

Alternative **FUELS**

I N T R U C K I N G



Vol. 2 Number 2

ALTERNATIVE FUELS AND THE TRUCKING INDUSTRY

*By U.S. Congressman Michael A. Andrews
(R-TX, 25th dist.)*

Sometimes the best way to approach a big problem is with a small idea that's given time to grow.

Take, for example, the difficulties of our domestic energy industry. The combination of a fluctuating world oil market and a lack of a defined energy policy has left our country dangerously too dependent on foreign oil and our domestic energy industry severely injured.

The most obvious solution would be shifting to cleaner-burning alternative fuels, like natural gas. Alternative fuels are domestically abundant, often cheaper than gasoline and have the potential to not only clean our air, but also to reduce our dependence on imported oil and create American jobs.

The facts tell the story: Half the oil we consume in this country comes from overseas, while studies show a 50 year domestic supply of clean-burning natural gas. While literally thousands of energy industry workers have lost their jobs in this country, an estimated 15,000 jobs could be created for every trillion cubic feet of produced natural gas. While smog and ozone are choking several of our cities, natural gas vehicles can reduce reactive hydrocarbons by up to 85 percent and nitrogen oxide emissions by up to 65 percent. Electric vehicles can offer between 25 and 100 percent reduction in greenhouse gases.

Envisioning the promise of alternative fuels, the U.S. Congress passed the Clean Air Act Amendments of 1990 and the Energy Policy Act of 1992, making clear its commitment to greater alternative fuel use. I suspect support for alternative fuels legislation will remain strong in the Congress — cleaner air, reduced oil dependency and job growth in alternative fuel industries are well received by policymakers.

The largest problem with the burgeoning alternative fuels industry has been one of infrastructure. Who wants a car or truck that runs on alternative fuels if you can't find a service station to fill up? And what service station is going to offer an alternative fuel if there aren't any vehicles that run on it?

To address the problem, Congress decided to start slow. Mandates for fleet vehicles began a small market for alternative fuel vehicles, which we hoped would grow larger both as people's familiarity and technological capability grew.

I was fortunate to have played a role in forging this policy during those 1990 debates. Legislation I wrote assisted businesses in meeting those new federal fleet mandates by letting them expense the incremental costs of alternative fueled vehicles as well as the costs of refueling facilities.

Happily, we are seeing significant progress in the car and light-duty truck markets. The next step is to target urban fleets of heavy-duty trucks, construction equipment, road maintenance vehicles, delivery trucks, and buses. However, for the men and women who drive these trucks, the issues of a preferable distance range, a practical refueling infrastructure, and adequate engine technology are major concerns.

The good news is that in places like Houston heavy-duty fleets are aggressively pursuing alternative fuels. The Houston Metropolitan Transit Authority is converting its entire bus fleet to run on LNG (liquefied natural gas). With LNG, bus drivers enjoy a driving range and refueling time comparable to diesel fuel. What's more, LNG means cleaner emissions, reduced engine maintenance, lower fuel costs and minimal contamination potential. This is only one example of where alternative fuels are making sense for heavy-duty vehicles.

Even more, we are making significant progress with developing alternative fuel engines. The Gas Research Institute and Southwest Research Institute have recently successfully tested a Mack E7 heavy-duty natural gas engine. This new 6-cylinder, 12-liter engine travelled from San Antonio to Boston with an on-board 45 gallon equivalent fuel tank.

Problems of finding an alternative fuel filling station are evaporating as well. Nationwide, about 600 stations offer natural gas, with about three stations added each week. Additionally, Texas Governor Ann Richards has joined other governors from Southwestern states in proposing a Natural Gas Zone from Louisiana to California. This zone is designed to maximize the refueling infrastructure for interstate travelers, including heavy-duty long-distance trucks.

