

# AFDC UPDATE

News of the Alternative Fuels Data Center

## AFDC/View Version 2.0 Provides Users with Many New Benefits

What looks and works the same as AFDC/View 1.14, but has four times the number of data queries, smoother operation, enhanced graphics capabilities, and data analysis?

AFDC/View 2.0 for Windows, of course.

This February, the AFDC will release Version 2.0 of its AFDC/View software, dramatically increasing the number of data queries available to users. And for the first time, the AFDC will include access to data analysis.

The new version is user friendly and menu-driven, like past versions, with one exception: It has more than 260 data query options, a major jump from the 65 available previously. "The whole intent of the new software issue is to increase the amount of data available to users," according to the AFDC's Lee

Schrock. New data, data analysis, and improved graphics capabilities will provide a substantially upgraded data base that will enable users to generate more useful reports and help them in making decisions. "Many bugs have been worked out of earlier versions, for smoother operation than ever before," said Schrock.

New and enhanced graphics capabilities will allow users to produce several types of graphics, such as pie charts, logarithmic graphs, stacked bar charts, and three-dimensional graphs. □

## New Data Accessible

New data, collected from vehicles at ten locations, are now accessible through AFDC/View Version 2.0. Formerly, data were available only on vehicles running on 85% methanol and 15% unleaded gasoline (M85) in four cities: Detroit,

MI; Washington, DC; San Diego, CA; and Los Angeles, CA. The new data include information from compressed natural gas (CNG) and ethanol (E85—85% ethanol/15% gasoline) vehicles operating in the federal fleet. These new data were previously available only through Oracle Data Query interface.

The data base now contains about 800 original equipment manufacturer alternative fuel and gasoline control light-duty vehicles. Of these vehicles, approximately 400 will have emissions measured this year using the Federal Test Procedure. The results will be entered into the AFDC.

For the first time, Version 2.0 also makes data accessible on fuel and oil consumption, maintenance, safety, fuel analysis, and routes traveled, plus emissions on transit buses and heavy-duty vehicles. The buses run on:

- Liquefied natural gas (LNG)
- Compressed natural gas (CNG)

- 95% ethanol/5% unleaded gasoline (E95)
- 100% methanol (M100)
- Diesel controls (and diesel with particulate traps)

If you are not already an AFDC user, you may call the National Alternative Fuels Hotline to request free software and an operations manual. □

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*For more information about articles in this newsletter or to become an AFDC user, please contact the Alternative Fuels Hotline at 800-423-1DOE, P.O. Box 12316, Arlington, Virginia 22209.*

## AFDC Creates Map Books of more than 700 U.S. CNG Refueling Sites

The U.S. Department of Energy's AFDC has made available map books showing the locations of more than 700 CNG refueling sites in 44 states.

Figure 1 is a summary map of these sites. Individual state maps indicate the locations of major roads, and refueling sites are listed by number in tables according to site name, address, city, phone, access hours, public access availability, and site status (some are in planning).

Although the maps are based on data collected in May of 1993, the American Gas Association (AGA) provided CNG refueling data, dated October 1993, which are accessible through the AFDC.

