

# Perspectives

A newsletter covering the research, demonstration and education projects of the Iowa Energy Center

## Rise in Gas Prices Brings on New Cars and Policy Changes

The sharp rise in gas prices this spring served as an ideal backdrop for auto companies to unveil their energy efficient and hybrid vehicles. Not surprisingly, a number of federal policy measures and programs were also introduced to address the gasoline shortages.

### Price Rises

Even when the price of crude oil is stable, gasoline prices fluctuate due to factors such as summertime travel and competition among local retail gas stations. Also, gasoline prices can change rapidly when world events or domestic problems (i.e., refinery or pipeline outages) disrupt crude oil supplies.

This spring's gasoline price increase was due in part to OPEC (Organization of Petroleum Exporting Countries) crude oil production cuts. In addition, higher demand from a recovering Asian economy caused more competitive bidding for crude oil supplies on the international market.

Overall, the prices of raw energy (crude oil, gasoline, electricity, natural gas, heating oil) are generally more volatile than prices of other commodities. One reason is that consumers are limited in their ability to substitute one type of energy for another. So, for example, while consumers can easily substitute between food products when relative prices shift, most do not have that option in fueling their cars.

### Hybrid Electric Vehicles

In the past five years, the auto industry has made strides in producing flexible-fueled vehicles like the E85 ethanol-gasoline engines. The new challenge for the auto industry is to produce cars that can use multiple fuel types. A number of gasoline-electric and gasoline-fuel cell hybrid vehicles are emerging in prototype stages. Some have even made it to the general marketplace in the last six months.

*continued on page 4 . . .*

### Story Outline:

- I. Price Rises
- II. Hybrid Electric Vehicles
  - a. Honda
  - b. Toyota
  - c. General Motors
  - d. Ford
  - e. DaimlerChrysler
- III. Policy and Programs
- IV. Research Grants
- V. Presidential Orders
- VI. More Information

### Inside

NFRC Offers Helping Hand 2

New Fuels Market Expanding 2

DDC-Online Debuts 3

What is a Fuel Cell? 6

Revolutionary Energy Plants 8

Up and Coming 9



## NFRC Offers a Helping Hand

The National Fenestration Rating Council (NFRC) offers an array of excellent resources to utilities, municipalities, businesses and other organizations who want to educate the public about the energy performance of windows.

Not only does the NFRC provide brochures that explain the NFRC rating and labeling system and the NFRC energy performance label, but they are also offering to work with organizations and businesses to design a bill insert customized for a company's location, programs and priorities.

Additionally, they can train your staff members who work with both residential and commercial energy issues on the benefits of NFRC and new efficient window technologies.

To gain all of these benefits all you have to do is ask. The key NFRC contact for these services is Vanessa Stoops 202-466-7391, ext. 1129 or nfrcosa@aol.com. NFRC is a non-profit organization that administers a rating and labeling system that provides accurate and reliable energy performance information about windows, doors and skylights.

## New Fuels Market Expanding in Face of Gasoline Hikes

A study from the Business Communications Company (BCC) found that the alternative fuels market could achieve an average annual growth rate (AAGR) of about 2.8 %, which higher than the conventional fuels market's predicted AAGR of 2.7%. The BCC report, titled *New Transportation Fuels: Trends and Development*, says renewable fuels use will increase from 0.502 quadrillion BTUs in 1999 to 0.577 quadrillion BTUs in 2004.

Within the alternative fuels market, the report notes some trends. The first major trend is that the market for methyl tertiary butyl ether (a.k.a. MTBE) is expected to decrease to about one-sixth of its current levels by 2004, while the AAGR for alcohol-based fuels is expected to increase by about 10% over the next five years. Another trend the report found was that the demand for fuels including compressed natural gas, liquefied natural gas, propane, biodiesel and others is expected to grow at about 24% annually over the next five years. Finally, the report notes that automakers are starting to offer more factory-built alternative fuel vehicles.

