

U.S. DEPARTMENT of ENERGY

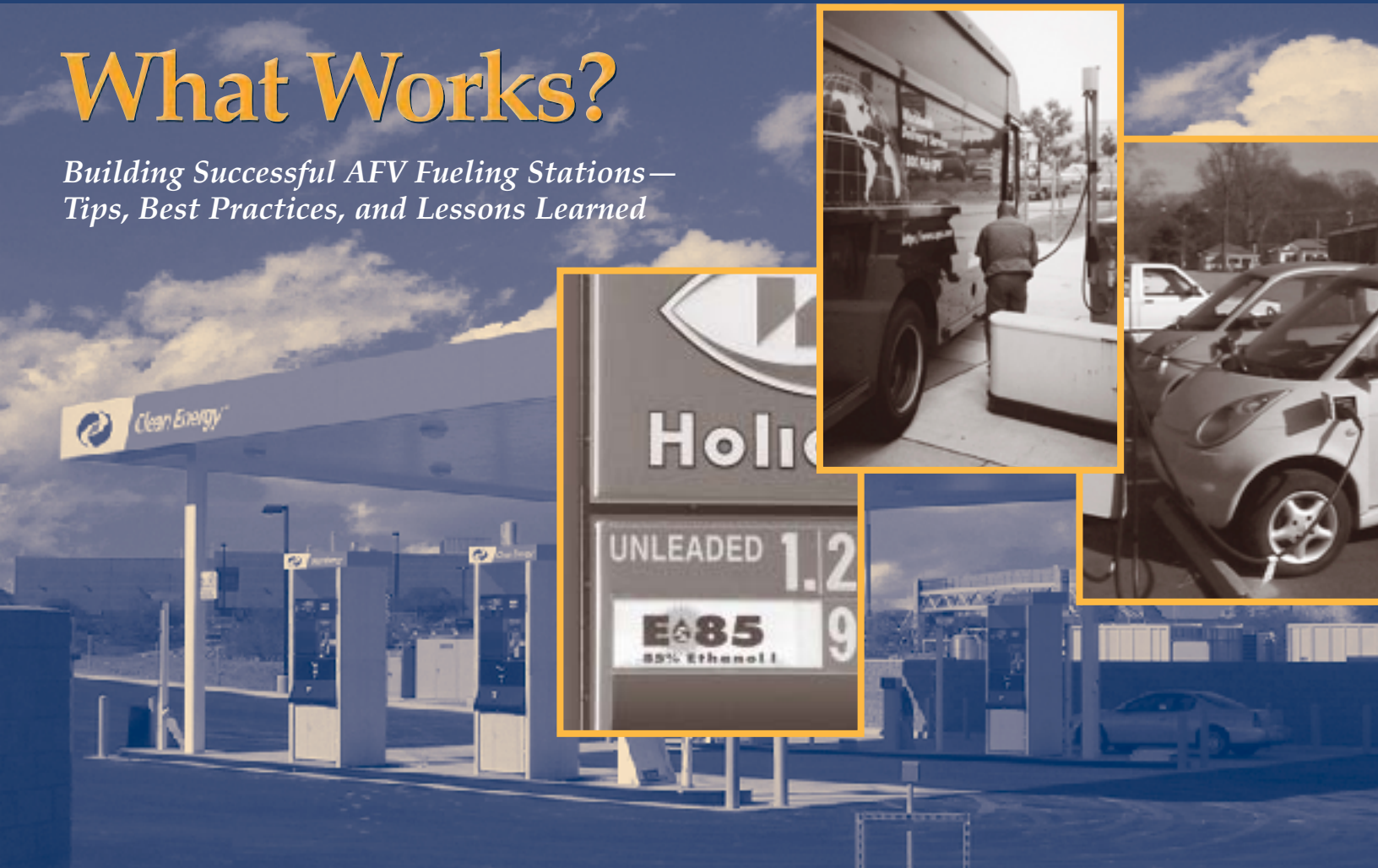
# ALTERNATIVE FUEL NEWS

An Official Publication of the Clean Cities Network and the Alternative Fuels Data Center

From the Office of Energy Efficiency and Renewable Energy

## What Works?

*Building Successful AFV Fueling Stations—  
Tips, Best Practices, and Lessons Learned*



**PLUS:**  
**School Bus Stories**  
**West Coast Ethanol**

**INSIDE:**  
**David Garman**  
**on Hydrogen**



Dear Readers:

Whenever I hear criticism of alternative fuels from advocates of competing fuels, I smile. Reggie Jackson once said, "Fans don't boo nobodies." If they weren't losing market share, our competitors wouldn't care. And with one of every four new transit buses purchased now fueled by natural gas, that's what I call market share.

Alternative fuels are finding homes in high fuel-use fleets, but it hasn't been easy. The challenges you know well—shrinking budgets, spotty support from Congress, and in some segments of the AFV market, diminishing vehicle choices.

Recently we examined nationwide AFV population data from DOE's Energy Information Administration from 1992 to 2000, as well as more recent reports and projections from Clean Cities coordinators. Our objective was to re-examine the program's "million-billion" goals—to put 1 million AFVs on U.S. roads, displacing 1 billion gallons of petroleum fuel annually, by 2010. The initial rationale for those goals, you may recall, was that if AFV growth within Clean Cities continues at 17 percent per year while growth elsewhere stays at its historical rate of 7 percent, we would succeed.

I am proud to report that our progress is on track. Within a narrow margin of error, we've found that the required growth rates have been achieved in recent years.

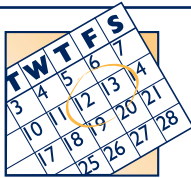
One particularly bright spot is the growth in medium- and heavy-duty trucks. That segment of the market increased by 40 percent in 2001 and 35 percent in 2002. Because they use more fuel, those vehicles may accelerate the development of alternative fuel infrastructure. They can also be instrumental in providing critical services that might be disrupted by petroleum shortages.

Oncoming technologies such as hydrogen fuel cells could make contributions previously unanticipated. Interestingly, the prospects for hydrogen-fueled transportation have been cited as a cause for concern about the future of existing alternative fuels. But hydrogen development could actually stimulate the market for today's fuels. See "Clean Cities and the Hydrogen Future" by DOE Assistant Secretary David Garman, page 8.

In the meantime, we will continue to consider whether our targets make sense. At this point, our answer is a cautious yes. So let's keep moving toward our goals, nibbling away at the gasoline and diesel markets. And let's try to relish the booping as much as we appreciate any applause.

