of diesel equivalent, representing a savings of about 40 percent. Given the supply and demand outlook for oil and natural gas, BCG expects this spread to remain stable.

While the fuel savings appear attractive, CNG vehicles carry higher up-front costs than their gasoline and diesel counterparts. These costs vary depending on the size of the vehicle. A natural-gas-powered Honda Civic, for example, costs about $8,000 more than a gasoline model, whereas the additional cost of Class 8 trucks—those weighing more than 33,000 pounds, such as tractor trailers—can exceed $50,000 compared with diesel models. Some states provide tax incentives to encourage the adoption of CNG vehicles, and in some cases, these incentives can subsidize as much as half of the incremental costs. Nevertheless, to earn back the incremental costs through fuel savings in less than three years requires significant fuel consumption—up to 50,000 miles driven annually for a light-duty vehicle.

As a result, the adoption of CNG vehicles is likely to be limited to low-fuel-economy vehicles in the medium- and heavy-duty truck markets, which include garbage trucks, shuttle buses, in-city delivery vehicles, and some maintenance and delivery vans and heavier pickups. Even in these segments of the market, though, operators can achieve cost savings from converting to CNG only if their mileage is high—30,000 miles per year for pickups and more than 80,000 miles per year for tractor trailers. If an operator’s mileage is less, other options, such as hybrids, are likely to recoup the up-front costs faster.

Robust Growth

During the past five years, growth rates for CNG vehicles have averaged less than 10 percent a year, but now that the price spread between natural gas and oil has widened and more CNG models are available, adoption rates are likely to accelerate. To assess the growth of CNG-vehicle adoption, BCG examined the total cost of ownership and customer buying preferences. Our research found that 40 percent of U.S. consumers would be willing to pay more for alternative-fuel vehicles if the payback period for the incremental cost was no more than three years. (See Powering Autos to 2020: The Era of the Electric Car? BCG report, July 2011.) On the other hand, the fact that CNG technology is still on the leading edge may impede adoption among buyers who see potential benefits but remain skeptical of a new technology. These buyers would prefer to wait for the industry to mature.

BCG forecasts the number of CNG vehicles to grow from about 170,000 in 2013 to more than 500,000 by 2020, an annual growth rate of about 17 percent. (See Exhibit 1.) We estimate that fuel demand will rise from about 100 billion cubic feet (bcf) of natural gas to more than 250 bcf by 2020. More than 90 percent of that demand will remain concentrated in the medium- and heavy-duty segments, which consume significantly more fuel per vehicle than the light-duty segment.

While the projected growth is robust on a percentage basis, it remains low in absolute terms. As a result, CNG vehicles will not significantly affect natural-gas demand or prices, nor will they reduce the oversupply of natural gas that has accumulated in the United States from hydraulic fracturing. BCG predicts that by 2020, CNG vehicles will account for less than 0.3 percent of all cars and trucks in the U.S. and less than 1 percent of all natural-gas consumption.

By international standards, CNG penetration in the U.S. will remain low, with the adoption economics less robust than in other countries. In Italy, for example, where CNG-vehicle market penetration is
2 percent, the gasoline-CNG price spread is about $6 per gasoline gallon equivalent, and the incremental vehicle costs are less than $3,000.

While BCG expects demand for CNG vehicles to continue to grow in the U.S., the fuel economics and incremental costs mean that their use will likely remain almost exclusively limited to replacing high-mileage, low-fuel-economy fleet vehicles.

Growth of Refueling Infrastructure and Availability

The growth of CNG vehicles has long been hampered by a chicken-or-egg problem with refueling infrastructure: adoption would rise if more refueling stations were readily available, and more refueling stations would be available if adoption rates were higher. However, this problem is primarily limited to the consumer market, which requires that vehicles have the ability to refuel at more than a single location. In contrast, operators of large-scale fleets, which typically return to the same location, are able to install CNG refueling infrastructure at or near these fleet bases at the same time that they introduce CNG vehicles to their fleets. This approach avoids the chicken-or-egg problem because infrastructure is built around concentrated and localized commercial fleets.

Most CNG refueling infrastructure in the United States has thus been developed not as an addition to petroleum retail stations but as part of fleet bases or as stand-alone CNG-refueling sites. Less than half of the 1,300 natural-gas refueling sites across the United States are accessible to the public. About 750 are privately operated by fleet owners, while another 425 are new, stand-alone sites and about 75 are additions to existing retail gasoline or diesel stations. These three different models for CNG refueling are being developed by a wide variety of industry players. (See Exhibit 2.)