## Map of U.S. CNG Refueling Sites

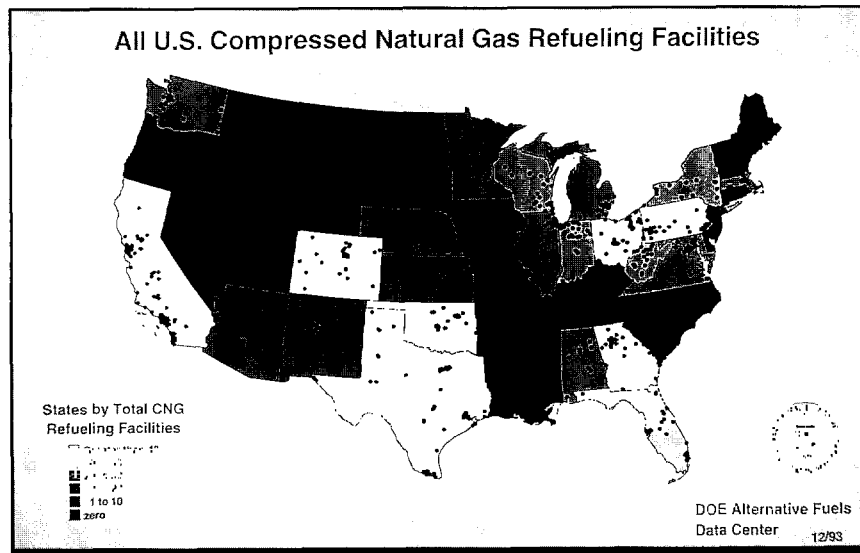


Figure 1

In addition to the map book, AGA publishes a *Directory of Natural Gas Refueling Stations*,

*Products, and Services* (Catalog #160012). To order, call AGA at 703-841-8600. □

## Protocols Developed for Data Collection and Entry into AFDC

To provide a consistent basis for data gathering and analysis, the U.S. Department of Energy, through the National Renewable Energy Laboratory (NREL), has developed comprehensive format and quality assurance protocols, which must be followed for data collection and entry into the AFDC.

Fleet managers benefit from following protocols and having data admitted to the AFDC, according to AFDC Manager Dr. Robert Wooley. The protocols compel fleet managers to collect and record data in a standardized way so the quality of the data can be assured, he said.

"The data are well-maintained and secured so that fleet managers can get data back out for comparisons to other fleets." The data are secured through proper data base procedures and tape backups that are kept off site. "If this building burned down, the data would not be lost," said Wooley.

New data collection programs are evaluated by NREL to see if they meet certain criteria. In general, the programs must provide "value-added" data, or information that is different from current programs already in the data center. Most activity currently focuses on

original equipment manufactured vehicles or engines, as opposed to aftermarket conversions. The selection of new or near-new test vehicles is also very important, as is the availability of well-matched control vehicles (identical specifications other than the alternative fuel, and comparable mileage). Other program criteria also exist, including the acceptance of NREL data collection procedures and protocols.

The protocols were originally developed to provide an efficient way to reduce data collected from demonstration vehicles under the Alternative Motor Fuels Act of 1988. The protocols were also designed to ensure proper analysis procedures to check data validity

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## Protocols

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and provide a common basis for comparisons between alternative and conventional fuels.

"We came up with these protocols to stress standardization and quality of data collection. With so many organizations now collecting information on alternative fuel vehicles, it is necessary for data to be standardized. It also makes it easier to place in the AFDC," according to Ken Kelly, AFDC's Quality Assurance Engineer.

Two levels of data collection are now being used to assess the operational and performance characteristics of federal light-duty vehicles (LDVs):

- Level 1 is more subjective, focusing on drivers' daily assessments of vehicle operation, in-use fuel economy, and related issues.
- Level 2 is more quantitative, focusing on industry-standard test methods, such as chassis dynamometer tests, evaporative emissions tests, and on-board electronic data collection systems that assess

vehicle operating parameters and duty cycles.

Individual fleet vehicles are designated for either Level 1 or Level 2 data collection. Information is loaded into data bases and transferred to NREL for entry into the AFDC. By selecting a significant number of vehicles for data collection, proper characterization of overall vehicle operation and a comprehensive understanding of engine/vehicle performance can be gained. □

## Quality Assurance Critical to AFDC

The old adage, "Necessity is the mother of invention" is certainly true in the case of the AFDC, where analysts began by manually checking all records, then graduated to a sophisticated, automated approach supplemented by human technical evaluation.

Each data point undergoes investigation as described below and shown in Figure 2.