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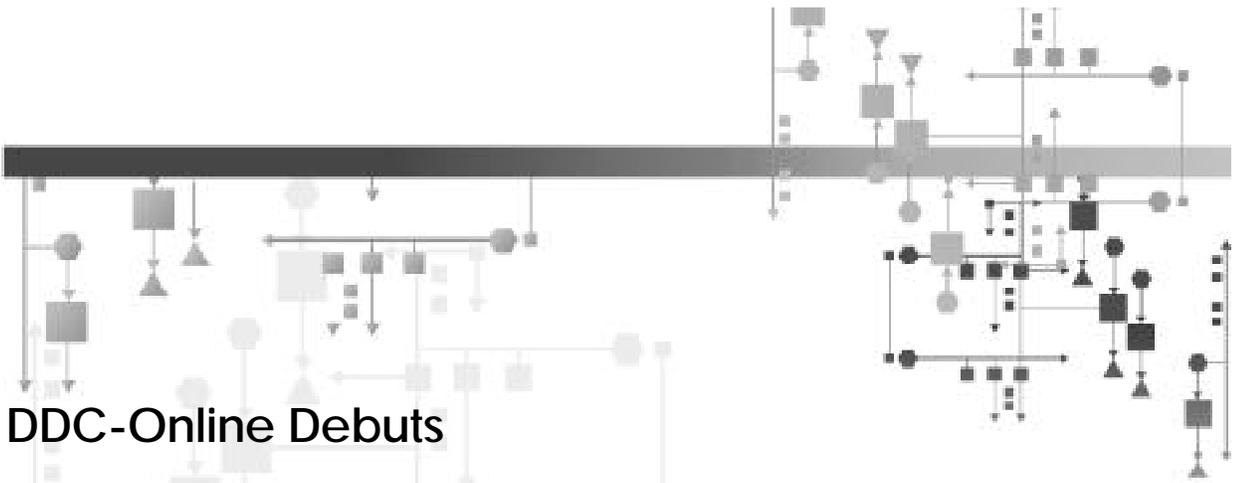
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The Iowa Energy Center was created by the 1990 Iowa Energy Efficiency Act. Its mission is to help Iowans reduce their reliance on imported fuels and nonrenewable resources and to increase efficiency in all areas of energy use. This is accomplished in part through a competitive grants program which sponsors energy efficiency and renewable energy research and demonstration projects.



To be added to the Center's mailing list call 515-294-8819 or e-mail [iecc@energy.iastate.edu](mailto:iecc@energy.iastate.edu).



## DDC-Online Debuts

*DDC Online* is a first in the Internet world.

This site was developed by the Iowa Energy Center to provide the public with the most comprehensive, nonbiased information on Direct Digital Controls (DDC). The highlight of this site is a searchable guide of DDC manufacturers and their products. The web site's address is [www.energy.iastate.edu/DDC\\_online/index.htm](http://www.energy.iastate.edu/DDC_online/index.htm).

The web site successfully debuted at the national ASHRAE meeting in Dallas in February. Many of the first time visitors to the site (several of whom were manufacturer representatives) commented on how this is the most comprehensive listing of national DDC vendors and their products anywhere in the world.

The purpose of this web site is to provide both generic and specific information on DDC systems including:

- a basic introduction to DDC and the terms used in the industry;
- a manual on the input and output processes of DDC systems;
- a detailed listing of DDC system architectures, hardware components and software associated with DDC systems from over 15 national/international vendors.

The specific product information in this site is presented using a generic framework of the various components and configurations used in current DDC systems. This framework provides information on DDC manufacturers in a consistent format so readers can easily compare relative features and benefits.

Due to the complexity and proprietary nature of DDC systems, it has become difficult to stay current with the designs, installations, operation and maintenance

of DDC systems. The manufacturers' guide portion of this web site was developed specifically to help building owners and consulting/specifying engineers deal with this issue.

The general introduction to the world of DDC systems and the detailed manual on input/output DDC processes also helps energy and building professionals come up to speed on this complex field.

The Center has its partners to thank for the success of this web site. Specifically, Facility Dynamics Engineering gathered the data used to develop the site and created a nonbiased framework to present the information. This web site was also funded in part by the U.S. Department of Energy's Office of Building Technology, State and Community Programs through Pacific Northwest National Laboratory.

