

Alternative **FUELS**

Volume 4, Number 2



Heavy-Duty Trucks Poised to Accelerate Growth of American Alternative Transportation Fuels Market

by Christopher P. Pedersen, President, Pedersen Consulting Group

Background

Since 1988, federal and state legislation has mandated the adoption of alternative transportation fuels, primarily because of environmental and energy security concerns. Recently, however, much of the alternative fuels activity has shifted. With the electoral revolution of 1992, Congress is rethinking environmental regulation and cutting federal appropriations for alternative fueled vehicles (AFVs). The U.S. Environmental Protection Agency (EPA) may delay implementation of stringent emission standards, and the U.S. Department of Energy (DOE) has delayed requirements for alternative fuel adoption that were set to go into effect on September 1, 1995.

In the late 1980s and early 1990s, as federal and state legislation was being crafted across the country, developments were made that would shake the foundation of the AFV market in the mid-1990s. The dominant share of AFV, particularly natural gas vehicle (NGV) activity, focused on light-duty vehicles that belonged to the natural gas utilities,

state governments, the federal government, services, and selected small private fleets. Fueling infrastructure evolved from utility service yards to the property of major and independent fuel marketers. In the wake of the Clean Air Act Amendments of 1990 (CAAA-90) and the 1991 Intermodal Surface Transportation Efficiency Act, transit authorities became the first to adopt alternative fuels, primarily compressed natural gas (CNG), for their heavy-duty fleets.

In this atmosphere of legislative retreat and market evolution, heavy-duty trucks are poised to accelerate the growth of the alternative transportation fuels market.

Liquefied Natural Gas (LNG)

Since 1990, LNG has taken enormous steps toward becoming a recognized alternative transportation fuel. Although LNG applications were initially considered for transit buses, new engine and storage technologies have led to LNG applications in a growing number of medium- and heavy-duty trucks.

INSIDE THIS ISSUE

<i>Heavy-Duty Vehicle Program Update.....</i>	<i>3</i>
<i>Natural-Gas-Powered Hybrid-Electric Bus</i>	<i>5</i>
<i>Ethanol Mandate Denied</i>	<i>5</i>
<i>AFV Purchase Rule to be Delayed.....</i>	<i>6</i>
<i>Labeling Rule for Alternative Fuels and AFVs.....</i>	<i>6</i>
<i>Alternative Fuels Alive and Well in Texas</i>	<i>6</i>
<i>New CNG Refueling Stations.....</i>	<i>6</i>
<i>“Self-Serve” LNG Dispenser in New Mexico ...</i>	<i>7</i>
<i>Propane Injection System in Vancouver.....</i>	<i>7</i>
<i>ADEPT Group Heads Propane Engine Project.....</i>	<i>7</i>

The driving force behind adopting LNG as a viable alternative transportation fuel has not been the environment or energy security, but economics!

Six factors have been working to improve heavy-duty truck LNG economics:

1. Fuel price differential. This allows operators of heavy-duty trucks to consider a move from diesel to LNG.
2. High fuel consumption. This allows even a small fuel price differential to provide a reasonable payback on investment in LNG conversion and fueling infrastructure.
3. Reasonable incremental cost. The premium charged for LNG-fueled vehicles has dropped significantly during the past few years, reducing the absolute levels of the fuel price differential and fuel consumption needed for acceptable economics.
4. Reduced excise taxes. In addition to lower commodity cost, excise taxes for LNG are lower than for diesel, and provide for a substantial per gallon savings compared with diesel.
5. High-duty cycle. Heavy-duty trucks operate at high average speeds, reducing throttling losses and bringing natural gas engines close to diesel efficiency.
6. Lower station costs. LNG fuel station costs have been coming down during the past 3 years, reaching a level below that of CNG in many cases. In addition, a number of private LNG

fuel station owner-operators have moved to eliminate fuel station costs from the heavy-duty truck fleet altogether.

The NGV Industry Strategy

In late 1993, the natural gas industry decided it was time to articulate a comprehensive strategy for developing natural gas as a transportation fuel. After many delays, the strategy was released this past May at the annual Alternative Fuels Market Fair and Symposium in Austin, Texas. In what some consider a surprising move, the strategy emphasized LNG use in heavy-duty fleets from 1995 to 2010.

Clean Corridors and Private LNG Marketers

One constraint to the expanded use of LNG by heavy-duty fleets has been the lack of a sufficient fueling infrastructure. Two developments have begun to address this concern, and will have profound implications on the trucking industry for the next 15 years:

1. Expansion of the Clean Cities Program into Clean Corridors, connecting cities with convenient and accessible fueling.
2. Formation of a number of private LNG marketers, which focused on the fueling infrastructure.