While the future seems bright, we are still some way from seeing trucks and buses using nat-

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ural gas, methanol, propane, electricity or hydrogen to course up and down our highways. There is still much work to be done. With some heavy-duty truck owners using LNG, the trucking industry may want to focus its efforts on LNG storage tanks and related engine research and development.

At stake are our energy independence, the future of our domestic energy industry and our environmental health. But, if the past three years are a guide, we have much to look forward to. ▼

ATA FOUNDATION'S ALTERNATIVE FUELS TASK FORCE MEETS AT ATA EXECUTIVE COMMITTEE MEETING

On Monday, June 14, 1993, the ATA Foundation's Alternative Fuels Task Force met at the Grand Hyatt Hotel in Washington, D.C. from 2:00 to 4:00 p.m. in conjunction with the ATA Executive Committee Meeting. Current membership of the Alternative Fuels Task Force exceeds fifty people employed in trucking, fuels and government. Many of these members are the same individuals that are participating in ongoing ATA Foundation demonstration projects, and are willing to commit resources to expanding and initiating new heavy-duty truck demonstration projects.

The meeting featured a roundtable discussion of fuels led by Karen Campbell of Air Products, who discussed liquefied natural gas, Ajit S. Ratra of Washington Gas, who discussed compressed natural gas, and Ken Smith of Midwest Grain Products, who discussed alcohol-blend fuels. For further information on Alternative Fuels Task Force activities, membership, or demonstration projects, please contact William H. Peerenboom, Vice President of the ATA Foundation at (703) 838-1863. ▼

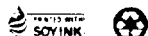
Alternative Fuels In Trucking

Volume 2-Number 2
Spring 1993
Timothy R. McGrath, Editor

Alternative Fuels In Trucking is published quarterly by the American Trucking Associations Foundation's Trucking Research Institute, 2200 Mill Road, Alexandria, Virginia 22314-4677. Telephone: (703) 838-1863. Articles may be reprinted with written permission.

The aim of **Alternative Fuels In Trucking** is to keep fleet owners and operators, equipment suppliers, government officials and other interested parties informed of important developments which impact the use of alternative fuels in heavy-duty trucks. Suggestions and comments are welcome.

1993 Trucking Research Institute



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ENGINE AND PROJECT PROFILE

Clean Engine Refuse Hauler Travels from Texas to Massachusetts on Natural Gas



A refuse hauler powered by a Mack E7 heavy-duty natural gas engine has completed a 10-day road trip from San Antonio, Texas to Boston, Massachusetts for a field test in commercial service, according to the Chicago-based Gas Research Institute (GRI) and Mack Trucks, Inc., of Allentown, Pennsylvania.

The two organizations cooperated in the development and durability testing of the 6-cylinder, 12-liter engine with the Southwest Research Institute in San Antonio, Texas. The natural gas version of Mack's E7 heavy-duty diesel engine will meet applicable U.S. Environmental Protection Agency (EPA) and California Air Resources Board (CARB) emission standards for 1994 through 1997 and maintains the performance and reliability of its diesel-fueled counterpart.

The Southwest Research Institute has investigated many approaches in the conversion of compression-ignition engines to natural gas-fueled operation, including dual-fuel (diesel pilot injection with natural gas fumigation), rich-burn with air injection into the exhaust, stoichiometric with EGR and three-way catalyst, lean-burn open chamber, and lean-burn stratified charge. Each approach has advantages and disadvantages. The lean-burn open chamber technology was selected for the Mack project because experience has shown that it would most closely meet Mack's goals of low emissions, rated power, and producibility.

A new combustion chamber oriented to lean-burn, turbocharged natural gas fuel operation was designed for the Mack E7 engine. The piston bowl configuration was determined by air flow and swirl requirements of the E7 cylinder head. There is an optimum combustion duration for every engine configuration. If combustion occurs too rapidly, NOx and HC are increased. If combustion occurs

too slowly, thermal efficiency is decreased. The Southwest Research Institute has had excellent results using low squish pistons in medium to high swirl engines.