**Shelley Launey, Director**

Clean Cities Program  
U.S. Department of Energy



### Upcoming Conferences and Events

**NGV-CNG Cylinder Inspection and Certification Training**

June 9–10, 2003  
Morgantown, West Virginia  
National Alternative Fuels Training Consortium  
304-293-7882  
<http://naftp.nrcce.wvu.edu>

**IMEAC: The Changing World of Fleet Management**

June 24–26, 2003  
Portland, Oregon  
U.S. General Services Administration  
800-315-4333  
[www.imeac.org](http://www.imeac.org)

**Annual Conference of the American Coalition for Ethanol**

July 30–August 1, 2003  
Sioux Falls, South Dakota  
Contact: ACE  
605-334-3381  
[www.ethanol.org/conference.htm](http://www.ethanol.org/conference.htm)

**2003 Energy Efficiency Exposition and Workshop**

August 17–20, 2003  
Lake Buena Vista, Florida  
U.S. Department of Energy  
410-997-0763  
[www.energy2003.ee.doe.gov](http://www.energy2003.ee.doe.gov)

For more conference and event information, visit [www.cities.doe.gov/events CGI.shtml](http://www.cities.doe.gov/events CGI.shtml)

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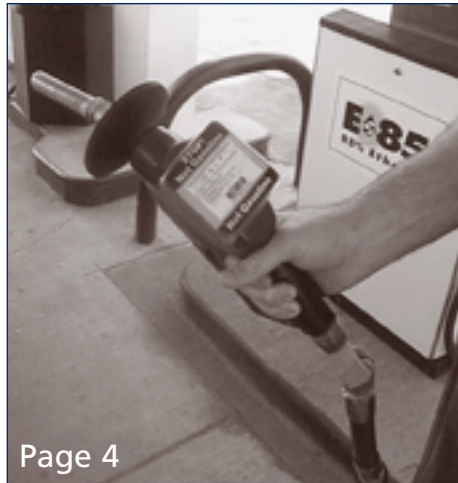
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**On the cover:** The nation's largest supplier of natural gas vehicle fuel has changed its name from ENRG to Clean Energy. This scene was created as a graphic composite by applying the company's new logo to a photo of an existing ENRG location. Inset are photos from Holiday Stationstores, UPS, and Georgia Power.

### Are you getting what you need in the *Alternative Fuel News*?

Would you like to subscribe to AFN, or cancel a subscription? Would you like to receive an email message whenever a new issue is posted online, rather than receiving a print copy by mail? AFN is usually available on the Clean Cities Web site before it's mailed. To view or download our latest issue as well as past issues, please visit [www.afdc.doe.gov/documents/altfuelnews](http://www.afdc.doe.gov/documents/altfuelnews). You can email us at [ccities@nrel.gov](mailto:ccities@nrel.gov), or call 800-CCITIES. We welcome comments and suggestions about the content of AFN.

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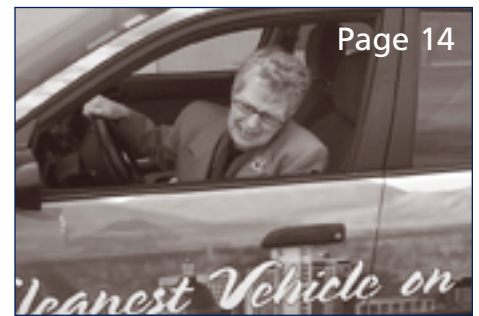
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# What Makes It Work?

## Building Successful AFV Fueling Stations— Tips, Best Practices, and Lessons Learned

*In real estate, the three biggest components of value are said to be “location, location, location.” In establishing an AFV fueling station, the secrets to success are more varied, relating to facility design, planning, marketing, accounting, and staffing.*

*Best practices are the core business of consultants such as Energy International and Marathon Technical Services. Such firms concentrate on the technical aspects of station management. Equally important are lessons learned by companies such as southern California-based Clean Energy (formerly ENRG), which has grown to be the nation’s largest operator of CNG stations; and Clean Fueling Technologies, which makes fuel-dispensing equipment for LPG and E85 stations. Valuable case history comes also from trade associations and individual entrepreneurs. Following is some of their best advice:*



### Find the big fish...

The first task is to identify customers who will use the station. How many vehicles will use it, and what type? Are there alternative fuel fleets in the area? “In the past some people believed ‘if we build it they will come,’ but many speculative CNG stations have failed,” says Rob Adams, vice president of Marathon, which specializes in CNG station design. “If you don’t know who’s going to use the station, you shouldn’t build it.” There should be a base number of quantifiable customers, such as a local fleet of alternative fuel taxis, to get the station started, says Adams.

Clean Energy calls them anchor tenants. Many of its CNG stations are on private land owned by the largest customer. Some are divided by a gate, with public-access fuel dispensers on the outside and private fueling on the inside. Clean Energy operates stations of that kind for SunLine Transit and Waste Management, both in southern California. Nationwide, stations have been anchored by shuttle operators, taxi fleets, and rental car companies. Airports are among the most common locations for successful publicly accessible stations.



Catering to fleets is a time-tested way to help ensure fueling station success.

### ...but don’t forget individual consumers

Relatively few E85 stations were designed that way from the ground up. At most, E85 was added long after the station was established in selling gasoline. Marketing of E85 may be ignored, with signage that mentions only gasoline and diesel fuel. Often E85 is dispensed from aboveground tanks placed far from the main driveway.

“Station operators should definitely have a sign” advertising the presence and the price of E85 along with gasoline, says Tim Gerlach, coordinator of the Clean Cities coalition based in Minnesota’s Twin Cities. This advice applies to any location where gasoline might overshadow the presence of an alternative fuel. Prominent signage is lacking at many CNG and LPG stations as well.

E85 station operators walk a fine line, says Gerlach. They want to sell the product, but only to the right customers—those driving flexible-fuel vehicles (FFVs), which can run on E85, gasoline, or any combination of the two. Drivers of gasoline-only cars are often curious about E85 because of its lower price. To discourage them while appealing to FFV drivers, some stations use nozzle “talkers”—small signs installed directly on the pump dispensing handle, explaining that E85 is for FFVs only.



Nozzle “talkers” inform customers in Minnesota that E85 isn’t for everyone.

PIX 02203

## Match the station's size with today's demand...

Stations should be sized based on present-day alternative fuel demand. Large-capacity CNG stations are costly (as much as \$1 million for light-duty vehicle stations and several million dollars for transit stations), and an underused station does not operate as smoothly as a fully used one. "In the past people building CNG stations said go big or go home," says Mario Pirraglia, vice president of marketing and international sales for FuelMaker. "The reality is if you go big, you may go broke. Stations that were sized based on projected future demand were often underutilized, and many failed."



Sometimes one pump is plenty, particularly in the early stages of operating a station.

A station shouldn't be underequipped either. "Don't skimp on storage," says Adams. "Additional storage improves a station's performance and reliability." Appropriate redundancy can also improve reliability. Several small compressors are better than a single large one, says Pirraglia. This ensures continued operation if one compressor fails.

## ...but leave room to grow

While building for today, it is also important to plan for tomorrow. A station should be able to grow as the demand from fleets and public use grows. "Think in terms of future growth when picking and siting equipment," says Adams. One way to do this is by using modular design. Proper planning and equipment selection enables modular compressors, dispensers, and storage to be added easily.

FuelMaker used this concept when installing CNG stations for the New York Department of Transportation. In 1999, 30 CNG stations were established with single cascade fast-fill CNG units. To meet increasing demand, additional compressors were added to eight of the stations in 2002 and 2003.

In Georgia, the Fulton County Public Works Department initially established two CNG fast-fill stations, each with two compressors. As demand grew, rather than adding more compressors per station, the county added a third station. The result was greater geographic reach as well as increased capacity overall.



New York built 30 CNG stations with an eye on future expansion.

## Ask questions

In and around Atlanta, Georgia Power has installed approximately 50 publicly accessible facilities for charging electric vehicles (EVs). According to Don Francis, the company's EV infrastructure product manager, the question of where to put them has often led to another question: "Where is somebody going where they'll want to stay for a while and be out of their car?" The answer has often included shopping malls, transit stations, airports, and office buildings.

Traditional gasoline stations typically don't double well as EV charging facilities, says Francis. But some BP stations, with the help of Georgia power, have experimented with EV recharging. Several "Plug in the Sun" stations feature grid-connected solar power systems, and EV recharging for motorists who need only to "top off" for another 5 or 10 miles of range. Even that can take 30 minutes, so the stations are equipped with convenience stores, coffee and sandwich shops, and comfortable seating.