### New Look, More Information

The Iowa energy Center's web site has undergone a major overhaul including:

- on line publications
- the DDC Online web site
- the Iowa Wind Energy Manual
- updated research summaries
- full downloadable grant and loan information
- energy tips and press releases
- solar and wind energy calculators for Iowa

Check us out soon at: [www.energy.iastate.edu](http://www.energy.iastate.edu)

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## Honda-Insight

### Insight

- gas/electric hybrid
- 1.0 liter, 3-cylinder engine/electric motor
- 2 passenger
- city = 61 mpg  
highway = 70 mpg
- aluminum body
- regenerative braking
- available in the U.S.  
starting price: \$20,000

### Honda

Honda was awarded the first-ever *Sierra Club Award for Excellence in Environmental Engineering* for its hybrid electric vehicle *Insight*. Honda's *Insight* is the first hybrid gasoline-electric car for sale in the U.S.

The two-seater *Insight* couples an efficient 1.0 liter, 3-cylinder engine with an ultra-thin electric motor. The car's aerodynamic body shape is made of lightweight, rigid aluminum – making it 47% lighter than a comparable steel-bodied car. It has a 10.6 gallon gas tank, and its batteries are recharged in-part via regenerative braking. All these factors help the *Insight* achieve a fuel economy of 61 mpg in the city and 70 mpg on the highway. Its starting price is around \$20,000.

Due to limited supply and high demand there are few display models available. As a result, Honda dealers have been taking the *Insight* on a road show-and-tell tour. The *Insight* was the featured attraction at the April meeting of the Iowa Association of Energy Efficiency, held at the Center's Energy Resource Station, in Ankeny. Honda has boosted production of the *Insight* by more than 50% to meet consumer demand for the car.

Honda is also working on a fuel-cell vehicle. The prototype is called *FCX*. This four-door sedan runs on methanol and includes an on-board reformer to generate hydrogen for the fuel cell. The target production date for the *FCX* is 2003.

Honda has also become the leader in developing high-efficiency engines. At a press conference, Honda president Hiroyuki Yoshino unveiled a new 2-liter, 4-cylinder engine. Honda claims this light, compact engine achieves low emissions while boosting efficiency by 10% to 20%. These engines will be for sale in U.S. models next year. By 2005, the new engines will replace all of Honda's 4-cylinder engines.

### Toyota

Toyota is joining Honda by offering its own hybrid electric car for sale this summer in the U.S. Its hybrid gasoline-electric version, called the *Prius*, is a five-passenger sedan that runs on both an all aluminum gasoline engine and an electric motor, achieving an estimated fuel economy rating of 52 miles per gallon in the city and 45 mpg on the highway.



### Prius

- gas/electric hybrid
- aluminum gas engine  
electric motor
- 5 passenger
- city = 52 mpg  
highway = 45 mpg
- available in the U.S.  
summer 2000

### General Motors

*Precept* is the name of GM's hybrid car line. There are both hybrid electric and fuel cell-powered versions of this five-passenger car. The four-wheel drive hybrid electric car uses an electric motor to drive the front wheels and an advanced diesel engine to drive



## GM-Precept

### Precept

- gas/electric hybrid or fuel cell
- diesel engine/electric motor or hydrogen cell
- 5 passenger
- estimated 80 mpg
- market ready by 2003

the rear wheels. GM claims the car should achieve 90 miles to the gallon – the efficiency equivalent of achieving 80 miles per gallon with gasoline.

The fuel-cell version of the *Precept* contains a hydrogen fuel cell. The hydrogen is stored in its chemical form as a metal hydride, rather than as a gas. The car is under development and is expected to be running by the end of this year. Both *Precept* cars are expected to be market ready by 2003.

### Ford Motor Company

The Ford hybrid electric *Prodigy* is also scheduled to be for sale by 2003. This five-passenger sedan uses an advanced four-cylinder diesel engine with an electric motor to provide extra power when needed. According to a Ford press release, *Prodigy* gets 80 miles per gallon.

Ford also announced earlier in the year that it is starting a new automotive brand called *TH!NK*, which will be dedicated exclusively to producing environmentally responsible technologies and transportation. Ford already is selling *TH!NK City*, a two-seater electric vehicle, in Norway. There are plans to being distribution of *TH!NK City* in the U.S. within the next three years.