During its 10-day trip, the vehicle refueled at public and utility-operated facilities that provide compressed natural gas for fleet vehicles powered by the alternative fuel. Nationwide, about 600 stations offer natural gas, and approximately three new stations are being added weekly.

The vehicle's on-board gas storage, holding the equivalent of about 45 gallons of diesel fuel, allows the vehicle to travel about 200 miles between refueling stops. The vehicle's range is designed to meet the needs of daily fleet service.

In Boston, Browning Ferris Industries, a national refuse disposal company, will test the vehicle in commercial service. Boston Gas Company will provide fuel for a portion of the test. Good performance could lead to testing of additional vehicles in late 1993.

"Besides offering low emissions, natural gas is gaining growing acceptance as a vehicle fuel because it is clean-burning, affordable, and an abundant natural resource. This heavy-duty engine is one of several Gas Research Institute initiatives with engine and vehicles manufacturers aimed at making a complete range of natural gas vehicles available to fleet customers," said Stephen D. Ban, President and CEO of GRI.

Mack's goal in the development is to meet the needs of truck fleet owners who may be required by legislation to operate alternatively fueled vehicles. The engine could also be applied to a variety of heavy-duty vehicles including long-haul tractor/trailers, construction equipment, and road maintenance trucks. ▼

CALIFORNIA'S ALTERNATIVE FUEL PROGRAM

California Energy Commission fosters competition in the transportation fuels marketplace

By Charles R. Imbrecht, Chairman, California Energy Commission

Alternative fuels can compete with gasoline and diesel and achieve real improvements in air quality and fuel diversity. As the result of Energy Commission-sponsored demonstrations of methanol- and compressed natural gas-powered light- and heavy-duty vehicles, alternative fuel technologies now compete in the market. This largest alternative fuel program in the U.S. has established California's leadership role in alternative fuels. The Energy Commission's goal is to provide several viable alternatives to motorists and truckers to help California attain cleaner air while reducing vulnerability to price shocks and temporary shortages in gasoline and diesel fuels.

Methanol Fuel Flexible Vehicles (FFVs) are now available from General Motors, Ford, and Chrysler in California new car showrooms at no increase in price. These cars (Lumina, Taurus, and Spirit/Acclaim) let motorists use methanol from more than 40 statewide retail fuel stations when it is convenient; they automatically adjust to gasoline when methanol isn't available. FFVs produce about 50 percent lower smog-forming emissions when using methanol and perform better on methanol than on standard gasoline. The goal is to have 8,500 FFVs in California this year and a total of 20,000 in 1994.

Fleets can now purchase GM pickups and Chrysler vans that use compressed natural gas and achieve very low emission values. Natural gas is much lower in price than gasoline and diesel, although this benefit is offset by the cost of compression and storage and the extra purchase price of the vehicles.

The threat of competition from methanol led the oil industry to co-sponsor a major research and testing effort with the auto industry to show that substantial changes in "reformulated" gasoline can also achieve cleaner emissions. The cleaner reformulated gasolines coupled with advanced automobile emission control technologies such as electrically preheated catalysts, may allow gasoline to compete with methanol and natural gas to meet the Air Resources Board's (ARB's) low emission vehicle regulations into the next century.

Energy Commission sponsorship of methanol bus engine technology led to the commercial availability of methanol bus engines from Detroit Diesel Corporation, the first low emission, heavy-duty, alternative fuel engine certified by the EPA and ARB. The Los Angeles County Metropolitan Transit Authority (formerly the Southern California Rapid Transit District) is now accepting delivery of 300 methanol transit buses to augment their total fleet of 30.

Natural gas transit bus engines from Cummins recently entered the market.

Sacramento Regional Transit is accepting delivery of their first phase of 75 buses.