Georgia Power/PIX 12501

"Plug in the Sun" stations feed current to EVs and to Atlanta's power grid.

## Hand off the hassles

A substantial federal tax incentive makes E85 cost competitive with gasoline. Whoever blends the fuel—whether it's a refinery, bulk plant, or fueling station—earns a tax credit of about 39 cents per gallon.

But many small stations steer clear of E85, particularly if they have to do the blending themselves. Qualifying for the deduction can be complicated, requiring the proper corporate legal structure and more sophisticated accounting than many stations can afford. Another potential problem for small operators is that a full year's accumulated tax credits don't yield any benefit until tax time.

In the Twin Cities region of Minnesota, some larger suppliers have relieved small stations of the hassles. The Marathon Ashland Petroleum refinery (not related to Marathon Technical Services) is one example. It blends the fuel, claims the tax credit, and passes along savings to its customers. Its efforts are part of a company pilot program to help establish E85 in the Twin Cities region. "If station operators don't want to get into blending E85 on site, I'd suggest they approach a supplier about doing it," says spokesperson Linda Casey.

Such an arrangement with a fuel supplier also removes the physical and logistical hassles of fuel blending onsite. This can be helpful to biodiesel stations as well as E85 facilities.

PIX 12502

## Take all the cards

Customer convenience is key, both in consumer business and fuel sales to fleets. That means accepting payment in as many forms as possible, including credit cards. Clean Fueling Technologies (CFT) makes dispensing equipment for LPG stations. Its pumps include universal card readers, linked by phone to a credit-checking service.

"The reality is, you need to take payment in whatever form the customer wants to give it to you," says CFT president Curtis Donaldson.



Universal credit card readers make things more convenient for customers, says Curtis Donaldson of Clean Fueling Technologies.

and Pacific Gas & Electric, as well as Clean Energy. They also accept Visa and Mastercard, and American Express will soon be added.

Many new dispensers also include video screens, which are often used for advertising. In some areas, customers are required to have training in pump operation. The units first show a 60-second training video, then "unlock" the pump. A two-digit code is issued, enabling the viewer to bypass the training next time.

That reality became clear in southern California, when new state rules required many taxi fleets to switch to CNG. It was good news for station operators such as recently renamed "Clean Energy," but the bad news was that independent taxi drivers as a group represent a high credit risk. The company responded with universal card readers. The units honor cards issued by many CNG suppliers such as FleetStar, SoCalGas,

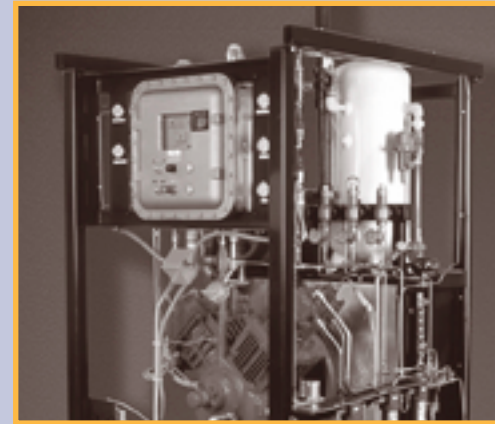
## Take it off the shelf

An alternative fuel station may be around for many years, but an equipment manufacturer may be gone tomorrow. If that happens, a station using proprietary equipment from one manufacturer suddenly finds itself without parts and service support. Even when the proprietary manufacturer stays in business, parts and service are often more readily available for nonproprietary "off-the-shelf" equipment. "We stay away from proprietary hardware when possible," says Adams. "You can't eliminate it, but you can minimize it."

For example, compressor controllers can be proprietary or off-the-shelf. Such

devices monitor temperature and pressure within the compressor; they control the system by starting and stopping the compressor, opening and closing valves, etc. Several large companies manufacture programmable logic controllers (PLCs) that can serve this purpose. PLCs made by these third-party manufacturers are used in a wide variety of industries, so parts and service are widely available.

"If I'm in Cleveland and need a third-party PLC part, I can make a call and have a replacement in an hour, and there are probably a dozen companies that provide service," says Adams. "If I need a proprietary compressor controller part and the single-source supplier doesn't have it, I've got a problem." Valves can also be proprietary or off-the-shelf, whereas most components inside the CNG compressor are proprietary.



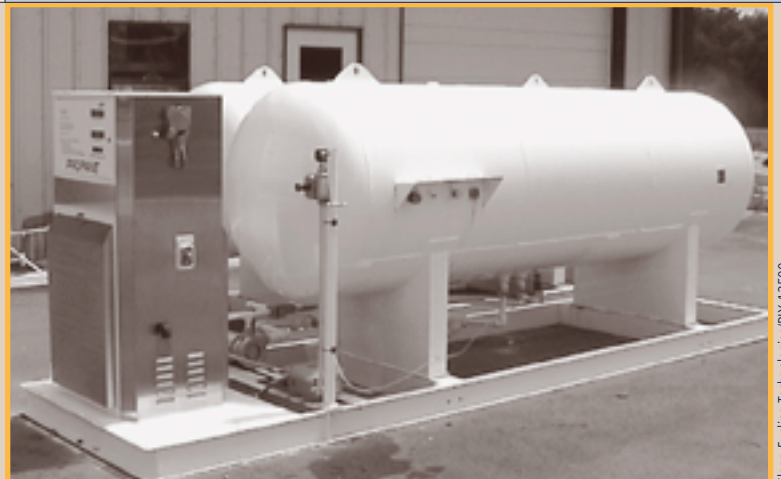
Electronic components can be proprietary or off-the-shelf.

## Take it away

When pressurized in a vehicle, propane (also called LPG or liquefied petroleum gas) is a gaseous fuel. But in its stored form at fueling stations, it is a liquid. It requires less pressurization than CNG, so propane fueling stations are often less costly and less complicated to build.

Propane tanks can be placed aboveground, which brings another potential advantage. An entire functional fueling station—tanks, pumps, and all—can be installed on a movable "skid." In a matter of days, a station can be installed or removed and taken elsewhere. Preparing a site for installation typically takes \$4,000–\$5,000 of preparation work.

One Canadian company exploited the idea of movable skids in the 1980s, in building its own infrastructure. Superior Propane effectively tested locations by installing movable skids onsite. If a site showed promise commercially, the company would then install permanent pumps and tanks and take its movable equipment elsewhere.



On a movable skid, a fully functioning LPG or E85 station can easily be installed, removed, or relocated.

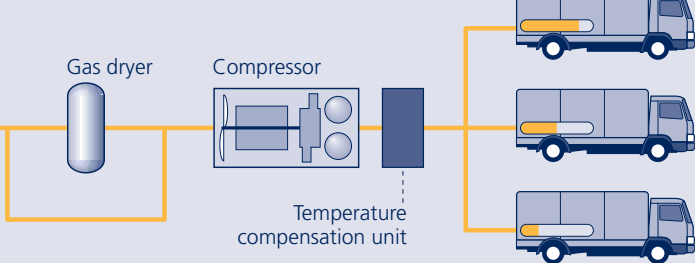
In the United States, the movable site concept is being tried by suppliers of E85, another liquid fuel that can be stored aboveground.