- Several sources collect data: vehicle drivers, oil analysis laboratories, emissions laboratories, maintenance shops, and others.
- After the computer operator enters the data, the data are immediately subjected to quality assurance with a specially designed screen that rejects data not meeting certain parameters; for example, the wrong vehicle identification number.
- Data are transmitted via electronic mail to the National Renewable Energy Laboratory's (NREL's) central computer, and then transferred to the AFDC.
- An automatic quality assurance program picks up the file, runs data validations, and compares the new

data with existing AFDC data. For example, if new data collected from a site show the mileage falling instead of increasing, the data will be automatically kicked back to the original sender. The program can also place data that may be erroneous into a separate "bad data" file

and send messages to the technician about the problem data.

■ Quality assurance is also performed by the NREL technical staff, who can determine if data can be corrected or should be omitted.

■ Once a technician has corrected

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## Flow of Information to the AFDC

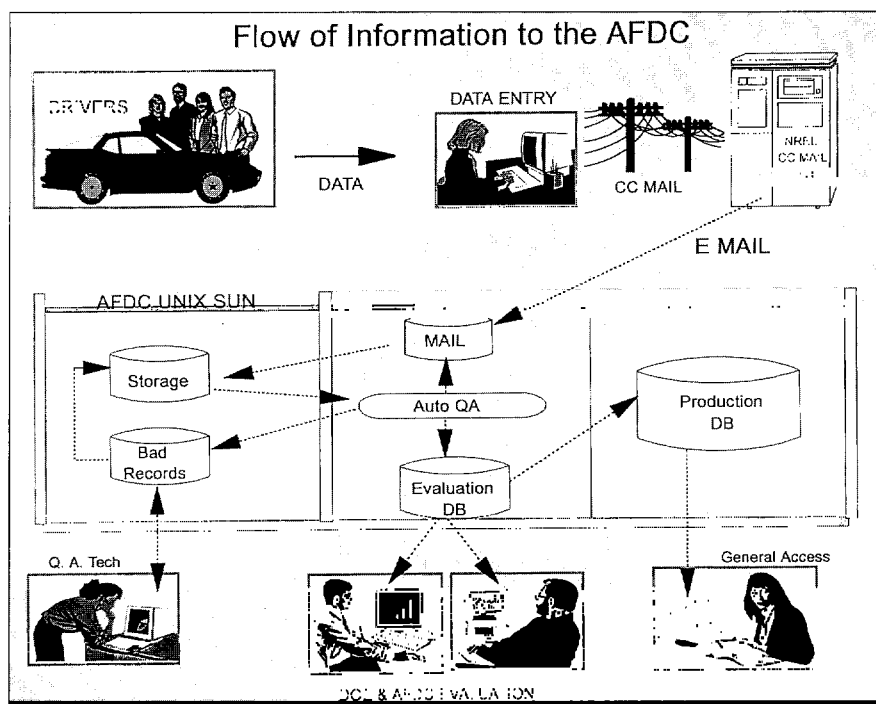


Figure 2

## Quality Assurance

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the data, the information is stored and automatic quality assurance is run once more.

■ Correct data go to an evaluation data base, where NREL and DOE engineers review the information. Incorrect data are further reviewed by AFDC quality assurance technicians and corrected or deleted as appropriate.

■ Once accepted by DOE and NREL, the data become available to the public through AFDC/View software and other retrieval methods.

"With tens of thousands of data base records accumulated in the AFDC, it was a necessity to use this approach," according to AFDC Manager Dr. Robert Wooley. □

## LPG Conversion Kit Evaluation Now Available in AFDC

The benefits and problems of three off-the-shelf liquefied petroleum gas (LPG) aftermarket conversion kits installed on a Chevrolet Lumina are outlined in a report available from the AFDC.

The study, *Evaluation of Aftermarket LPG Conversion Kits in Light-Duty Vehicle Applications*, was conducted by Southwest Research Institute (SwRI) under contract to the National Renewable Energy Laboratory (NREL) with funding provided by the U.S. Department of Energy (DOE). It measured and compared Federal Test Procedure (FTP) emissions and fuel economy of the conversion kits operating on three LPG fuels.