Fleet Operators

Fleet operators have become the key driver of both CNG demand and refueling infrastructure because they reap the biggest benefits from adopting CNG. For operators with high-mileage, low-fuel-economy fleets, CNG can present an attractive alternative to diesel or gasoline and even to...
other alternative fuels, providing a net present value of $20,000 to $80,000 per vehicle relative to traditional-fuel vehicles. Consequently, several large fleet operators have taken the lead in converting to CNG. AT&T, for example, has said it will convert about 20 percent of its fleet, or 15,000 vehicles, to CNG during the next decade. Waste Management already has a fleet of more than 3,000 CNG vehicles and plans to convert many of its remaining 18,000 vehicles at a rate of about 800 trucks a year.2

Most of the opportunity for fleet operators, however, remains untapped. Utilities, telecommunications companies, food and beverage delivery companies, and the service and maintenance industries are all ideal candidates for CNG conversion that so far have been slow to adopt the technology. In some cases, fleet operators worry about the refueling issue. One solution, of course, is to install refueling infrastructure at their fleet base or to partner with a CNG refueling provider. Fleet operators whose trucks return to the same location every day can achieve the lowest-cost CNG supply by developing their own refueling operation.

### Dedicated CNG Stations for the Public

Some fleet owners with base refueling stations have opened them for public use as well. Waste Management, for example, has 20 stations open to the public across the U.S. Other, smaller operators have opened just one or two stations in conjunction with conversion of their small fleets.

Meanwhile, companies such as Clean Energy Fuels and several utilities have built stand-alone sites for both fleet and public access. CNG refueling offers utilities a chance to capture value from the emerging CNG refueling infrastructure. For regulated utilities, developing CNG stations can increase demand for natural gas, which in turn increases revenue within the utility’s service area. Unregulated utilities can develop and operate CNG stations in new regions. Chicago-based Integrys Energy Group acquired the independent station developer Trillium CNG to capitalize on the growth in CNG demand, while Questar is using its experience in Utah to develop CNG stations in states beyond its service area.

In addition to the direct financial benefits, developing CNG refueling infrastructure...
can promote strong relationships with stakeholders because of the environmental benefits of natural-gas fuels and the economic benefits of increased demand for natural gas. Many utilities are major fleet operators themselves, and they can capture additional savings by converting their fleets to run on CNG. These converted fleets provide reliable base demand from which to expand refueling operations.

**CNG Refueling at Petroleum Stations**

Conventional petroleum-fuel stations have been slow to add CNG refueling. Many face space constraints, are unwilling to convert existing gasoline or diesel pumps to CNG, or worry that a reduction in parking spaces to accommodate a new CNG pump will diminish convenience store sales. This is especially true in urban and suburban locations, where space is often limited and use of existing pumps is high. As a result, adding CNG refueling to existing petroleum stations is viable at only a few station types, typically larger locations on highways or in rural areas.

Despite these challenges, several regional chains have added CNG to their existing stations, typically in conjunction with fleet partnerships. Love’s and OnCue Express, in particular, have added CNG capacity after gaining a vehicle fleet as an anchor customer. Kwik Trip, meanwhile, has converted its own delivery vehicles, which supply its stores, essentially becoming its own anchor customer. While the company also sells CNG to other fleets and the public, much of the value comes from the reduced operating costs of its fleet.

These types of fleet arrangements are key to driving the development of CNG refueling infrastructure, ensuring a stable source of demand from which to recoup investment.

**Investment Opportunities**

For investors looking to benefit from the growth in the CNG market, equipment makers that supply the industry may provide attractive opportunities, including the following:

- **CNG Refueling Equipment.** As demand for CNG expands, it creates the potential for new competitors to enter the market at scale with a more standardized, lower-cost product. Currently, the market share for equipment makers tends to be concentrated among a few providers, but this may change.

- **CNG-Vehicle Fuel Systems.** The market is already attracting new entrants such as auto industry suppliers Bosch and Delphi. However, the market for fuel systems is fragmented, with potential consolidation possible in the near term.

- **CNG Storage Tanks.** A limited number of companies currently supply a constrained market for tanks. The biggest barrier to entry is the time it takes to obtain certification from the Department of Transportation, making it difficult for new entrants to gain a foothold. Acquisition of an existing tank maker could provide an entry point into the CNG market.

**THE MARKET FOR CNG VEHICLES AND REFUELING IS PRIMED FOR ROBUST GROWTH IN THE NEXT FEW YEARS, CREATING OPPORTUNITIES FOR A VARIETY OF PARTICIPANTS, INCLUDING UTILITIES, FLEET OPERATORS, AND EQUIPMENT MANUFACTURERS.**

While the benefits of CNG are real, they are primarily enjoyed by fleet operators, which are the key drivers of demand. CNG is unlikely to fundamentally transform transport fuels in the U.S., but it is rapidly becoming an effective alternative fuel, particularly for some of the country’s biggest fleets.

**NOTES**

About the Authors

Rohan Nath is a partner and managing director in the Houston office of The Boston Consulting Group. You may contact him by e-mail at nath.rohan@bcg.com.

Guillaume Aubert is a partner and managing director and Alex Dewar a project leader in the firm’s Washington office. You may contact them by e-mail at aubert.guillaume@bcg.com and dewar.alexander@bcg.com.

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