## Select the right sort of CNG station

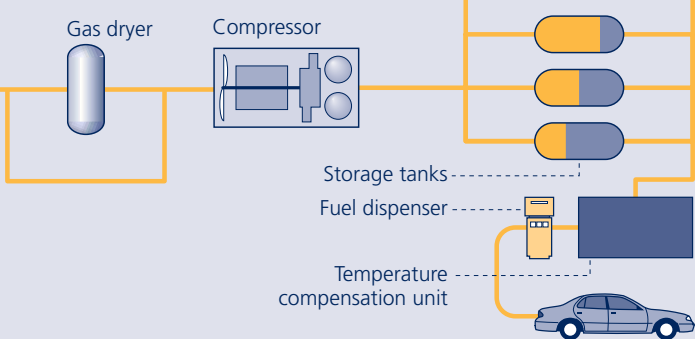
Selecting the right configuration is key to the station's success. According to Energy International, a global energy consulting firm, the main considerations in choosing a station type are the number and type of vehicles fueled and their fueling pattern. Secondary considerations include location, potential future growth, and permitting restrictions. Its CNG Station Guide is available online (see "Natural Gas Resources" below). Energy International outlines four major CNG station types:

**Time-fill** stations fill vehicles over a six- to eight-hour period. Compressors compress natural gas from pipeline pressure (5–100 psi) to the required vehicle pressure (2400–3600 psi) and dispense it into multiple vehicles simultaneously. These stations are best for vehicles such as school buses and utility trucks that return to a central location and can fuel while parked for an extended period. Among all options, they are least expensive to build and staff, requiring no full-time attendant. But extended fueling time is needed because time-fill stations have relatively small compressors and no CNG storage.

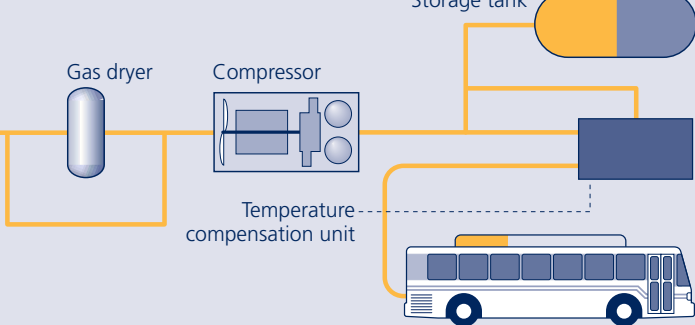
### Time Fill



### Cascade Fast-Fill



### Buffered Fast-Fill



**Cascade fast-fill** stations provide fast and convenient fueling similar to that provided by conventional liquid fuel stations. CNG storage vessels arranged in cascades, or banks, are used to quickly fill vehicles during peak fueling times, when the compressors alone cannot meet demand. During off-peak times, the compressors refill the CNG storage cascades. These stations are suitable for fueling light-duty vehicles at public access stations where use patterns are random. They are also suitable for fueling fleets of light-duty vehicles, such as taxis and police cars, that require a fast fill and have peak fueling periods. Cascade fast-fill stations are not appropriate for continuous, high-volume fueling because the compressors are not large enough to provide a fast fill once the CNG storage has been depleted. Most of the several hundred public access CNG stations in North America use a cascade fast-fill system.

**Buffered fast-fill** stations provide fast, continuous, high-volume fueling. Relatively large compressors run continuously during fueling, filling vehicles and, in the interval between vehicles, a CNG storage buffer. The storage buffer provides CNG to vehicles at the beginning of the fueling cycle and allows the compressor to run for long periods. Unlike CNG storage in cascade fast-fill systems, buffer storage is not separated into separate banks. Buffered fast-fill stations are suitable for quickly fueling large numbers of heavy-duty, high-fuel-capacity vehicles, such as transit buses.

### Vehicle refueling appliances (VRAs)

VRAs are like small time-fill stations, containing a small compressor and other equipment within a single unit. VRAs use natural gas from low-pressure pipelines found in many homes and businesses and require 220-volt, single-phase electricity. They are suitable for fueling individual vehicles over an extended period. Grouping multiple VRAs together and adding a cascade storage system provides small to medium-sized light-duty fleets with fast-fill fueling. VRAs will soon be available for residential installation.



Residential CNG refueling appliances will be available soon, according to FuelMaker and American Honda.

## Infrastructure Resources

**AFDC Infrastructure Section** – New addition to the Alternative Fuels Data Center provides info on equipment and installation, codes and standards, fuel providers, safety, training, success stories, contacts. Link to industry groups such as DOE's Natural Gas Vehicle Technology Forum. [www.afdc.doe.gov/altfuel/infrastructure.html](http://www.afdc.doe.gov/altfuel/infrastructure.html)

**Clean Cities Tiger Teams** – Created to help coalitions overcome AFV and infrastructure challenges, with experts from various technical disciplines. Part of the Clean Cities Technical Assistance Program. [www.cities.doe.gov/tiger.html](http://www.cities.doe.gov/tiger.html)

**CNG Station Guide** – Free online guide helps prospective and existing station owners build and operate efficient and cost-effective facilities. Created by Energy International, sponsored by DOE and the Gas Technology Institute. [www.energyint.com/cng\\_station/index.htm](http://www.energyint.com/cng_station/index.htm)

# CLEAN CITIES AND THE HYDROGEN FUTURE

David K. Garman  
Assistant Secretary  
U.S. Department of Energy



**I**N HIS STATE OF THE UNION ADDRESS in January, President Bush announced that the United States would “lead the world in developing clean, hydrogen-powered automobiles so that the first car driven by a child born today could be powered by hydrogen, and pollution-free.”

Elaborating on his vision for a hydrogen future a few days later, the President noted, “By being bold and innovative... we can change our dependence on foreign sources of energy... Let us promote hydrogen fuel cells as a way to advance into the 21st Century.”

Building on the FreedomCAR initiative announced a year earlier, the President’s Hydrogen Fuel Initiative seeks to develop the technologies we need to free our light-duty cars and trucks of foreign petroleum while we free our cities from the pollution that results from personal transportation. To be successful, these technologies must preserve the freedom of mobility and choice that Americans expect, and be economically successful in the marketplace.

This is a dramatic, game-changing effort to remove the automobile from the environmental equation. Success in this endeavor would be the greatest success that our Clean Cities coalitions could hope for. But the fact that we are engaged in a long-term quest toward a hydrogen economy does not eliminate the need to maintain our efforts to reduce petroleum use in the near term.

In April, the Bush Administration increased corporate average fuel economy (CAFE) standards for light-duty trucks for the first time since the 1996 model year. This increase, covering pickup trucks, vans, and sport utility vehicles in the 2005–2007 model years, constitutes the greatest increase in fuel economy standards in the last 20 years. This new standard alone will save 3.6 billion gallons of gasoline over the lifetime of the trucks involved.

The Administration also proposed tax credits for hybrid vehicles in the President’s National Energy Plan and in the two federal budgets submitted since. We are optimistic that Congress will pass such a tax credit this year as part of a comprehensive energy bill, and we are encouraged that more automakers will be offering hybrid models over the next few model years. We are also supporting language in the comprehensive energy bill establishing a renewable fuels standard projected to more than double ethanol and biodiesel use by 2012.

And of course, we will continue support for our Clean Cities Program—a unique, voluntary approach supporting more than 80 local coalitions that deploy alternative fuel vehicles and promote the supporting infrastructure.

Some have expressed concern that our enthusiasm for hydrogen and its role as a future transportation fuel signals a lack of regard for the alternative fuels of the present. Let me assure you that this is not the case. Natural gas, ethanol, biodiesel, propane, and electricity are important fuels that can clearly lessen our dependence on imported petroleum. The President himself drives an LPG-powered vehicle at his ranch in Texas that we at DOE call “Propane One.” However, these alternative technologies, as important as they are, cannot completely eliminate our dependence on imported petroleum as hydrogen eventually can.