Two of the kits are produced by IMPCO Technologies, and the third by MOGAS.

One analysis within the study, funded by the Texas Railroad Commission in cooperation with NREL, compared an additional LPG fuel composition to look at potential differences in performance and emissions.

In addition, speciated hydrocarbon (HC) emissions were measured to determine the ozone-forming potential of LPG HC emissions.

### Some SwRI findings:

- Off-the-shelf conversion kits demonstrated good driveability, making LPG conversion unnoticeable to the operator.
- Emissions of carbon dioxide (CO<sub>2</sub>) were significantly lower with LPG than with gasoline, but oxides of nitrogen (NO<sub>x</sub>) emissions were higher.
- HC speciation revealed that the reactivity (ground-level ozone-forming potential) of the LPG-fueled engine HC emissions was much lower than that of gasoline emissions. According to the report, "It appears that LPG can be one approach to reducing ozone in ...nonattainment areas."
- Most of the problems observed with LPG conversion kits could be overcome with minor hardware and documentation changes. "Perhaps the manufacturers should document a conversion and conduct an FTP emissions test for one example of an engine family for which the kit is intended, before offering it commercially..." the evaluation suggests.

The evaluation's primary author, SwRI's Edward Bass, said the main problems with the conversion kits were insufficient documentation and missing parts.

Because conversion kits may need to be adapted on a vehicle-by-vehicle basis, Bass advises those who perform retrofits to ask kit

manufacturers for a list of vehicles on which their kits have been tested. This will help installers understand how the equipment might perform.

The Institute of Gas Technology is conducting a companion study for compressed natural gas conversion kits. Stewart and Stevenson's GFI conversion kit is being evaluated, as well as another kit manufactured by ANGI. □

## Case Study

### General Services Administration Blazes the AFV Trail

In an effort to accelerate the use of alternative fuel vehicles (AFVs), the General Services Administration (GSA) has gone beyond the requirements of the Alternative Motor Fuels Act and Energy Policy Act by taking an active role in collecting data and resolving unexpected problems. "Our aim is to get AFVs to a point where they are invisible to the drivers," said GSA official Bill Rivers, comparing AFV operations to those of conventional automobiles.

GSA found that on-road vehicle operations are very different from controlled development environments. General Motors (GM) compressed natural gas (CNG) Sierra pickup trucks performed as anticipated under ideal conditions (70°F, 3,600 psi of natural gas, consistent fuel composition). However, field conditions varied significantly; thus, so did vehicle performance.

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### Case Study *(continued from page 4)*

Shortly after receiving the GM Sierra pickups, drivers noticed operational problems: sputtering, rough idling, and surging — symptoms of a fuel system failure. Although GM replaced the injectors, the problems continued.

GSA, along with its customer agencies, took the initiative and organized a meeting attended by all involved parties: GM, PAS (GM's conversion contractor), local GM dealers, fuel suppliers, technicians, and drivers. "Problems are solved when all the players come together to make a solution," said Rivers. "The AFV program highlighted the need for OEM involvement in understanding vehicle development and eliminating problems."

Following investigations that stemmed from the meeting, several modifications were made, including a nickel coating on the fuel injector and the attached platform, which helped resist damages caused by fuel contaminants. In addition, a smaller fuel filter was added to remove finer contaminants. Finally, a computer chip was added to control the rough idle. The entire 600-vehicle fleet was then modified.

Although the fuel injectors were working properly, the drivers

were not satisfied with the 120-130 mile range, 60-70 miles less than expected, caused by varying fuel compression, ambient temperature, and fuel characteristics.

To accommodate the consumers, GSA went back to GM and PAS. An agreement was reached to add an additional tank to 501 pickups, obtaining the desired range. To further improve range, GM plans to offer bi-fueled vehicles in 1994.