Forces have begun moving to make the Southwestern NGV Zone, a concept developed several years ago for CNG, an LNG reality. Beginning in California, an LNG fueling infrastructure is being planned from Los Angeles east to Phoenix and on into Texas, northeast to Salt Lake City (the western-most point where

trucking can move on to both San Francisco and Los Angeles), and north to San Francisco and Sacramento. Ultimately, the eastern route will continue to Florida, and the northern route will continue to Vancouver. Similar corridors are expected to be built in the Southeast, the Northeast, and the Midwest during the next several years.

The formation of private LNG marketers is the force behind the Clean Corridors, and should remove any remaining substantive barrier to the adoption of LNG. Pacific Enterprises, the parent of Southern California Gas Company, has formed an LNG marketing company with MESA, Inc. Marcum Fuel Systems has entered into an agreement with Minnesota Valley Engineering. EcoGas has moved into the United States after initiating operations in southeast Asia.

Applied LNG Technologies

Finally, one of the most aggressive companies in the growing LNG marketing arena is Applied LNG Technologies, or ALT. Formed by Jack B. Kelley, Inc. (a trucking company based in Amarillo, Texas), and Cryenco Sciences, Inc. (a cryogenic equipment company based in Denver, Colorado), ALT has moved quickly to a perceived position of leadership.

ALT has staked its growth on the I-10, I-5, I-15 triangle that encompasses Salt Lake City, Sacramento, and Los Angeles. ALT recently signed a letter of intent to build an LNG station at the Ramos Oil Company station in West Sacramento, in addition to existing LNG facilities in Salt Lake City and Los Angeles. At the same time, Golden Spread Energy, a

Jack B. Kelley company, signed a letter of intent to acquire Tren • Fuels, Inc., and its 11 FleetStar branded natural gas fueling sites in Phoenix, Las Vegas, and northern California from Transco Energy Company.

ALT has a clear vision for implementing its aggressive business plan. Ken Kelley, Chief Executive Officer (CEO) of ALT, and Dale Brubaker, President of ALT, are committed to developing a \$1 billion LNG fueling industry during the next 5 years. Realization of this plan should give

heavy-duty trucking fleets confidence that their move to LNG will be part of a historic evolution of the American transportation sector.

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The U.S. Department of Energy Alternative Fuel Heavy-Duty Vehicle Program Update

by Peter W. McCallum, Systems Engineer, Antares Group, Inc.