Why do I say that? Hydrogen is the most abundant element on Earth, and it can be derived from a wide variety of feedstocks (including water and biomass) using a variety of methods. This potential diversity of supply is key in helping us to eventually eliminate the use of petroleum in the light-duty transportation sector.

But where will the hydrogen come from? Today, most of our hydrogen—used in a variety of applications from petroleum refining to food processing—is produced from natural gas. Currently, the United States produces an estimated 9 million metric tons of hydrogen annually from natural gas. We estimate that it would take 40 million metric tons of hydrogen annually to power a fleet of 100 million light-duty vehicles. We also expect that much of the hydrogen produced during the early years of hydrogen vehicle use will come from natural gas that is distributed to fueling stations using established infrastructure, and reformed into hydrogen at the station. Several such fueling stations are in place today in the United States, Europe, and Japan.

It is noteworthy that natural gas, an alternative fuel that our Clean Cities Coalition partners are very familiar with, is likely to play a central role in the transition to the hydrogen economy. And the clean air benefits of natural gas are not lost in the conversion to hydrogen.

Compared to a gasoline vehicle, a fuel cell vehicle using compressed hydrogen reformed from natural gas uses 50 percent less energy and emits 60 percent less carbon dioxide from “well to wheels.” Included in that calculation are the energy use needed to extract and distribute natural





*“By being bold and innovative... we can change our dependence on foreign sources of energy... Let us promote hydrogen fuel cells as a way to advance into the 21st Century.”*

— PRESIDENT GEORGE W. BUSH, STATE OF THE UNION ADDRESS, 2003

- We must develop new technologies for storing hydrogen onboard a vehicle to enable range between fueling of better than 300 miles.
- We must develop needed codes and standards. There are more than 40,000 different code jurisdictions in the United States, not to mention the international standards and protocols related to a new hydrogen fueling infrastructure.
- We must continue the progress we have made in associated vehicle technologies such as hybrid drive, lightweight materials, energy storage, and power electronics.

For almost past two years, the Office of Energy Efficiency and Renewable Energy has worked to develop and refine the “technology roadmap” leading to the hydrogen economy. This process has involved industry, academia, and public interest groups. Our eventual success in this effort will not be brought about by the DOE working in isolation. Instead, we will work closely with other federal agencies, industry, and coalitions of stakeholders.

That is where Clean Cities has a vital role. We envision the Clean Cities structure as an important part of the effort to help inform the public about the possibilities offered by hydrogen transportation, and to help accelerate the deployment of this technology when it is ready for the marketplace. As our FreedomCAR and Hydrogen Fuel Initiative efforts grow, and as more hybrid vehicles come into the marketplace, Clean Cities should consider how to position itself to encourage the use of alternative fuels AND hybrid technologies as we make the transition to a hydrogen future, and to help drive that change.

The hydrogen future presents options, benefits, and opportunities that can be dramatic. In his State of the Union address the President spoke of a “child born today” having the chance to drive a practical, affordable, pollution-free vehicle when he is ready to purchase his first car. I am determined that my new son, literally born within hours of the time those words were penned, will have that opportunity. I can think of no greater legacy for the next generation.

*David Garman is DOE’s Assistant Secretary, Energy Efficiency and Renewable Energy (EERE). Within the EERE Office is DOE’s Office of Weatherization and Intergovernmental Program (OWIP), headed by John Millhone. OWIP supports various programs and initiatives including the Alternative Fuels Data Center and the Clean Cities Program, directed by Shelley Launey.*

gas, its conversion to hydrogen, the compression of hydrogen, etc. Carbon dioxide and only trace elements of criteria pollutants would be emitted at the station’s reformer—the vehicles would emit nothing but water.

As the demand for hydrogen grows, centralized hydrogen production will be possible using a wider variety of feedstocks and methods. For example, hydrogen can be produced through the gasification of agricultural residues, the electrolysis of water, or through thermochemical water splitting using high temperature solar or nuclear energy. It is also possible to gasify coal, employing capture and sequestration technologies to avoid emissions of carbon dioxide and pollutants. We want to be able to refine these technologies so that hydrogen production can occur on a zero, near-zero or net-zero basis. We do not intend to taint hydrogen, a clean energy carrier, by producing it using methods that would not significantly reduce air emissions overall.

But formidable technology barriers stand between us and our vision of practical, affordable hydrogen fuel cell transportation:

- We must lower by a factor of 4 the cost of producing and delivering hydrogen from its most affordable source, natural gas.
- The cost of producing hydrogen using other methods is even higher, so we must lower the costs and improve the efficiency of other production-related technologies such as renewable electricity generation, electrolysis, carbon capture and storage, biomass gasification, and photolytics, just to name a few.
- We must lower the cost of fuel cells by a factor of 10.



# Niche Markets

## Fuels for Schools

*The nation's 600,000 school buses represent a huge niche market opportunity for alternative fueling. Perhaps 99 percent of them are currently diesel fueled. But increasingly, CNG, propane, and biodiesel are making the grade.*

*School districts rarely operate fleets regulated by EPA's Act, which applies to state and federal agencies. Often their fueling choices are influenced by local regulating bodies such as California's South Coast Air Quality Management District, which effectively mandates alternative fueling in many school district fleets. Many districts are motivated purely by a desire to reduce emissions and protect the health of the 24 million students who ride buses to school every day in the United States.*

*To help them persuade colleagues to make the switch, Clean Cities is assembling an Alternative Fuel School Bus Resource Kit, to be available on the Web this summer. The kit will include customizable PowerPoint presentations explaining the how and why of alternative fuel school buses; a financial cost comparison of CNG and propane versus diesel; and lists of school bus manufacturers and other industry resources. Also included will be fact sheets providing case studies of successful alternative fuel use. Those stories are excerpted here:*

### CNG Leader

#### *Evansville-Vanderburgh School Corporation, Indiana*

With 100 of its 189 buses running on CNG, the Evansville-Vanderburgh School Corporation is one of the largest natural gas school bus fleets in the country. The buses transport 18,000 students daily and consume 320,000 diesel equivalent gallons of fuel while traveling 1.6 million miles per year.

The corporation began converting to natural gas in 1986 because of the price instability of gasoline and diesel fuel. It invested almost \$250,000 in the project. This investment was repaid in a single year by fuel cost savings. The corporation currently has more than 60 CNG fueling pumps for its natural gas buses. It is also investigating the use of B20 in its diesel buses.

### Savings Add Up

#### *Tulsa Public Schools, Oklahoma*

In 1990, the Oklahoma Department of Commerce asked the Tulsa Public Schools to participate in a two-year pilot program to test the viability of alternative fuels. The district converted 24 school buses to natural gas and continued to convert buses after the pilot period ended, assisted by several bond issues and zero-interest loans from the State of Oklahoma and support from local utility Oklahoma Natural Gas. The fleet continued to grow and now includes 190 dedicated CNG vehicles, including buses, trucks, and cars.

The loans and equipment costs for these vehicles are funded through savings that result from using natural gas rather than gasoline or diesel. The district typically uses the equivalent of 26,000 gallons of gasoline and 29,000 gallons of diesel per month. Overall savings average \$300–\$500 per vehicle per year. The district has made it policy to consider AFVs first when purchasing new vehicles. "The switch to natural gas has saved the district around \$1.6 million if you consider fuel costs, engine longevity, and other matters," says Larry Rodriguez, a vehicle technician at the district. "It has definitely been worth it."