Both Detroit Diesel and Cummins are interested in adapting their alternative fuel bus engines for the truck market and the Energy Commission is working with the South Coast Air Quality Management District and others on expanded truck demonstrations. The Energy Commission has recently completed the first phase of the methanol truck demonstration, with over 287,000 miles on nine trucks in California. The first phase included methanol truck engines from Caterpillar, Cummins, Detroit Diesel, Ford, and Navistar. These demonstrations encompass seven host-sites: the City of Los Angeles, City of Glendale, City of South Lake Tahoe, Golden State Foods, Federal Express, Arrowhead Water, and Waste Management- and include local delivery truck and trailers, garbage haulers and packers, and dump trucks.

The Energy Commission launched the first OEM compressed natural gas heavy-duty truck demonstration in California with a Caterpillar G3406 engine, and expects to expand this to at least three trucks with different engines. Everyday, this first truck, an 80,000 pound Ford operated by the Vons Companies, Inc., hauls a load of groceries from El Monte over Tejon Pass on Interstate 5 to Bakersfield. This demonstration is co-sponsored with the South Coast Air Quality Management District, the Gas Company, and the U.S. Department of Energy.

The Energy Commission is sponsoring the California Clean Safe Schoolbus Demonstration Program, which has placed 163 new schoolbuses with 14 school districts in Phase I. These include 103 advanced diesel buses (with DDC 6V-92TA DDEC diesel engines meeting '91 standards), 50 methanol buses (with DDC 6V-92TA DDEC methanol engines), and 10 CNG buses (with GM/Tecogen 7000 engines). The second phase consists of 400 new schoolbuses now being delivered to 47 school districts. These include 200 advanced diesel buses (with Caterpillar 3116 diesel engines meeting '94 standards), 100 methanol buses (with DDC 6V-92TA DDEC methanol engines certified to '94 standards) and 100 CNG buses (with GM/Tecogen 7000 turbocharged engines certified to '94 standards).

The Energy Commission has worked with major oil companies to provide methanol at selected California fuel stations. This program includes ARCO, Chevron, Mobil, Shell, Texaco, and Ultramar (Beacon). 47 stations now operating, nine under construction, and a total of 81 stations committed to be built by the end of 1994.

The Energy Commission has sponsored construction and with the California Air Resources

Board (ARB) is supporting operation of a heavy-duty chassis emission test facility at the Los Angeles County Metropolitan Transit Authority. The facility is testing diesel and alternative fuel buses and trucks to measure actual emission levels and verify emission benefits. This information will help ARB and local air quality management districts develop incentives for investment in low emission alternatives. The intent is to establish a market for clean air credits to offset the extra purchase and fuel costs of low emission, alternative fuel trucks and other vehicles.

The Energy Commission is also sponsoring the Clean Diesel Program to determine if diesel trucks can achieve emissions that are as clean as clean alternative fuels. If not, this program will look at ways to lower emissions from existing and new diesel engines using petroleum diesel fuel.

The Clean Diesel Program is funded from fines levied by ARB on smoking trucks cited at local weigh stations. These funds will help the trucking industry to improve its environmental image.

The Energy Commission supports electric vehicle (EV) development through co-sponsorship of CALSTART with California electric utilities and EV component producers. CALSTART is chartered to establish EV component, infrastructure, and bus production in California using surplus aerospace resources: facilities, technology, and personnel. This is really "beating swords into plowshares."

The Energy Commission has supported methanol since 1979, because coal and natural gas resources and carbon-containing wastes that can be used to produce methanol are from 10 to 100 times the size of world oil reserves. Even though natural gas and propane engine conversions were then available, the Energy Commission promoted an additional alternative that offered air quality advantages, easier distribution and storage as a liquid fuel, and less change to engine fuel induction systems than the gaseous fuel alternatives.

With the resurgent support of the natural gas industry, we see the opportunity for both methanol and natural gas alternatives to compete with gasoline and diesel in many transportation market niches. Methanol and natural gas complement each other, as both reduce emissions and provide fuel diversity for the transportation sector. Our economy benefits from competition to provide more useful products at lower prices.