Another vehicle in the *TH!NK* line, is a prototype unveiled earlier this year called the *TH!NK FC5*. *FC5* is a fuel-cell-powered, four-door sedan. It uses metha-

nol as a fuel and converts it into hydrogen using an on-board reformer. The hydrogen supplies a fuel cell that generates electricity to power an electric drive. The *TH!NK FC5* is expected to be road tested this summer as part of a demonstration project run by the California Fuel Cell Partnership.

Finally, Ford is addressing American's love of the sport utility vehicle (SUV) in their long-range efficiency plans. The company announced in April that it would produce a hybrid-electric sport utility vehicle that will get 40 mpg in the city. The SUV will have a four-cylinder gasoline engine with an electric booster that will perform like an a six-cylinder vehicle. It will also use regenerative braking to recharge its batteries and will shut down the engine when coasting or stopped.

### Prodigy

- diesel/electric hybrid
- 4-cylinder engine/ electric motor
- 5 passenger
- estimated 80 mpg
- market ready by 2003

## Ford-Prodigy



### DaimlerChrysler

DaimlerChrysler is taking a slightly different approach in the development of its hybrid vehicle, choosing to produce a diesel-electric car. Like the other prototypes the *ESX3* is a five-passenger car. It has a three-cylinder diesel engine that works with a motor drive on the front wheels to propel the car. It also uses regenerative braking to charge its lithium-ion batteries. The body of the *ESX3* is also unique in that it is made of injection-molded plastic and is extremely lightweight. The company claims that the

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ESX3 achieves the gasoline equivalent of 72 miles per gallon.

### ESX3

- diesel/electric hybrid
- 3-cylinder diesel engine/motor drive
- regenerative braking
- lithium-ion batteries
- body made of injection-molded plastic
- 5 passenger
- estimated 72 mpg
- market ready by 2003



## Policy and Programs

**Public-Private Actions** - All three of the American motor companies' hybrid cars were developed as part of a public-private partnership called the Partnership for a New Generation of Vehicles (PNGV).

PNGV is an historic public/private partnership between the U.S. Federal government (led by the Technology Administration at the Department of Commerce, including seven agencies and 19 federal laboratories) and DaimlerChrysler, Ford and General Motors. PNGV's aim is to strengthen America's competitiveness by developing technologies for a new generation of vehicles.

PNGV's long term goal, dubbed the "Supercar" goal, is to develop an environmentally friendly car with up

to triple the fuel efficiency of today's midsize cars – and not sacrifice affordability, performance or safety. The timeline for the Supercar goal is that by 2004 each of the participating automotive companies will have their hybrid prototypes in production. To learn more, visit the PNGV web site at [www.ta.doc.gov/pngv/cover/pngvcover.htm](http://www.ta.doc.gov/pngv/cover/pngvcover.htm).

## Research Grants

The U.S. Department of Energy (DOE) recently awarded funds for three different transportation research endeavors. The first is a five-year research project to develop cleaner and more fuel-efficient trucks, ranging from pickup trucks and sport utility

## What is a Fuel Cell?

A fuel cell is an electrochemical energy conversion device with no moving parts. It combines hydrogen – derived from fuels such as natural gas, propane, methanol or gasoline – and oxygen to produce electric power without combustion.

The chemical reaction is quiet and similar to a battery except that, unlike a battery, the fuel cell never needs to be "recharged" because a continuous supply of hydrogen and oxygen provides its energy. Fuel cells are basically nonpolluting, particularly when compared with more traditional methods of generating electricity.

Most research efforts have focused on using fuel cells in the automotive industry, aerospace and electric utilities. In the past few years, research and testing has also been done on using fuel cell technology in homes and commercial buildings.

vehicles to 18-wheel tractor trailers. With initial DOE funds of \$5 million, the project is expected to total \$30 to \$50 million in a combination of DOE and industry funding. The project will develop hybrid natural gas and electric motor drives for trucks and buses, as well as advanced components to reduce the fuel consumption and emissions from truck diesel engines.

