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AFDC UPDATE

News of the Alternative Fuels Data Center

Clean Air Cabs Supply Data to AFDC, Enjoy Success

In early 1995, the AFDC began presenting fuel economy data on the Washington, D.C.-based Clean Air Cab Company, the first cab company in the United States to operate all its vehicles on compressed natural gas (CNG).

Clean Air Cab, formed in 1992, was inspired by the Clean Air Act Amendments of 1990, which will require certain fleets to use clean alternative fuels beginning in 1998. The company hopes to double its fleet from 15 to 30 vehicles by the end of the summer, according to Clean Air Cab President Todd Ruelle.

Clean Air Cab plans to expand to cities such as Denver and Atlanta, with fleets of 30 cabs each. The company's cabs would serve Denver's new airport and would be accessible to attendees of the 1996 Olympics in Atlanta.

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"We want to do with our cabs what Starbucks did with coffee," Ruelle said. "We want to glamorize the industry and expand our availability to the public. Right now, the taxi business is in decay; many cabs are 8 1/2 years old and need to be replaced. We can satisfy that market."

Ruelle discussed several reasons why he believes his company is the answer to the industry's problems. A key benefit he mentioned is that CNG is cleaner than gasoline.

"CNG has environmental benefits and economic cost opportunities," he said, citing CNG's emissions reduction potential and lower fuel costs. He estimated fuel costs to be about 60¢ per gasoline equivalent gallon in the Washington, D.C., area, as opposed to $1.20 a gallon for gasoline.

Because CNG is less expensive than gasoline, Ruelle said, the $4,000 conversion cost per vehicle could be paid back in 20 months. He based the payback time on a $200 per month CNG cost per vehicle, as opposed to a $400 per month gasoline cost per vehicle used under similar operating conditions. The total capital cost per vehicle is $21,000 ($17,000 per vehicle; $4,000 per conversion).

Ruelle said his drivers do not perceive any differences in vehicle performance between the dedicated CNG cabs (model year [MY] 1994 Ford Crown Victorias) and conventional gasoline vehicles. Nonetheless, he said drivers were not as pleased with the bi-fuel vehicles (MY 1993 Chevrolet Caprices); the drivers were uncomfortable shifting between CNG and gasoline, he said.

Average fuel economy is equal to or better than that of gasoline, he said (see Table 1 for fuel economy data on the CNG taxis[1]). And drivers do not see any noticeable power difference between vehicle types, he added. Some members of the CNG industry, however, have said that use of these engines might result in a 10%–15% loss of power.

A portion of Clean Air Cab's vehicles will be emissions-tested. Upcoming issues of *AFDC Update* will provide further information.

In the future, Clean Air Cab Company plans to collaborate in the development of a CNG infrastructure and to provide services to Baltimore in late 1995 and to other cities in 1996.

"We're changing how people think about taxicabs," Ruelle said. "If you're going to take a taxi and spend fare, why not do it with an environmentally correct car rather than a typical taxicab?"

Clean Air Cab fuel economy data, which are included below, can be accessed through AFDC/View or AFDC/Menu under the category "CNG Light-Duty Vehicles." See the Q&A on database features, page 4, for information on Internet access.

[1] There are no data to compare Clean Air cabs to gasoline control cabs because the company does not operate any gasoline vehicles.

Federal Express Project Ends after 2 Years of Data Collection

Photo courtesy of George Sverdrup, Battelle Memorial Institute

One of the CleanFleet demonstration vans in California

A final report on an extensive alternative fuel demonstration project managed by the Battelle Memorial Institute will be available this summer to help fleet operators select the fuel that best serves their needs as they move forward to meet federal regulations.

By the end of the 2-year trial, known as the CleanFleet study, 111 vans operating on four alternative fuels and two gasolines had been driven more than 3 million miles, delivering packages for Federal Express in the Los Angeles area.