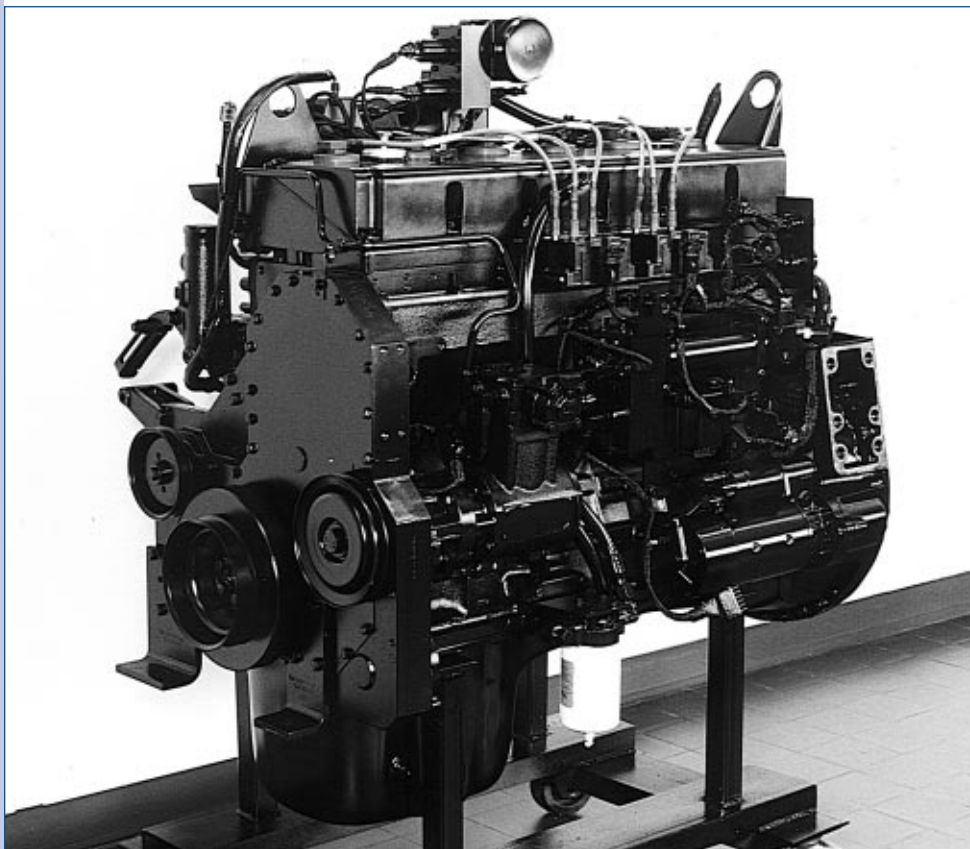


Photo courtesy of Cummins Engine Company

Cummins Engine Company natural-gas-powered L10-300G

Each year, DOE's Office of Alternative Fuels reviews heavy-duty engine research and development, alternative fuel truck demonstrations, heavy-duty emissions regulations, and the availability of information from ongoing and completed tests. The results of this survey are summarized in a report made available to the trucking industry and other interested parties. This year, the first third of this report was prepared. Steve Goguen, who heads DOE's Alternative Fuel Truck Application Program, presented it at DOE's Diesel Engine Emission Reduction Workshop in La Jolla, California, on July 24, 1995. The updated report will be presented in Dearborn, Michigan, at DOE's Contractors' Coordination Meeting October 23-27, 1995. Federal alternative fuel heavy-duty truck efforts grew out of Section 400 BB of the Alternative

Motor Fuels Act of 1988 (AMFA). AMFA was intended to encourage the development and use of alternative fuels and to stimulate the production of alternative fuel engines. The Clean Air Act Amendments of 1990 (CAAA-90) reinforced AMFA's goals by requiring "clean fuel" fleets in the country's poorest air quality regions. The CAAA-90 also imposed stringent new emissions requirements on heavy-duty engines, making the adoption of alternative fuels an effective near-term compliance measure. Finally, the Energy Policy Act of 1992 (EPACT) provided incentives to fleet operators to purchase AFVs and refueling facilities.

This year's survey makes clear that engine manufacturers and fleet operators have made natural gas, of all the available alternative fuels, the focus of their efforts and interests. Detroit Diesel Corporation (DDC), which has had considerable success with its methanol- and ethanol-fueled 6V-92TA engines (there are 550 in service), reports it has no current orders for the 6V-92TA engine plant. DDC is marketing its Series 30G gas engine and its Series 50G bus engine, and developing the Series 50G and Series 60G natural gas engines for the truck market. Caterpillar has developed the G3306 and G3406 natural gas engine, derived from its diesels. Cummins is producing or developing four medium- and heavy-duty natural gas engines—the B5.9G and L10G are in production, the C8.3G is undergoing testing, and the M11G is slated for a 1998 introduction. Navistar International developed its 7.3-liter natural gas engine jointly with DDC and will also market it. Navistar may enter into a second joint venture with DDC to develop a natural gas engine based on Navistar's

