

Natural Gas Waits For Its Moment

By PAUL STENQUIST

CARS and trucks powered by natural gas make up a significant portion of the vehicle fleet in many parts of the world. Iran has more than two million natural gas vehicles on the road. As of 2009, Argentina had more than 1.8 million in operation and almost 2,000 natural gas filling stations. Brazil was not far behind. Italy and Germany have substantial natural gas vehicle fleets. Is America next?

With natural gas in plentiful supply at bargain prices in the United States, issues that have limited its use in cars are being rethought, and its market share could increase, perhaps substantially.

According to Energy Department price information from July, natural gas offers economic advantages over gasoline and diesel fuels. If a gasoline-engine vehicle can take you 40 miles on one gallon, the same vehicle running on compressed natural gas can do it for about \$1.50 less at today's prices. To that savings add lower maintenance costs. A study of New York City cabs running on natural gas found that oil changes need not be as frequent because of the clean burn of the fuel, and exhaust-system parts last longer because natural gas is less corrosive than other fuels.

Today, those economic benefits are nullified by the initial cost of a natural gas vehicle — 20 to 30 percent more than a comparable gasoline-engine vehicle. But were production to increase significantly, economies of scale would bring prices down. In an interview by phone, Jon Coleman, fleet sustainability manager at the Ford Motor Company, said that given sufficient volume, the selling price of natural gas vehicles

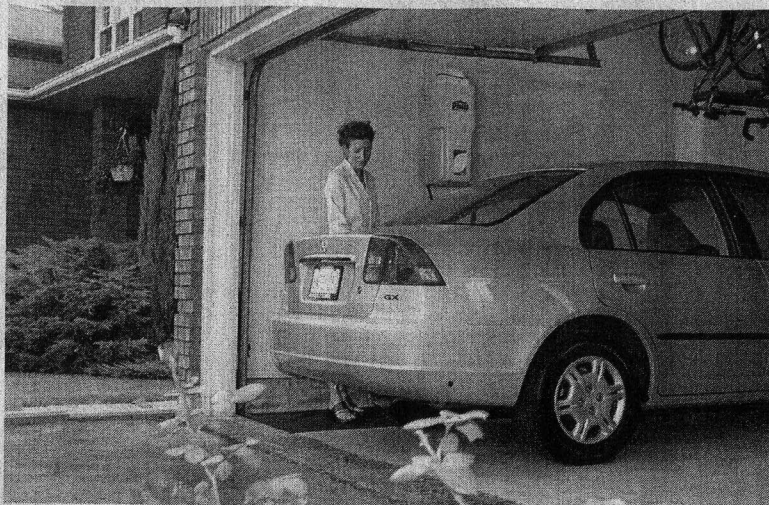
could be comparable to that of conventional vehicles.

It may be years before the economic benefits of natural gas vehicles can be realized, but the environmental benefits appear to be immediate. According to the Energy Department's website, natural gas vehicles have smaller carbon footprints than gasoline or diesel automobiles, even when taking into account the natural gas production process, which releases carbon-rich methane into the atmosphere. Mercedes-Benz says its E200, which can run on either gasoline or natural gas, emits 20 percent less carbon on compressed natural gas than it does on gasoline.

The United States government appears to favor natural gas as a motor vehicle fuel. To promote the production of vehicles with fewer carbon emissions, it has allowed automakers to count certain vehicle types more than once when calculating their Corporate Average Fuel Economy, under regulations mandating a fleet average of 54.5 miles per gallon by 2025. Plug-in hybrids and natural gas vehicles can be counted 1.6 times under the CAFE standards, and electric vehicles can be counted twice.

Adapting natural gas as a vehicle fuel introduces engineering challenges. While the fuel burns clean, it is less energy dense than gasoline, so if it is burned in an engine designed to run on conventional fuel, performance and efficiency are degraded.

But since natural gas has an octane rating of 130, compared with 93 for the best gasoline, an engine designed for it can run with very high cylinder pressure, which would cause a regular gasoline engine to knock from premature ignition. More cylinder pressure yields



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IN THE GARAGE FuelMaker's Phill unit can refill natural gas vehicles at home.

more power, and thus the energy-density advantage of gasoline can be nullified.

"Whenever you have the opportunity to run 130-octane fuel, a lot can be done to optimize engine operation," said Gregg Black, Chrysler's senior manager for advanced engine systems, in an interview by phone.

Currently, there are no dedicated and fully optimized natural gas vehicle engines produced for the United States market, although vehicles capable of burning the fuel are available. Ford sells the most domestically — medium- and heavy-duty vehicles prepped for natural gas with some special engine parts on the assembly line but outfitted later by secondary suppliers with compressed natural gas hardware.

Because refueling stations are few and far between, all of the Ford offerings are bifuel and can run on both gasoline and natural gas, a capability that requires compromises. GM has similar offerings but also offers one dedicated natural gas vehicle — a work van.

When asked if the van's engine was

modified to take advantage of the 130 octane of natural gas, Dick Kauling, engineering manager for gaseous fuels at GM, said, "We haven't at this point done all the optimization that's possible to take advantage of the octane that's available in natural gas."

Chrysler produces a version of its Ram pickup fully prepped for natural

With a fuel cheap and plentiful, is it time for greater market share?

gas, but it is a bifuel model too, and, according to Mr. Black, it is engineered to be at its best when running on gasoline.

Honda sells the only natural gas passenger car available in the United States. A version of its Civic subcompact, the car has a revamped version of a gasoline engine that has been prepped

for natural gas with a higher compression ratio and modified control systems. Produced in small numbers, it is \$8,000 more costly than a comparable gasoline-engine Civic.

In brief, little effort has been expended on the optimization of natural gas engines, and that probably will not change unless demand and volume justify the expense.

Until the pressurized fuel tanks of natural gas vehicles can be easily and quickly refueled, the fleet cannot grow substantially. The number of commercial refueling stations for compressed natural gas has been increasing at a rate of 16 percent yearly, the Energy Department says. And, while the total is still small, advances in refueling equipment should increase the rate of expansion. Much of the infrastructure is already in place: America has millions of miles of natural gas pipeline. Connecting that network to refueling equipment is not difficult.

Although commercial refueling stations will be necessary to support a substantial fleet of natural gas vehicles, home refueling may be the magic bullet that makes the vehicles practical. Electric vehicles depend largely on home charging and most have less than half the range of a fully fueled natural gas vehicle. Some compressed natural gas home refueling products are available, but they can cost as much as \$5,000.

Seeking to change that, the Energy Department has awarded grants to a number of companies in an effort to develop affordable home-refueling equipment. Among them is Eaton Corporation, which announced in July 2012 that it was developing a compressed natural gas home refueling station that would be available "before the end of 2015, with a target production price of \$500." When asked how that figure might translate to a selling price, James J. Michels, Eaton's communications manager, said in an email that the company had not established a selling price.

If Eaton can offer it at a reasonable price, it could be a game changer.