The fuels included in the study were M85 (85% methanol, 15% gasoline), compressed natural gas (CNG), propane, electricity, California Phase 2 reformulated gasoline (RFG), and baseline unleaded gasoline. Table 2 summarizes the fuels and vehicles included in the study. "What we learned in CleanFleet is that no single fuel is 'best,' that is, can meet all the needs of all fleet operators," said Battelle Project Manager George Sverdrup.

Besides electric vehicles (EVs), CNG might prove to offer the greatest emissions reductions, according to the study. Early results showed that California Phase 2 RFG is also effective in reducing emissions without affecting vehicle reliability, although driving range was reduced slightly compared to baseline gasoline.

In addition to tracking emissions and the effects of accumulated miles, the CleanFleet study was designed to examine a variety of economic, safety, and driver considerations covering both vehicles and the alternative fuels infrastructure.

The report is expected to help fleet managers plan for costs that might be encountered in switching to an alternative fuel, including

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Table 1
Clean Air Cab Company—Overall Fuel Economy and Mileage per Vehicle[1]

Vehicle	Starting	Latest	CNG (Eq gal)	MPGE	EPA Estimated
Caprice	15,751	49,782	295.9	17.8	16/25
Caprice	11,705	48,312	1,303.5	13.6	16/25
Caprice	15,752	63,846	440.9	18.1	16/25
Caprice	14,004	52,163	290.9	15.7	16/25
Caprice	16,813	68,300	367.8	18.7	16/25
Crown Victoria	1,740	5,985	189.1	21.2	18/25
Crown Victoria	8,276	12,151	47	20.5	18/25
Crown Victoria	3,725	15,109	363.2	20.1	18/25
Crown Victoria	1,336	1,916	25.2	23.5	18/25
Crown Victoria	62	62	0	N/A	18/25
Crown Victoria	6,773	7,332	32	18.0	18/25

Sources: National Renewable Energy Laboratory; Model Year 1993 & Model Year 1994 Fuel Economy Guides; U.S. Department of Energy; U.S. Environmental Protection Agency.
[1]Fuel economy is calculated from valid refuelings only.

installation of new or different tanks and dispensing systems. The report also addresses building modifications such as increasing ventilation if certain vehicles are housed or serviced indoors.

In the short term, "a significant fact is that all infrastructure for storing and dispensing [reformulated gasoline] is similar to gasoline systems and would already be in place in most fleet operations," Sverdrup said. "Thus, reformulated gasoline can be easily used in most urban areas, and emissions can be reduced."

The lack of a widespread alternative fuel infrastructure doesn't rule out the other fuels for the near future. For Federal Express, the flexible-fuel capability of the M85 vehicles helped overcome the limited commercial supply of methanol at retail service stations. A summary of the report also advised that, for CNG and liquefied petroleum gas, some fleet managers may elect to store the fuel on site.

Sverdrup said EVs might not yet be cost competitive for fleet operators, but their reliability is improving. The early lead-acid battery-powered vans were about 40% less reliable than their gasoline counterparts, but nickel-cadmium batteries narrowed the gap to 9%.

Range was another issue CleanFleet examined. The range for EVs was 82%–91% less than that of gasoline vans; the range for the methanol flexible-fuel, propane, and CNG vehicles was 42%–60% less. Range can be increased by using different tank sizes and configurations, according to Battelle. A summary of the study states that vehicles capable of running on more than one fuel can help the vehicles overcome the early limited commercial supplies of the alternative fuel. Despite decreased range, the alternative fuel fleets "did deliver" as part of Federal Express's routine fleet operations, Sverdrup said. Some were used for all but the longest delivery routes, and the range of the EVs was adequate for delivery service in downtown areas, he added.

Sverdrup stressed that the vehicles all represent 1992 technology, a significant fact because developments in alternative fuel vehicles are moving quickly.

The $16 million project was funded by a public-private consortium of 19 agencies that included the U.S. Department of Energy, U.S. Environmental Protection Agency, California Air Resources Board, California Energy Commission, various fuel organizations, and the vehicle manufacturers.