### Biodiesel for the Bluegrass State

#### *Kentucky Schools*

In 2002, as part of a pilot project, the Kentucky Division of Energy provided grants to offset the incremental cost of biodiesel for several school districts. Compared with diesel, the incremental cost of B20 supplied to the schools was about \$0.20 per gallon. The incremental cost of B2, which is 2 percent biodiesel, was about \$0.02 per gallon.

Within four Kentucky school systems, 225 buses use B20 and 100 use B2 (see table). The project will displace approximately 45,000 gallons of diesel fuel, resulting in emission reductions of 150 pounds of particulate matter, 160 pounds of sulfur dioxide, 200 pounds of hydrocarbons, and 1,800 pounds of carbon monoxide, according to the Kentucky Clean Fuels Coalition.

The school systems have been pleased with the biodiesel. Drivers say it has less odor than regular diesel. At least two school systems have indicated they will continue to use biodiesel after the grant funding expires. The pilot project is scheduled to go through October 2003.

School System	Biodiesel Bus Fleet	Biodiesel Mix Used	Total Ridership per Day
Campbell	65	B20	5,000
Kenton	160	B20	13,000
Marshall	50	B2	3,500
McLean	50	B2	3,000

### French Fries to Fuel

#### *Clark County School District, Nevada*

The Clark County School District operates almost all its 1,186 buses on B20, which is a cost-effective way to improve the safety of its 246,000 students, according to district vehicle maintenance coordinator Frank Giordano. "It was our obligation to explore alternatives that would help clean up the exhaust from our diesel engines," says Giordano. "We worked with the engine manufacturer to



More than 24 million students ride buses to school every day in the United States. An Alternative Fuel School Bus Resource Kit will be posted on the Clean Cities Web site.

include its new generation of cleaner burning diesel engines, and got its consent to run them on biodiesel.”

Because the local area lacks a supply of soybeans, the traditional biodiesel feedstock, suppliers turned to one of the area’s plentiful resources: cooking grease from restaurants and casinos. Clark County restaurants produce twice the national average of three gallons of grease per resident per year. A joint venture between Nevada-based Haycock Petroleum and Biodiesel Industries supplies the grease-based biodiesel to the school district.

## **Clean and Quiet**

### *Lower Merion School District, Pennsylvania*

When its community complained about noise and pollution from diesel school buses, the Lower Merion School District responded. The district started to acquire natural gas buses in 1996 and now operates 68 CNG school buses and two Ford Ranger bi-fuel CNG pickups as support vehicles. It also has two fast-fill CNG stations. To date, the buses have logged more than 4 million miles and displaced 850,000 gallons of diesel.

The district has built its fleet and infrastructure through successful applications for alternative fuel grants. It has received funding and technical support from the U.S. Department of Energy, the Pennsylvania Department of Environmental Protection, and PECO Energy. District officials say they would like to convert their entire fleet of 79 school buses and 30 support vehicles to natural gas.

## **Economical and Safe**

### *Northside Independent School District, Texas*

The Northside Independent School District has fueled its school buses and transportation service vehicles with propane since 1980, and now operates 430 propane buses, or 94 percent of its fleet. The buses travel nearly 8 million miles annually.

Northside initially switched to propane because of its relatively low price in Texas. But the district found continuing economic benefits. An analysis showed annual

savings of \$1,100 per bus in fuel and maintenance costs relative to diesel buses, giving a conversion payback time of 1.4 years. In addition, the time between oil changes is extended with propane, and engines using propane have a longer life expectancy.

Safety is another key area where Northside’s propane buses excel. More than 80 million miles have been logged by its propane buses since 1980, with no major incidents resulting from fuel system malfunctions. The district is committed to operating all its vehicles on propane and plans to increase its fleet to 448 propane buses by 2005.

## **100 Percent Propane**

### *Portland Public Schools, Oregon*

Portland Public Schools started using propane buses in 1983 because of concerns about increasing conventional fuel prices and stricter air quality regulations. Today all the district’s 325 buses run on propane, consuming 1.4 million diesel gallon equivalents of fuel while traveling 3.5 million miles per year. Some of the district’s support vehicles use propane as well.

The district owns 85 small Type A school buses—built on cutaway van chassis—which are converted to propane for \$3,000–\$4,000 per vehicle. A contractor serving the district owns 240 larger propane buses, and fuels its buses from propane storage tanks at its site. The district’s buses are fueled by a truck that transports fuel from the contractor’s tanks to school property. This eliminates the need for additional storage.

The propane buses have earned high marks for safety. In a collision with another vehicle, a bus was struck directly in the fuel tank area. The impact sheared the fuel line from the tank, but valves on the tank sealed immediately to contain the fuel. The tank was not ruptured, and no fire or explosion occurred. The buses have also received accolades for drivability, clean emissions, positive public perception, and reduced fuel and maintenance costs.

## **CNG Clears the Air**

### *Hudson City Schools, Ohio*

The Hudson City Schools have used natural gas buses since the early 1980s and are currently operating 14 of their 44 buses on CNG. The proportion of CNG buses is down from 80 percent because of vehicle retirements, but the district is working to return its fleet to being 80 percent alternative fueled.

Using alternative fuel buses is part of the district’s good neighbor policy. CNG buses produce fewer emissions and odors than diesel buses. The odor reduction is especially noticeable when the buses idle at the beginning and end of each school day while waiting for students.

The district owns a private CNG fueling station with slow-fill and fast-fill capabilities. Operating costs for its CNG buses have been roughly equal to the operating costs for its diesel buses.



# At the Pump

## Biofuels in Berkeley

*It's not just from the Midwest any more, as one California fleet adopts home-grown ethanol*

A fleet operated by the Lawrence Berkeley National Laboratory in California includes approximately 35 flexible-fuel vehicles (FFVs) that can run on E85. By this summer, the laboratory will have a way of making sure that they do, when it opens its own E85 fueling station.

The site will include one fuel dispenser and one 4,000-gallon aboveground storage tank. Initially it will dispense about 500 gallons of E85 per month, says site services manager Bill Llewellyn. That figure will double in the next two years as the lab doubles its FFV fleet. "We made the decision to go almost completely to E85 with our AFV fleet," says Llewellyn.

As the operator of a regulated federal fleet, the Berkeley lab considered various ways to go about meeting its mandates. Under EPCA (the Energy Policy Act of 1992), federal fleets must make AFVs a substantial percentage of their vehicle acquisitions. Under Executive Order 13149, regulated fleets have been ordered to reduce their petroleum consumption by 20 percent between 1999 and 2005.

"We ran electric vehicles for years," says Llewellyn. From the U.S. General Services Administration (GSA), the lab leased approximately 20 Ford Ranger pickups and

### Ham and Eggs and E85

AFVs and alternative fueling are often said to be subject to a "chicken-and-egg" problem. What must come first? Are potential vehicle buyers waiting until more fueling stations are established? Or are the fuel suppliers hesitating, hoping to see more vehicles on the road?

In the world of E85, the chicken-and-egg model no longer applies, says Phil Lampert of the National Ethanol Vehicle Coalition (NEVC). "What we have now is a ham-and-egg problem," he says. "The chicken is merely involved; the pig is fully committed."

Fully committed to alternative fueling, he says, are many fleets at the state and federal levels. Such fleets have already bought, or have committed to buy, vehicles in large numbers. The U.S. Department of Defense, for example, has implemented FFVs and other AFVs in most branches of the military. Counting individual motorists, more than 2 million people now drive FFVs, and the number is growing rapidly.

"The vehicles are out there," says Lampert. What must follow are more stations selling E85, and more awareness of the fuel among people whose cars can use it.