In addition to the CNG pickup issues described above, the alcohol fuel vehicles also had initial problems. Most centered on the fuel sensor, which was eventually redesigned. However, a continuing concern is the need for a special, more expensive, oil in these vehicles.

"This is what AMFA is all about," said Department of Energy's Alternative Fuel Utilization Program Manager, John Russell, concerning the vehicle improvements. "It's marvelous that the demonstration fleets are testing the technology, providing feedback, and producing a quality end product for the consumers. And, GSA has done an outstanding job of dealing with displeased customers and issues in the field," Russell said.

In addition, GSA is encouraging

agencies to use alternative fuels by offering a 10% discount on agency accounts. The incentive is granted on an individual vehicle basis. "We understand the inconveniences [of using alternative fuels] and want to recognize the effort of those using them," explained Rivers. If every vehicle used the fuels, GSA would be granting more than \$4 million in reduced fees per year to encourage alternative fuel use.

GSA already has 6,237 AFVs out of 145,000 vehicles. In 1994, DOE will assist GSA in doubling its AFV fleet by providing the incremental costs associated with these vehicles. □

### Drivers Key to Data Collection

*More than 600 of GSA's drivers and several auto dealerships in each of the ten locations are collecting data samples that will eventually be made available through the AFDC.*

*The AFDC staff would like to recognize the additional effort made by these individuals, many of whom are volunteers. According to Ken Kelly, AFDC's Quality Assurance Engineer, "We couldn't do this without them."*

*All data undergo quality assurance to verify their integrity. For example, if for some reason a vehicle has an unusually high fuel economy reading, the AFDC pulls the record. The record is then researched to evaluate whether a refueling record was missed. Once the data are verified, they are then added to the AFDC.*

*The AFDC staff recognizes that the data collection is an added burden to the drivers and dealers and values their cooperation.*



*Federal CNG fleet vehicle*

## Public Interest in AFDC Growing as Data Expansion Progresses

The dramatic expansion of information in the AFDC has been mirrored by increased interest from the public, as evidenced by the growing number of AFDC users. Currently, about 400 individuals from a variety of organizations have sought access to AFDC data; more than 750 have registered for use and received software (see Figure 3).

The purpose of the AFDC is to disseminate and analyze demonstration data on all Alternative Motor Fuels Act projects. By this winter, the AFDC will contain data on:

- More than 800 light-duty vehicles at ten locations running on M85 (85% methanol/15% unleaded gasoline), E85 (85% ethanol/15% gasoline), and compressed natural gas (CNG)
- Nineteen heavy-duty trucks at four locations running on E95 (95% ethanol/5% unleaded gasoline) and CNG