Five reports will be available starting this spring with a data summary for the last quarter of the demonstration. Reports on driver attitudes, fleet economics, vehicle fuel economy, and maintenance will follow.

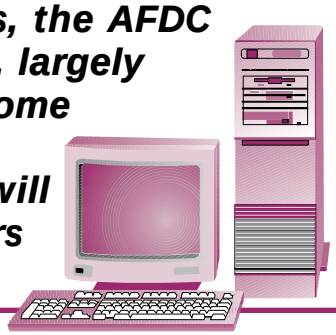
Data for the Federal Express fleet are available from the Alternative Fuels Data Center or by calling Battelle Memorial Institute at (617) 424-4062.

Table 2
Fuel and Vehicle Description in CleanFleet Study

Fuel	Vehicle Description
CNG	Chevrolet special-build vans
	Dodge production vans
	Ford special-build vans
Electric	G-Van (an early EV prototype, both lead-acid and nickel-cadmium batteries)
M85	Ford flexible-fuel vans
Propane	Ford vans (with gasoline catalysts)
	Chevrolet vans (with propane catalysts)
RFG	Chevrolet standard vans
	Dodge standard vans
	Ford standard vans
Unleaded gasoline	Chevrolet vans
	Dodge vans
	Ford vans

Source: Battelle Memorial Institute

Within the last several months, the AFDC has added some new features, largely because the database has become available to Internet users. Information discussed below will assist Internet users and others in using the AFDC.



Q. What is the World Wide Web?

A. The World Wide Web (WWW) is an Internet service that can be used to distribute and receive information—complete with text, graphics, and illustrations— across computer networks. Important ideas within or across publications are connected by a series of hyperlinks, and you can move to linked documents by selecting highlighted items. You need an Internet connection and a browser such as Mosaic, which will enable you to see formatted documents that contain graphics and highlighted hyperlinks.

Q. What is Mosaic?

A. Mosaic, a client-server, graphical, user-interface browser for the Internet, allows the user to access written reports, photographs and other graphics, sound, and video. For AFDC users, it is especially useful for viewing *AFDC Update* newsletters and other graphically oriented documents. Mosaic was developed by the National Center for Supercomputing Applications (NCSA) at the University of Illinois. Client software is necessary to operate the interface. It is free and available from NCSA. Use the File Transfer Protocol (FTP) to obtain the Mosaic client software from the NCSA site (ncsa.uiuc.edu).

Q. How can I access the AFDC through Mosaic?

A. The opening screen (home page) of Mosaic is user friendly; simply use your mouse to click on any information you would like to view.

A login ID and password are not required to access the AFDC through Mosaic. The AFDC's Uniform Resource Locator is

http://www.afdc.nrel.gov

which can be accessed through Mosaic or another browser.

Q. What is Lynx?

A. Lynx, a character-based interface, provides the same services as Mosaic. It can be accessed with any type of communications software (with a modem) or via the Internet. It does not show graphic designs, but designs can be downloaded and viewed later on your computer. Lynx, unlike Mosaic, is not a client-driven system.

Q. How do I access AFDC information using Lynx?

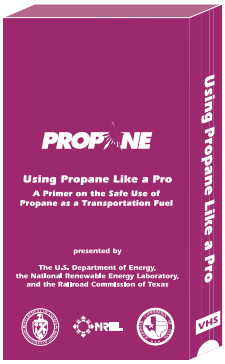
A. You can use a modem to access an Internet provider and use the provider's Lynx program to connect to the AFDC. You may also dial the AFDC, log in, and use the AFDC's Lynx connection.

A client usually accesses Lynx through a UNIX-based computer. You need an ID and password if you wish to start Lynx from the AFDC. If your computer has Lynx, you can connect to the AFDC with only the address:

http://www.afdc.nrel.gov

For the Alternative Fuels Data Center headings and AFDC Internet and phone information, see sidebars on page 6.