### NEVC and GM Launch E85 Campaign

GM and the NEVC have announced a two-year multimillion dollar campaign to increase the use of ethanol in cars and trucks. The campaign will spread the word about E85 through advertising, direct-mail, online activities, and dealer-distributed information.

The promotion effort will begin in six key states: Missouri, Wisconsin, Colorado, Minnesota, Michigan, and Illinois, according to NEVC. "E85 alternative fuel is only beginning to become available in many areas," said Gary Herwick, director of alternative fuels for General Motors. "GM is manufacturing E85-compatible vehicles and we are encouraging industry and consumers to do their parts by continuing to develop the E85 infrastructure, and by using E85."

All 2003 full-size GM sport utility vehicles equipped with the 5.3-liter Vortec engine are E85 capable, including the Chevrolet Tahoe and Suburban and the GMC Yukon and Yukon XL. Also available as FFVs are the Chevrolet Silverado and GMC Sierra full-size pickup trucks. FFVs from other automakers include the Taurus, Explorer, and Ranger from Ford Motor Company, and DaimlerChrysler's Dodge Stratus, Chrysler Sebring, and many minivans.

Chrysler EPIC minivans, all electric powered. But when their leases expired, GSA was unable to continue its arrangement with Ford, and the vehicles were called back. The lab also considered gaseous fuels. CNG was ruled out because the fueling site sits on a hilltop, and extreme pressurization would have been required to pump the fuel uphill. Available LPG-fueled trucks would have been impractical due to cargo carrying incompatibility.

E85 stations are most common in the Midwest, where the corn crop is abundant. On the West Coast, historically they have been extremely rare. But the importance of ethanol is increasing in California, with a coming ban on MTBE as an oxygen-boosting gasoline additive. Ethanol will be its replacement in most cases.

Fuel at the Berkeley site will contain ethanol produced not from corn, but as a by-product of whey at a cheese factory in southern California. (Ethanol from other atypical sources may create new E85 fueling opportunities in the United States. In Hawaii, for example, ethanol producers are following the lead of Brazil, using sugarcane as a feedstock.)

The Berkeley site will accept payment only from GSA-issued fleet credit cards. It will be open to vehicles operated by the DOE office in Oakland, the University of California at Berkeley, and the Lawrence Berkeley National Laboratory. It will not be publicly accessible. Much of the funding for the facility will come from DOE, in the form of an Alternative Fuel Refueling Infrastructure grant in the amount of \$81,361. The lab will contribute approximately \$40,000 to construction of the site.



## From the States

### Made in Maine

#### *L.L.Bean tests biodiesel in its own fleet as it supports propane power in a National Park*

Already a strong voice for Maine’s environment, outdoor clothing and equipment retailer L.L.Bean is becoming one of the state’s alternative fuel leaders. The company is also on the road to becoming a Clean Cities stakeholder.

In April, L.L.Bean began testing biodiesel (B20) in three tractor-trailers that shuttle goods between warehouses in the company’s headquarters of Freeport, Maine. The three

trucks consume about 1,000 gallons of fuel per month. The fuel is supplied by Frontier Energy, based in South China, Maine. Frontier installed a skid-mounted B20 tank and dispenser at one of the warehouses. L.L.Bean is the first major Maine company to test market biodiesel in a distribution fleet according to Frontier.



Company driver Greg Barker fuels up with B20.

Clean Cities assisted L.L.Bean with the biodiesel

project. “We knew about L.L.Bean’s commitment to the environment and encouraged them to explore alternative fuel options,” said Maine Clean Communities (MC<sup>2</sup>) coordinator Steven Linnell. “We helped bring the right people together to get the project started, and we were a resource for alternative fuel information.” L.L.Bean is working on a memorandum of understanding to become a stakeholder in the MC<sup>2</sup> coalition.

“L.L.Bean has a long history of being an advocate for environmental stewardship,” says company spokesperson Rich Donaldson. “We support conservation through corporate giving as well as the promotion of volunteerism.” L.L.Bean has had a corporate recycling program for many years. Employees also recycle regularly as part of their

daily routines, and recycling is increasing each year. “In 2002, L.L.Bean recycled 81 percent of its waste, such as packaging, boxes, and paper,” says Donaldson.

In addition to the environmental benefits of biodiesel, the company chose the fuel because it is renewable and domestically manufactured. There may be economic and operational benefits as well: onsite fueling eliminates the 10-mile trip the trucks had been taking to fuel at a retail diesel station.

L.L.Bean also plans to use propane-powered light-duty service trucks. “We’re excited to be moving forward with these alternative fuel initiatives,” says Donaldson. The company’s efforts may already be having a positive ripple effect. The town of Freeport is considering biodiesel for public works vehicles and school buses and may cooperate with L.L.Bean on fueling infrastructure.

These alternative fuel projects follow the company’s \$1 million donation to Friends of Acadia in support of Acadia National Park’s Island Explorer—a fleet of 17 propane-powered buses that transport passengers during the park’s busiest period, from mid-June through mid-October. L.L.Bean says the buses have cut carbon monoxide emissions in the park by 33 percent.



With substantial support from L.L.Bean, propane-powered Island Explorer buses ease pollution and traffic congestion in Acadia National Park.

L.L.Bean/PX 12498

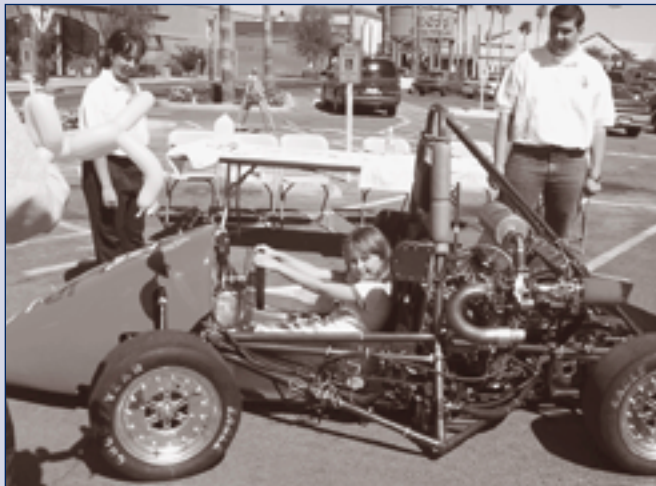
L.L.Bean/PX 12499

## Long Island Extends CMAQ Funding Success

The Greater Long Island Clean Cities Coalition continues to build on its success in securing Congestion Mitigation and Air Quality (CMAQ) funds for alternative fuel projects. A \$1.4 million CMAQ grant has been designated to fund 11 Long Island projects, which the coalition estimates will displace more than 200,000 gallons of petroleum fuels annually.

The projects are diverse, ranging from an electric vehicle charging station for a real estate business to a publicly accessible CNG fueling station at a retail gasoline station. In one unique project, the Centerport Fire Department is obtaining two CNG fire trucks, a CNG ambulance, and an onsite CNG fueling station with a credit card reader.

This recent award brings to more than \$4.5 million in CMAQ funding that the coalition has participated in designing for AFV acquisition and infrastructure development (see related article, *AFN* Vol. 6, No. 3, p. 15).



Tucson Clean Cities Coalition/PX 12497

Tucson residents celebrated alternative fueling at their own AFV Day in March. The Tucson Clean Cities Coalition hosted the event, which was part of the Clean Air Fiesta sponsored by the Pima County Department of Environmental Quality, City of Tucson, and Pima Association of Governments. Showcased were E85, CNG, LPG, biodiesel, and hybrid-electric vehicles. Crowd favorites included biodiesel- and CNG-powered dump trucks and an ethanol race car (shown) built by University of Arizona students. Special emphasis was placed on natural gas to build awareness about the recent opening of Tucson's first public CNG station. Local radio and television stations covered the event, which took place at Tucson's Foothills Mall.