We have now succeeded in bringing competition into the transportation fuel marketplace. ▼

ENGINE AND PROJECT PROFILE:

Overnite Transportation and Cummins Engine Company, Inc.

Overnite Transportation Company recently unveiled a liquid natural gas (LNG) powered highway truck that is a significant new application of alternative fuels in commercial transportation. Overnite plans to use its new tractor-trailer truck for local pickups and deliveries in the Richmond, Virginia area.

The engine that powers the tractor-trailer rig was designed by Cummins Engine Company, Inc. of Columbus, Indiana and installed especially for Overnite. Cummins adapted its proven L10 compressed natural gas engine by modifying the engine's fuel delivery system to handle liquid natural gas. Fuel for the Overnite truck is a high purity liquid natural gas (RLM™ Fuel) produced by Air Products and Chemicals, Inc. of Allentown, Pennsylvania.

The L10-240G engine is the first natural gas fueled heavy duty engine to receive the California Air Resources Board (CARB) approval. The engine, equipped with a catalytic converter for control of hydrocarbons, achieves emission levels significantly below ARB standards for particulates and nitrous oxides.

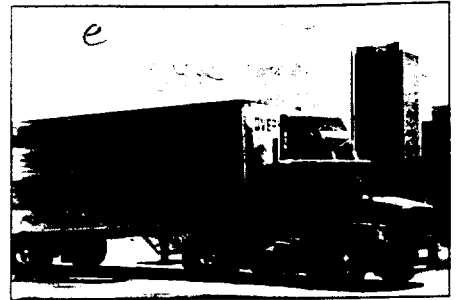
The L10-240G is spark ignited as well as turbocharged and aftercooled. It is rated at 240hp at 2100rpm, with 850lb.-ft. of peak torque at 1400rpm. Its primary advantage is its lean burn technology for

meeting the tough nitrous oxide and particulate standards. The lean burn technology utilized by the Cummins engine provides cooler combustion temperatures for reduced levels of nitrous oxides and increased durability. This technology raises the thermal efficiency of a typical spark ignited engine from approximately 32 to 37 percent.

With a six cylinder, in-line heavy duty engine like its diesel counterpart, the L10 natural gas engine is equipped with a carburetor, governor and spark ignition system which replace the diesel injection system. The 10.5 : 1 compression ratio is lower than diesel. The Holset WH-2D turbocharger on the L10 natural gas engine is wastegated, providing the optimum air-to-fuel ratio over the entire operating range.

Overnite's use of the CARB-certified L10 design is the first heavy truck application of a production natural-gas engine. Unlike other natural-gas powered truck engines, it is not a conversion of an engine built originally for gasoline or diesel fuel.

Converting the fuel system to use liquified natural gas made the engine better suited for use in a truck tractor. Storage tanks for the liquid fuel are substantially smaller than the tanks used for buses powered with compressed natural gas and provide increased travel distances per fill. This dual advantage of lower weight and greater range is of great



importance to trucking applications.

Cummins already has more than 300 L10 engines operating on compressed natural gas in transit buses. Many municipal transit authorities are taking advantage of the lower cost and abundance of the domestically produced fuel.

Overnite's new Class 8 highway truck, which bears a logotype on its 28-foot trailer promoting the LNG engine, will be based at its Richmond terminal. Air Products has built a customized-designed fueling station and storage facility on the terminal site to supply the trucks. Minnesota Valley Engineering, Inc. has provided a 3,000 gallon cryogenic storage tank for the facility.

Air Products RLM™ fuel is a 99 percent methane natural gas that is stored at -260 degrees Fahrenheit under low pressure at the terminal. When transferred to the vehicle, the gas is pressurized to about 100 pounds per square inch for storage in the 120-gallon double-walled, stainless steel tank. ▼

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Alexandria, VA 22314-4677

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