NREL, Texas Railroad Commission Offer Propane Video



"What's an old football player like me doin' standin' up here?" asks Randy White in his introduction to a new 12-minute video, "Using Propane Like a Pro: A Primer on the Safe Use of Propane as a Transportation Fuel," produced by the Texas Railroad Commission for the National Renewable Energy Laboratory (NREL). The video is free and available to the public.

White, former Dallas Cowboy standout and National Football League Hall-of-Famer, begins by giving the viewer a general course in "Propane 101," and ends by describing five steps for a successful "handoff." But White is not mixing sportscasting with alternative fuels—"handing off" is simply a metaphor for transferring propane from one "carrier" to another, or refueling, by moving the fuel from pump to vehicle.

This course provides a brief overview of propane, which is also known as liquefied petroleum gas (LPG). Propane is a by-product of natural gas and oil and is an ideal transportation fuel because it burns cleaner than gasoline, according to White. Because it uses a closed fuel storage system, propane minimizes evaporative emissions, which constitute 35% of the total vehicle emissions in the United States. Propane tailpipe emissions, which are less reactive in sunlight, have up to a 45% lower smog-forming potential than exhaust emissions from gasoline.

Also, propane is abundant domestically, White says. If its infrastructure were to expand, he says, the United States would become less dependent on foreign oil and would increase U.S. jobs. Currently, there are more than 10,000 propane dealers nationwide.

In addition to describing propane's benefits, White also discusses how vehicle fuel systems operate. After propane goes into a vehicle's cylinders as a liquid, it exits as a vapor. Its fuel delivery system's automatic shutoff valve prevents flow of fuel when the engine is not running and filters foreign particles from the fuel when it's still a liquid. The fuel system's vapor regulator lowers the pressure of the fuel, causing it to vaporize.

After passing Propane 101, it's time for the handoff, which requires special equipment. Because propane transforms from liquid to vapor at -44°F, neoprene gloves must be worn to avoid freeze burns during refueling. Cotton or leather gloves should be avoided.

White talks the viewer through each of the five refueling steps as a technician performs the tasks. White discusses each of the refueling components and shows how they are interrelated. If you remember these five steps, he says, then you'll be able to refuel safely with propane. But most important, he adds, "you have to treat [propane] with respect."

To obtain a free video, call the National Alternative Fuels Hotline at (800) 423-1363.

L.A. Times Tests Heavy-Duty CNG Engine

The *Los Angeles Times* newspaper has been taking part in a 2-year test demonstration that uses a prototype Detroit Diesel Series 60 compressed natural gas (CNG) engine in one of its heavy-duty tractors. The tractor, a Ford LTLA-9000 AeroMax, operates twice a day, delivering newspapers to distributors.

The vehicle travels 50–200 miles per day during its Southern California delivery run. The tractor refuels at Shell Oil Company's CNG site in Los Angeles.

The Detroit Diesel Series 60 engine used in the vehicle is rated at 370 horsepower at 1800 revolutions per minute. It is a four-stroke, six-cylinder spark-ignited engine, which reaches the following emissions levels (emissions goals in parentheses):

- Oxides of nitrogen: 5.0 (2.5) grams per brake-horsepower-hour (g/bhp-hr)
- Carbon monoxide: 15.5 (2.5) g/bhp-hr
- Hydrocarbons: 1.3 (1.0) g/bhp-hr
- Particulate matter: 0.25 (0.02) g/bhp-hr.

The newspaper's use of an alternative fuel is hardly a new practice, according to Terry Spencer, Transportation Training Manager for the *Los Angeles Times.*

"Twenty years ago, we started using propane vehicles," Spencer said. "When the opportunity arose to upgrade our fleet to include larger vehicles, we welcomed the idea of using natural gas in a Class 8 tractor.

"There's a general perception that CNG is a cleaner burning fuel than diesel. It has always been a company philosophy to be as

Photo by Warren Gretz, NREL

This CNG tractor delivers the Los Angeles Times to distributors of the paper.

environmentally friendly as possible."