Salt Lake City Clean Cities Coalition/PX 12512

**Sweet sorrow.** Beverly Miller, coordinator of the Salt Lake City Clean Cities Coalition, reluctantly relinquishes her natural gas Honda Civic GX. Miller was named Clean Cities Outstanding Coordinator in 2000, and was later awarded use of the Civic for this honor. The car will go next to 2002 Outstanding Coordinator Tim Gerlach of Minnesota's Twin Cities Clean Cities Coalition. To replace her cherished Civic, Miller hopes to purchase a bi-fuel CNG pickup at a General Services Administration vehicle auction.

## AFV Auction Set for 2003 Conference

Clean Cities and the U.S. General Services Administration (GSA) are collaborating on plans to bring AFVs directly to program stakeholders, with an auction set to occur on May 20 at this year's Clean Cities Conference. Scheduling of the ninth annual conference, May 18–21 in Palm Springs, California, coincided with plans for publication of this issue of *Alternative Fuel News*.

Set to be auctioned are 25 used AFVs including many CNG- and E85-fueled models. Most are from model years 1996–2002 and driven fewer than 50,000 miles. The auction list includes the Ford Contour and Taurus, Dodge Caravan, and Ford and Dodge trucks. Vehicles will be on display in the expo hall throughout the conference. Participants are encouraged to attend the fast-paced auction to bid, buy, or just see how the process works.

GSA holds auctions nationwide as part of its commitment to manage assets, including vehicles for the federal government. More information and an AFV auction calendar are at [www.autoauctions.gsa.gov](http://www.autoauctions.gsa.gov).



# On the Web

## What's New, What's Happening on the AFDC and Clean Cities Sites?

The best thing about the World Wide Web is that it changes every day. And the worst thing about the World Wide Web is that it changes every day. So much new stuff, so little time to keep up. So we decided to show you some of our new and updated pages and remind you of some of the important parts that have been around awhile on the Clean Cities and Alternative Fuels Data Center Web sites.

**NEW**

**Niche Markets.** Tools for marketing AFVs to specialized markets such as transit, airport, and delivery fleets.

### Coordinator Toolbox.

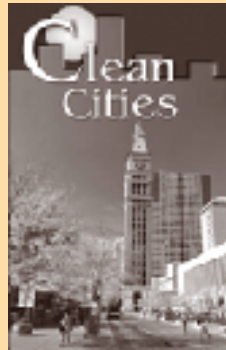
How to work with media, find funding, stage events, etc.

**Support and Funding.** Project funding fundamentals, grant sources, selected opportunities. Technical help from the Tiger Teams.

**Alternative Fuel News.** Articles, news, photos. Download current and back issues in PDF or plain-text HTML format.

### www.ccities.doe.gov

The Clean Cities Web site is the informational nerve center of the program, starting with "What is Clean Cities" and "What's New?" Read success stories, learn about AFVs, and link to other sites, including the AFDC.



**Coalitions, Corridors, Contacts.** Click on any state in the interactive map and zero in on a coalition. Learn about clean corridors and coalitions to come. E-mail addresses can be found at [www.ccities.doe.gov/contact.shtml](http://www.ccities.doe.gov/contact.shtml).

**Vehicle Buyer's Guide.** Sections for fleets and consumers. New cost calculator, light- and heavy-duty vehicle specs, state and federal alternative fuel and hybrid incentives and laws.

**What's New.** Up-to-date news on AFVs, fuels, and the Clean Cities Program. Plus newly added features in our own site.

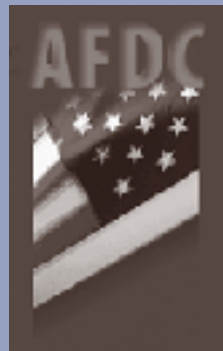
**NEW**

### K-12 Resources.

New under the Resources and Documents link. Alternative fuel activities, events, and teaching material for students and teachers from kindergarten through high school. Visit [www.afdc.doe.gov/educational\\_tools.html](http://www.afdc.doe.gov/educational_tools.html).

### www.afdc.doe.gov

The Alternative Fuels Data Center (AFDC) is a one-stop shop for info on AFVs and other advanced vehicles. Search among 3,000 documents. Submit a detailed info request to Alternative Fuels Hotline, or connect by e-mail. Links to many other government and industry sites.



**Fleet Information.** Does EPA act affect you? Information and regulations based on the Energy Policy Act of 1992.

**NEW**

### Alternative Fuels.

Basic information on alternative fuels, with new sections on hydrogen and alternative fuel infrastructure. Plus a new interactive tool to compare technical characteristics of fuels.

**Document Database Search Tool.** Search for documents by keyword, author, title, or document number at [www.afdc.doe.gov/cgi-bin/doc\\_search/searchora.cgi](http://www.afdc.doe.gov/cgi-bin/doc_search/searchora.cgi).

**Station Locator/Route Mapper.** Search our database for alternative fuel stations nationwide. Street addresses, hours of operation, credit cards accepted, etc. Choose the alternative fuel you want, and plot a route across the country or across town. Complete with driving directions.

Not online? Call 800-CCITIES

## ***New York City and Middle Georgia Join Clean Cities***

The Clean Cities Program officially welcomed two new coalitions in April. The Middle Georgia coalition was designated on April 17 at the Macon Centreplex. About 150 people attended the designation, including U.S. Representative Jim Marshall, Macon Mayor C. Jack Ellis, DOE's Tom Gross, and Major General Donald J. Wetekam, Commander of Robins Air Force Base. "The hydrogen vehicles of the future will certainly reduce our dependency on foreign oil," Gross said. "But, we can take immediate steps to solve the problem of oil dependency *today*, with alternative fuels. Clean Cities coalitions are the pathfinders—they're leading the way."

The New York City coalition was designated on Earth Day, April 22, at City Hall Park. DOE Assistant Secretary David Garman, EPA Administrator Christie Whitman, and New York City Mayor Michael Bloomberg joined about 150 people at the ceremony. "The New York City Clean Cities Coalition has made great progress in promoting the use of alternative fuel and alternative fuel vehicles," Garman said. "Their efforts to increase the use of domestically produced, cleaner burning alternative fuels such as ethanol, natural gas, propane, biodiesel, and electricity are helping to reduce our nation's dependence on imported oil, strengthen energy security, and improve our environment."



New York Clean Cities Coalition/PIX 12494

Mayor Michael Bloomberg speaks at the New York City designation ceremony. Seated next to the podium, from left: Wally Parker, president of Keyspan Energy; Bob Catell, chairman and CEO of Keyspan Energy; David Garman, DOE Assistant Secretary; and Christie Whitman, EPA Administrator.



Middle Georgia Clean Cities Coalition/PIX 12495

Key Clean Cities supporters gather at the Middle Georgia designation ceremony. From left: Calder Clay, representative of Georgia Governor Sonny Perdue; Major General Donald Wetekam, Commander of Robins Air Force Base; C. Jack Ellis, Mayor of Macon, Georgia; Tim Stewart, chairman of the Middle Georgia Clean Cities Coalition; Tom Gross, DOE; and U.S. Representative Jim Marshall.



Middle Georgia Clean Cities Coalition/PIX 12496

U.S. Representative Jim Marshall and Major General Donald Wetekam test drive a GEM neighborhood electric vehicle at the Middle Georgia designation ceremony.