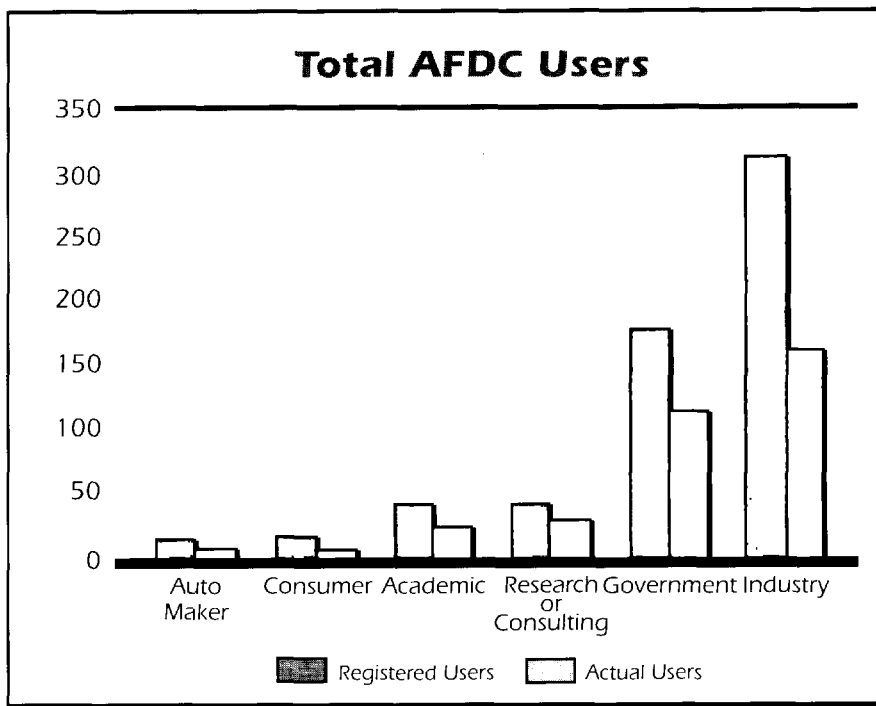


Figure 3. Data on users and amounts of data for each category of collection

■ More than 60 transit buses at various locations running on CNG, liquefied natural gas (LNG), M100 (100% methanol), and E95. Additional data being collected include emissions from 17 vehicles with CNG conversions at Tinker Air Force Base in Oklahoma; 111 "CleanFleet" vehicles being run in a demonstration by Federal Express; and historical data on past

heavy-duty truck alternative fuel demonstrations collected by the American Trucking Association. Data are available electronically from the AFDC or through the National Alternative Fuels Hotline, which to date has answered more than 7,000 requests for information. The hotline staff can help AFDC users with general, as well as software-related, questions. □

**If you are interested in becoming an Alternative Fuels Data Center user,**

please detach, fill out this form, and return to:

AFDC, P.O. Box 12316, Arlington, VA 22209

Phone: 800-423-1DOE Fax: 703-528-1953

Date \_\_\_\_\_

Name \_\_\_\_\_ Company \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Phone \_\_\_\_\_ Fax \_\_\_\_\_

In order to use AFDC/View for Windows, your PC must meet the following minimum specs: 80386 Processor, DOS 3.3, Windows 3.1, 2 MB RAM (4 recommended), Mouse, 1200 baud modem (minimum).

Please send me:  AFDC/View 3-1/2" disk  AFDC/View 5-1/4" disk

## The National Alternative Fuels Hotline frequently receives calls about federal alternative fuels programs. Below are examples of some inquiries.



### Q. What is the Clean Cities Program?

A. The U.S. Department of Energy's (DOE) Clean Cities Program is a voluntary federal program designed to encourage communities to plan the acquisition of alternative fuel vehicles (AFVs), along with refueling and maintenance facilities. By helping local governments and private organizations to form partnerships and develop markets for AFVs, the use of AFVs should accelerate and expand beyond the requirements of the Clean Air Act Amendments of 1990 and the Energy Policy Act of 1992, thereby improving air quality and reducing U.S. dependence on foreign oil. The fuel-neutral program allows for local flexibility, but requires commitment from the stakeholders.

Since the program's beginning, six communities have become "Clean Cities": Atlanta, GA; Denver, CO; Philadelphia, PA; Wilmington, DE; Las Vegas, NV; and Washington, DC. In addition, more than 50 cities have expressed interest in the program.

To get started as a "Clean City," call the Clean Cities Hotline at 800-CCITIES (224-8437). The hotline will provide an overview of

the program, answer questions, and send a Clean Cities Program information kit. Your name will be forwarded to the DOE Regional Office Clean Cities coordinator, who will contact you and tell you more about the program and activity in your area.