Spencer said the main drawbacks of CNG compared with diesel are decreased fuel economy and increased refueling time. He estimated a 20% loss in fuel economy and a refueling time of 35–40 minutes, as opposed to 5–10 minutes for diesel.

Otherwise, Spencer said, minor problems related to piston rings and valves were corrected before the vehicle went into operation. He also said his drivers have accepted that they will need to learn new skills to adjust to the new vehicle technology.

"One can't begin to drive with CNG and feel comfortable right away," he said. "The drivers have viewed this program as a challenge, and they've felt good taking part in it. They want the program to succeed. If unforeseen problems arise, you correct them, and then you move forward."

The demonstration program, a public-private partnership sponsored by the California Energy Commission, South Coast Air Quality Management District, Southern California Gas Company, the U.S. Department of Energy's National Renewable Energy Laboratory, and the Trucking Research Institute, is designed to monitor the ability of heavy-duty trucks to meet stringent air quality standards. Others involved in the project include Detroit Diesel Corporation, Ford Motor Company's Truck Division, and Valley Detroit Diesel Allison. Acurex Environmental Corporation, an engineering firm, manages data collection for the program.

Preliminary data have been collected by Acurex, which will issue a report that evaluates emissions, as well as performance, reliability, and operations and maintenance costs.

Information in the Alternative Fuels Data Center (AFDC) is listed under the following headings:

- Alcohol light-duty vehicles (LDVs)
- Compressed natural gas LDVs
- Buses
- Heavy-duty vehicles
- Federal Express CleanFleet vehicles
- Emissions
- Demonstration site weather conditions
- Refueling facilities
- Original equipment manufacturer alternative fuel vehicles
- AFDC information updates.

Data on the following have been updated or added to the AFDC in the past year:

- Heavy-duty trucks
- Buses
- Vehicle maintenance
- Emissions for:
  - Heavy-duty trucks (May 1994)
  - CleanFleet (July 1994).

Internet and Phone Information

- To obtain a login ID and password or user manuals for the AFDC, call the National Alternative Fuels Hotline at 800-423-1363.
- To access the AFDC over the Internet through anonymous FTP, the address is **afdc.nrel.gov**
- E-mail messages should be sent to **hotline@nrel.gov**
- For Mosaic Internet access, the AFDC's Uniform Resource Locator (URL) is **http://www.afdc.nrel.gov** NREL'S URL is **http://www.nrel.gov**

Meetings and Conferences

June 3–6: Pinnacle 2000: National Propane Gas Association (NPGA) Annual Meeting & Educational Conference, La Quinta Golf & Tennis Resort, La Quinta, California. For information, call Rita Pecilunas at (708) 515-0600, or write to: NPGA, 1600 Eisenhower Lane, Suite 100, Lisle, IL 60532.

June 11–13: American Gas Association (AGA) Executive Conference, Broadmoor Hotel, Colorado Springs, Colorado. For information, call Dee Harrington at (703) 741-8443, or write to: AGA, 1515 Wilson Boulevard, Arlington, VA 22209.

June 12–14: Windsor Workshop on Alternative Fuels, Ramada Hotel, Toronto, Ontario, Canada. For information, call Susan Horton at (905) 822-4111, or write to: ORTECH, 2395 Speakman Drive, Mississauga, Ontario, Canada LSK 1B3.

June 14–15: Society of Automotive Engineers (SAE) Propane Technology TOPTEC, Toronto, Ontario, Canada. For information, call (412) 772-7148, or write to: SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

June 20–29: Sunrayce 95, starts in Indianapolis, Indiana, and ends at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. For information, call Jeri Wagner at (303) 384-4317, or write to: NREL, Conferences Group, 1617 Cole Boulevard, Golden, CO 80401.