The DOE also awarded \$750,000 to three small businesses and two universities for cost-shared studies on advanced engine coolants and sensors, and sensors and improved materials for batteries and other applications.

The last new DOE project will develop advanced heavy-duty diesel engines for 18-wheel tractor trailers. It also received \$5 million funding that will be matched by industrial partners Caterpillar, Cummins Engine Company and Detroit Diesel Corporation. The research of this public-private group will focus on developing cleaner and more fuel-efficient diesel engines and cutting operating costs for truckers.

## Presidential Orders

President Clinton has also been active in promoting the use of energy efficient transportation among federal organizations. On Earth Day he issued two executive orders. One set a new standard for federal vehicle fleets to reduce their annual petroleum consumption by at least 20% by 2005, relative to 1999 consumption levels. This order suggested reducing fleet sizes and the number of miles driven and increasing the use of alternative fuels and hybrid-electric vehicles.

The second executive order mandates the creation of federal fringe benefit programs for federal employees to defray the costs of using mass transit and vanpools. It established a transit pass program in the D.C. area and a three-year pilot program for all their employees nationwide before the end of this year.

## More Information

There is a vast amount of information on the Internet about hybrid vehicles, gasoline use in the U.S. and

research on energy efficient engines and fuel cells. Each company in this article has a comprehensive web site and they are easily found using most Internet search engines.

The fifth edition of *ABCs of AVFs*, is a great place to start learning about alternative fueled vehicles (AVF). This free publication provides information about AVFs and the uses of alternative fuels. It gives a history of AVFs, including their applications, fuel types and various infrastructures required to support AVFs. Copies are available by calling the California Energy Commission at 916-654-5200 and requesting publication #500-99-013 or by downloading the booklet from CEC's web site at [www.energy.ca.gov/afvs/ABCsintro.html](http://www.energy.ca.gov/afvs/ABCsintro.html).

## New Fuel Credit Bill

Democratic and Republican senators came together to introduce a bill that would give federal tax credits for alternative fuel vehicles (AFVs) to both businesses and individual consumers.

According to Reuters News Service, the bill provides a 50% tax credit on the difference between a gasoline fueled vehicle and one that runs on compressed natural gas, liquefied natural gas, propane, hydrogen or any fuel containing at least 85% methanol by volume. A credit of 10% (up to \$4,250) is included for electric vehicles (EVs) and an even higher credit is available for EVs with at least a 100-mile range and a half-ton or more payload.

The bill also provides a 25 cents-per-gallon-equivalent credit to retailers who sell alternative fuels and a 35% credit to those who buy vehicles that comply with the Clean Air Act's strictest emissions standards.

More information on this bill, as well as an opportunity for public comment, can be found at Vermont Senator Jim Jeffords' web site [www.senate.gov/~jeffords/index.html](http://www.senate.gov/~jeffords/index.html).



## Revolutionary Energy Plants

The U.S. Department of Energy awarded \$29 million for the development of six low-emissions energy plants capable of processing a wide range of fuels and generating multiple forms of energy.

These plants are part of Vision 21, a public-private project. Rather than producing a single product from a single fuel — for example, electricity from coal. Vision 21 plants will be capable of processing a wide range of fuels such as coal, natural gas, biomass or municipal wastes, and generating multiple forms of energy such as electricity, transportation fuels and chemicals.

“Through our Vision 21 program, industry-led design and engineering projects will provide the critical building blocks necessary to turn vision into reality,” said U.S. Secretary of Energy Bill Richardson.

A goal of the Vision 21 program is to alleviate virtually all environmental concerns about the way coal and other fuels are used to generate energy. According to a DOE press release, Vision 21 plants will hopefully be equipped with technologies that convert pollutants, such as sulfur and nitrogen-based gases into commercially valuable commodities, in effect turning pollution into products. Vision 21 technologies could also work to capture greenhouse gases, such as carbon dioxide, and prepare them for permanent storage or recycling

Four of the projects will focus on key technologies for a Vision 21 plant:

- FuelCell Energy, Inc., in Danbury, Connecticut, will begin developing a “hybrid” power system that would combine a fuel cell and gas turbine to generate electricity at ultra-high efficiencies.
- Siemens Westinghouse Power Corporation, in Pittsburgh, Pennsylvania, will

develop a membrane for separating oxygen from air and using it to convert the depleted fuel from a specially modified solid oxide fuel cell into carbon dioxide and steam. The carbon dioxide could then be easily separated for eventual sequestration.