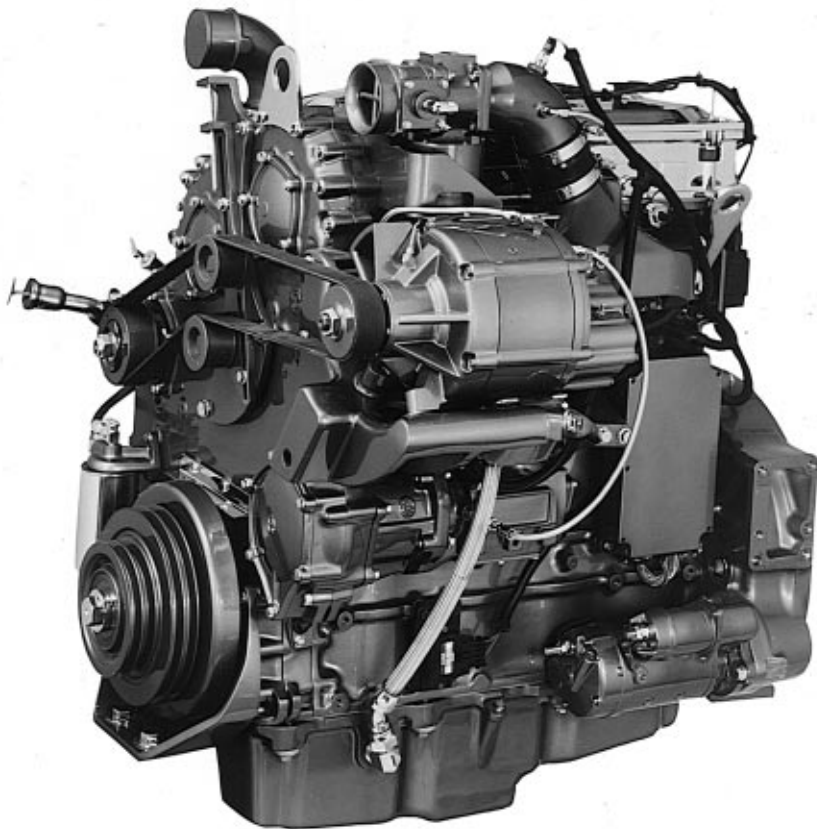


Photo Courtesy of Detroit Diesel Corporation

Detroit Diesel Series 50 natural-gas-powered engine

8.7-liter diesel engine. Mack Trucks is field testing a natural gas derivative of its E7 engine and expects to offer it in two ratings. Hercules Engines' 5.6- and 3.7-liter natural gas engines have achieved wide acceptance in medium-duty applications, and Hercules is pursuing electronic feedback fuel metering. Tecogen (a division of Thermo Power Corporation) will provide 276 additional 4.3-liter V-6 natural gas engines to United Parcel Service and is developing a diesel-to-natural-gas conversion package for the Navistar DT466. Most of these companies' engines are represented in DOE or Trucking Research Institute demonstration fleets.

The availability and favorable pricing of natural gas are expected to make it the alternative fuel of choice for the immediate future. LNG's

energy storage density will suit it best for line-haul trucks, and CNG will make inroads in the vocational markets and city fleets with central refueling facilities. In the future, an increasing degree of electronic engine control will be employed to protect medium- and heavy-duty natural gas engines from thermal stresses and from the effects of variable fuel composition.

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Photo courtesy of Unique Mobility, Inc.

Natural-gas-powered hybrid-electric bus being demonstrated in New York

New York State Transit Operators to Demonstrate a Natural-Gas-Powered Hybrid-Electric Bus

Seven New York state transit operators (from Albany, New York City, Ithaca, Long Island, Westchester County, Buffalo, and Niagara Falls) will demonstrate a natural-gas-powered hybrid-electric bus as part of an ongoing research project sponsored by the New York State Energy Research and Development

Authority, Albany, New York; and Unique Mobility, Inc., Golden, Colorado. Unique Mobility converted the 25-foot Orion II bus to use a natural-gas-fueled engine to power a generator that continuously charges thirty 12-volt batteries while the bus is operating. Ultra-low tailpipe emissions are achieved in a way reported practical and cost-effective. If the demonstrations prove successful, transit operators are expected to add similar vehicles to their fleets to comply with clean air mandates.

Federal Court Denies EPA's Mandate to Require Use of Ethanol in Reformulated Gasoline (RFG)

A federal appeals court in Washington, D.C., has ruled that EPA may not mandate the use of ethanol in RFG. The decision is a major setback to the ethanol industry. Had the directive been upheld, 15% of oxygenates in RFG would have come from ethanol beginning this year, increasing to 30% in 1996.

The court proclaimed that EPA lacked the authority to order the use of renewable oxygenates. The American Methanol Institute, the American Petroleum Institute, and the National Petroleum Refiners Association challenged the decision in court.

DOE Set to Delay AFV Purchase Rule

DOE has announced that it will publish a notice of limited reopening of the comment period, which would delay the proposed rule under EPCACT that requires state and fuel-provider fleets to begin adding AFVs on September 1, 1995. A letter signed by 29 members of the House of Representatives called the DOE fleet rule “excessive and unreasonable,” and requested that the rule be withdrawn and “re-proposed in a form consistent with the intent of the law.” Citing the need for sufficient lead time to evaluate and order AFVs for fleet use, most affected parties have requested delays in the rule.

Federal Trade Commission (FTC) Issues Final Labeling Rule for Alternative Fuels and AFVs

The FTC has issued final labeling rules for nonliquid alternative fuels, such as CNG, electricity, and hydrogen; and for AFVs. Under the rule, cost and benefit information must

be made available for each fuel, and dispensers of the gaseous fuels must display a label that identifies each fuel and its principal component. The label must be displayed conspicuously and will have three sections:

- Information on cruising range and EPA emission standards
- A list and explanation of factors consumers should consider when purchasing an AFV
- Directions for consumers to obtain additional information from DOE and the Department of Transportation (DOT).