June 28–30: 1995 International Alternative Fuels Conference, Milwaukee Exposition, Convention Center & Arena, Milwaukee, Wisconsin. For information, call Jill Miller at (800) 447-5088 or (414) 783-7005, or write to:

Alternative Fuels Briefs

In February, the Gas Research Institute (GRI) provided Johns Hopkins University with a $400,000 contract to continue work on its advanced natural gas vehicle (ANGV). GRI hopes the university's Applied Physics Laboratory (APL) will be able to improve the ANGV's fuel-storage system—doubling the vehicle's range— and lower the price gap between natural gas vehicles and gasoline vehicles.

With the new contract, APL, along with Brunswick Composites, will develop an enhanced fuel-storage system that is lower in cost, stores more fuel, and is safer than the current system.

The ANGV was first discussed in **AFDC Update's** *February 1995 issue.*

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The U.S. Department of Energy's Office of Alternative Fuels, together with Idaho National Engineering Laboratory, will participate in a demonstration project for liquefied natural gas (LNG) intercity buses in Idaho. Emissions will be tested by the West Virginia University Transportable Heavy-Duty Vehicle Emissions Testing Laboratory, and data will be collected on six LNG buses and three diesel control buses. Vehicle performance will also be tested.

Data on this project are expected to appear in the AFDC; consult upcoming issues of **AFDC Update** *for further information.*

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Based on the excellent performance of the 20 dedicated compressed natural gas (CNG) engines in its Washington, D.C., fleet, United Parcel Service (UPS) has decided to order 276 more Tecogen 4.3-L CNG engines and retrofit additional vehicles with these engines. The original 20 vehicles operated under U.S. Department of Energy (DOE) sponsorship. The repowered vehicles will operate in Connecticut and Southern California and will not be funded by DOE. UPS expects CNG vehicles to play an important part in its fleet operations.

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Two Energy Policy Act of 1992 Notices of Proposed Rulemaking, recently published in the *Federal Register,* can be accessed through the U.S. Department of Energy's (DOE's) Energy Efficiency and Renewable Energy Network (EREN). The proposed rules—which address fuel provider and state fleet alternative fuel vehicle purchase requirements and DOE's Alternative Fuel Vehicle Credit and State and Local Incentives Programs—are available to World Wide Web users by performing the following when on the Internet:

- Type the following Uniform Resource Locator: http://www.eren.doe.gov
- Click on News, Events, and Hot Topics
- Click on Codes and Regulations
- Click on Alternative Fuel Transportation Program.

An option to download information is provided at the beginning of each proposed rule.

Alternative Fuels Conference, P.O. Box 1283, Brookfield, WI 53008-1283.

July 3–6: Eleventh International Conference & Exhibition on Liquefied Natural Gas (LNG 11), International Convention Centre, Birmingham, United Kingdom. For information, call 011-4471-228-8034, or write to: Event Organization Company, 8 Cotswold Mews, Battersea Square, London, UK SW11 3RA.

July 9–13: First International Symposium on New Materials for Fuel Cell Systems, Hilton Bonaventure Hotel, Montreal, Canada. For information, call Oumarou Savadogo at (514) 340-3215, or write to: École Polytechnique de Montréal, CP 6079, Succursale Centreville, Montreal, Quebec, Canada H3C 3A7.

July 15–20: Solar '95, Marriott City Center, Minneapolis, Minnesota. For information, call (303) 443-3130, or write to: American Solar Energy Society, 2400 Central Avenue, Suite G-1, Boulder, CO 80301.

July 16–20: National Conference of State Legislatures (NCSL) Annual Meeting & Exhibition, Mecca Convention Center, Milwaukee, Wisconsin. For information, call Linda Worrell at (303) 830-2200, or write to: NCSL, 1560 Broadway, Suite 700, Denver, CO 80202.

July 17–20: Environmental Resource Institute National Management Conference, Westin Hotel O'Hare, Chicago, Illinois. For information, call Judith Long at (419) 422-6063, or write to: Environmental Resource Institute, P.O. Box 854, Findlay, OH 45839.

Some upcoming events cannot be listed because of space limitations. For an expanded listing of conferences and events, please contact the National Alternative Fuels Hotline at (800) 423-1363.

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