- Eltron Research, Inc., of Boulder, Colorado, will develop a ceramic membrane to separate valuable hydrogen from the gases exiting a coal gasifier for later use in a fuel cell.
- Clean Energy Systems, Inc., in Sacramento, California, will adapt a rocket engine design to burn a clean fuel gas and mix the combustion products with water to produce a hot, high-pressure, steam-saturated gas stream that could power an advanced turbine.

The other two projects will develop advanced methods for designing Vision 21 plants and integrating the key modules using new computer processes:

- National Fuel Cell Research Center, in Irvine, California, will define engineering issues associated with integrating key components and subsystems into Vision 21 plants.
- Fluent, Inc., of Lebanon, New Hampshire, will begin building a “virtual demonstration” system that would give future plant designers a way to model a fully-functional Vision 21 plant on a computer.

In each project, the industrial partner will contribute 20% to 33% of the total project cost. Additional details can be found on the DOE fossil energy web site [www.fe.doe.gov](http://www.fe.doe.gov).

# Up and Coming . . .

## **BioEnergy Development: The Role & Capacities of the State Universities and Land-Grant Colleges**

Hosted By: U.S. Department of Energy, Industries of the Future Program and Iowa State University

When & Where: June 15-16, Ames, Iowa

Focus: This conference will identify new opportunities with the U.S. Department of Energy and its Industries of the Future Program. Participants will learn about bioenergy research and extension programs at Iowa's colleges and universities; building links with DOE and their labs; and new funding opportunities at DOE.

For More Information: Greg Cameron 515-294-8280, [conted@exnet.iastate.edu](mailto:conted@exnet.iastate.edu)

## **Energy 2000**

Hosted By: U.S. Department of Energy's Federal Energy Management Program

When & Where: August 21-23, Pittsburgh, Pennsylvania

Focus: This event is an interactive and informative workshop and trade show for energy professionals in the private and public sector. The event covers the latest energy-related technologies and deregulation issues.

For More Information: [www.energy2000.ee.doe.gov](http://www.energy2000.ee.doe.gov)

## **Boilers: An Operator's Workshop**

Hosted By: National Technology Transfer

When & Where: August 8-10, Des Moines, Iowa

Focus: This operator-oriented program is designed to address the needs of those who are responsible for the operation, safety, maintenance and economics associated with commercial and industrial boilers.

For More Information: 1-800-922-2820

## **Geothermal Heat Pumps in Iowa Schools**

Hosted By: Iowa Heat Pump Association and Iowa Department of Natural Resources

When & Where: July 26 - 27, Iowa Energy Center's Energy Resource Station, Des Moines Area Community College, Ankeny, Iowa

Focus: This conference is designed for school superintendents, board members, chief financial officers, facility directors and maintenance staff. The conference will provide participants with the information, financial justification and contacts to install ground source heat pumps in their schools.

For More Information: Iowa Heat Pump Association 1-800-950-6000

## **ACEEE 2000 Summer Study Program**

Hosted By: American Council for an Energy Efficient Economy

When & Where: August 20-25, Pacific Grove, California

Focus: This annual summer study program is designed for individuals interested in promoting energy efficiency in buildings through innovative technologies, programs and policies.

For More Information: <http://aceee.org> or 302-292-3966

## **Carbon: Exploring the Benefits to Farmers and Society**

Hosted By: Iowa public and private agriculture organizations, U.S. Department of Energy; USDA

When & Where: August 29-31, Des Moines, Iowa

Focus: The conference will present the agricultural perspective on emerging policies and technologies involving carbon management and sequestration; the impacts and benefits of carbon sequestration as it affects agricultural producers, society and the environment.

For More Information: Alice Vinsand, 515-225-1051; [avinsand@aol.com](mailto:avinsand@aol.com)