### Q. What is the Federal Fleet Conversion Task Force?

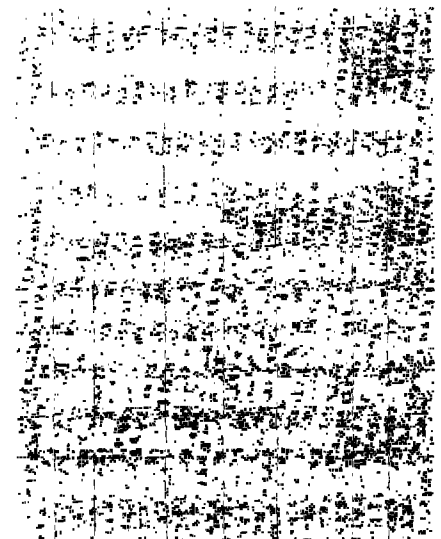
A. The task force was created on April 21, 1993 by the President with the signing of Executive Order 12844, which outlined the administration's commitment to clean fuel alternatives. The task force's mission is to develop and recommend a coordinated plan whereby the public and private sectors accelerate the commercialization and market development of AFVs in the United States.

In mid-October, the task force released its first interim report. The primary recommendation was the establishment of a Presidential Clean Cities Initiative. The initiative will prioritize cities into three tiers to concentrate federal fleet vehicles in FY 1994 through 1996 and has many of the same goals as the DOE Clean Cities Program.

DOE is now preparing a formal response to the recommendations. The Presidential Clean Cities Initiative and the DOE Clean Cities Program may be combined. It is expected that President Clinton's Initiative will provide prioritization of cities and additional publicity, and DOE will implement the combined

The report also makes specific recommendations for overcoming regulatory, economic, and technical barriers that have hindered the general use of AFVs.

Copies of the report should be available shortly through the National Technical Information Service (NTIS) at the the U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161, 703-487-4600. Questions for the Task Force should be directed to DOE at 202-586-3042 or to the Texas General Land Office at 512-463-9989. □



## Meetings and Conferences

**February 3-4:** Natural Gas Vehicles: Speeding Up the Industry, Houston Medallion Hotel, Houston, TX. For information, call the conference department at 713-460-9200, or write to: *Gas Daily*, 13111 Northwest Freeway, Suite 230, Houston, TX 77040.

**February 28-March 3:** 11th International Seminar on Primary & Secondary Battery Technology & Application, Howard Johnson's Ocean Resort & Conference Center, Deerfield Beach, FL. For information, call 407-338-8727, or write: Florida Educational Seminars, Inc., 1900 Glades Road, Suite 358, Boca Raton, FL 33431.

**March 15-17:** APS Solar & Electric 500 Race, Phoenix International Raceway, Phoenix, AZ. For information, contact Mike Shaw at 602-953-6672, or write to: Solar & Electric Racing Association, 11811 N. Tatum, Suite 3031, Phoenix, AZ 85028.

**March 16-17:** Alternative Fuels Refueling Equipment Technical Conference & Trade Show, Twin Towers Hotel & Convention Center, Orlando, FL. For information, call Bob Young at 918-494-9696, or write to: Petroleum Equipment Institute, P.O. Box 2380, Tulsa, OK 74101.

**March 22-24:** World Conference on Refinery Processing and Reformulated Gasolines, La Villita Assembly Hall, San Antonio, TX. For information, call Lori McEwen at 800-872-3835 or 703-528-2500, or write to: Information Resources, Inc., 1925 N. Lynn Street, Suite 1000, Arlington, VA 22209.

**March 23-25:** 5th Annual U.S. Hydrogen Meeting & Exhibition: The Bridge to Sustainable Energy, Hotel Washington, Washington, DC. For information, call

Angela Barbara at 202-223-5547, or write to: National Hydrogen Association, 1800 M Street, N.W., Suite 300, Washington, DC 20036.

**March 27-30:** International ASME Solar Energy Conference, San Francisco, CA. For information, call Cynthia White at 212-705-7793, or write to: American Society of Mechanical Engineers, 345 East 47th Street MS-7H, New York, NY 10017.

**April 11-13:** Renew '94 Conference & Exhibit: The Benefits of Renewable Energy to the Economy and Environment, Sheraton Stamford Hotel, Stamford, CT. For information, call Paul Lipke at 413-774-6051, or write to: Northeast Sustainable Energy Association, 23 Ames Street, Greenfield, MA 01301.

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