Alternative Fuels Move Ahead in Texas Despite Recent Legislation

The alternative fuels industry is alive and well in Texas despite recent legislation that allows RFG and low-sulfur diesel to be classified as alternative fuels, said Garry Mauro, Texas General Land Commissioner, at the recent Alternative Fuels Market Fair and Symposium in Austin, Texas. More than 2900 Texas DOT vehicles have been converted to operate on propane or natural gas since 1991, and at least 50% of the entire 10,000-vehicle fleet will be running on one of the gaseous fuels by 1996. Traditional alternative fuels will probably be needed to achieve the lower emission levels required in the late 1990s under CAAA-90 and EPCACT.

New CNG Fueling Stations Expand NGV Refueling Infrastructure

The CNG infrastructure continues to expand as more refueling facilities come on stream. Columbia Gas of Ohio and Emro Marketing have opened Ohio’s first public natural gas refueling facility in a commercial service station in Middleburg Heights. Two new stations have opened in Baltimore, Maryland, the result of a joint effort between Amoco and Baltimore Gas and Electric. Park City, Utah, and Petersburg, Virginia, also have newly opened public facilities.

New Jersey’s First Public CNG Refueling Station Opens

Public Service Electric and Gas Company and Shell Oil opened New Jersey’s first public CNG refueling facility in a service station near the Holland Tunnel in Jersey City. The utility company converted 108 vehicles to CNG in 1993 and added 130 new NGVs in 1994. Shell and the New Jersey utility shared the \$250,000 cost of the natural gas compressor. The utility has a \$3 million rebate program in effect that gives individuals \$1,000 and fleet customers as much as \$50,000 toward conversion costs. Bell Atlantic, N.J. Transit, and the State of New Jersey are cooperating, as they already have natural-gas-powered vans, cars, and buses in service and will be able to take advantage of the new fueling location.

South Florida to Have 10 New Public Refueling Stations

Florida Natural Fuels and Amoco have announced that 10 public-access natural gas refueling stations will be built and opened in southern Florida within the next 2 years. The strategy is to locate a CNG facility about every 10 miles for vehicles traveling along Interstate 95 between Miami and Palm Beach Gardens. Current estimates put the number of NGVs in the area at about 500, although the count should increase rapidly in an area with 92 municipalities and about 3 million vehicles.

First “Self-Serve” LNG Vehicle Fueling System Installed

CH-IV Cryogenics, Lawrence, Massachusetts, has installed the first “self-serve” LNG fueling dispenser for vehicles in Bloomfield, New Mexico. Four years of effort went into developing the system that allows LNG vehicles to be fueled similarly to gasoline vehicles. This is in sharp contrast to normal LNG vehicle fueling, which requires trained operators to wear protective clothing and follow strict procedures. The patent-pending design allows the driver to remove the fueling nozzle from the dispenser, insert the nozzle in the vehicle, wait for the fueling to be completed, and return the nozzle to the dispenser.

Project Under Way to Develop Clean-Burning Heavy-Duty Propane Engine

Mogas Sales, Inc., and B.C. Research Inc., both of Vancouver, British Columbia, are working on a joint project to develop a clean-burning propane injection system for a 250-hp engine. The project is important, in that heavy-duty vehicles must meet 1998 emissions standards in Canada and several U.S. states. A heavy-duty truck with a Cummins C 8.3 engine will be modified and operational in 1996 for use in ICG Propane’s fleet. Detroit’s automakers are introducing propane injection systems for small vehicles, but the Canadian project is focusing on medium- and heavy-duty engines.

Project Under Way to Develop Heavy-Duty Engine for Mobile and Stationary Applications

The ADEPT Group, Inc., is managing a Series 50 Propane Engine Project that will develop, certify, and demonstrate the first dedicated heavy-duty propane engine for mobile and stationary applications. The project is being conducted in conjunction with the Alternative Fuels Research and Education Division, Railroad Commission of Texas; Natural Resources Canada; South Coast Air Quality Management

District; and DOE through NREL. DDC manufactures the 8.5-liter engine, which will be targeted for mass transit buses, Class 7 trucks, generator sets, and agricultural pump engines. The \$4 million project began in August 1994 and is expected to be completed in December 1996.

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I N T R U C K I N G

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The aim of **Alternative Fuels in Trucking** is to inform fleet owners and operators, equipment suppliers, government officials, and other interested parties about important developments in the use of alternative fuels in heavy-duty trucks. Suggestions and comments are welcome and may be directed to the National Alternative Fuels Hotline at 1-800-423-1DOE. Views expressed by guest authors are their own, and not those of ATAF, DOE, or NREL.

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