

Illustrations by Frank J. Quinones

# ENERGIZING A

SCIENCE, BUSINESS AND GOVERNMENT UNITE



TOW 2025  
ay



By Rafaela Ellis

# ALTERNATIVES

TO FUEL CENTRAL FLORIDA'S ENERGY FUTURE.

»» America circa 2025 won't be much different than America today, at least in one crucial respect: our quality of life will largely depend upon the vehicles, electronics and climate-control systems that help us survive in this high-tech, gotta-get-there-fast environment.

However, the choices we make today about how we'll fuel these future necessities will have a huge impact on the rest of the picture: Will the air choke with smog above the gridlock while, just off exit ramps, cars encircle gas stations, waiting hours to pay hundreds of dollars per tank? Or will the interstate flow with economical hybrids and fuel-cell vehicles — both private and public — while sunshine is captured to cleanly power our homes and businesses?

"The question is, are we willing to make an investment today so we don't have to pay six dollars a gallon in the future for foreign fuel," says James Fenton, director of the Florida Solar

Energy Center (FSEC) at the University of Central Florida. "The technology is there to make the fuel in Florida; it's the cost that holds us back." seek cost-effective photovoltaic panels and hydrogen fuel cells, Progress Energy is testing hydrogen fuel-cell vehicles driven by its energy efficiency counselors performing home and business energy audits, and Gov. Jeb Bush has put the force of his office behind Florida's "Hydrogen Highway," a public-private partnership that recently broke ground in Orlando on the state's first hydrogen fueling station.

"Our greatest need is to ensure enough supply to the state as it continues to grow," says Allan F. Bedwell, deputy secretary for regulatory programs and energy at the Florida Department of Environmental

Protection. "Alternative fuels are going to play an increasingly sizable role." notes that plastic bags actually create less net pollution because "the biggest impact on the environment is that it takes five trucks to haul the same amount of paper bags as [fit into] one truck of plastic bags."

And his point would be?

"You have to look at the total environmental impact of every decision. That's what counts," he says.

Take the humble water heater, for example. Right now, most Floridians use 17 percent of their home electricity, at an average of 10 cents per kilowatt hour, to heat water. Although the cost of heating water with solar-thermal technology is about 8 cents per kwh, few people choose the money-saving option because the price of a solar water heater is currently as much as 10 times that of a traditional gas or electric device.

In the long term, Fenton says, the solar unit actually will save the homeowner money. It also will decrease the amount of imported coal or natural gas used to generate the electricity that powers an electric water heater. And by taking advantage of a native Florida fuel, it also will advance the goal of energy independence for the state, which now must build a new power plant every two years just to keep up with the demand caused by growth.

"To me, the no-brainer is you definitely want to take advantage of the sun," he says. "The bottom line is everybody in Florida ought to have a solar hot water heater on their roof."

Fenton makes the same argument when discussing alternatives to the gasoline-powered automotive engine.

"A hybrid vehicle costs roughly \$5,000 more than a non-hybrid, but it uses less gasoline, so there's a trade-off," he says.

All of which brings Fenton back to his life's work — researching ways to produce and store alternative fuels that can power vehicles, homes and businesses — and, in the process, finding solutions to the prohibitive costs that have steered business, government and consumers away from investing in these technologies.

Using some \$12 million each year in grants, mostly from the federal govern-

**"The question is, are we willing to make an investment today so we don't have to pay six dollars a gallon in the future for foreign fuel. The technology is there to make the fuel in Florida; it's the cost that holds us back."**

— James Fenton, Florida Solar Energy Center

ment. "Alternative fuels are going to play an increasingly sizable role." And already, Central Florida is playing a sizable role in investigating and promoting these essential alternatives.

And so, once again, it comes down to dollars — and sense. We can continue importing foreign oil and building coal-fired power plants, spending billions and damaging our fragile environment in the process, or we can support — through both personal choices and precious dollars — alternative energy sources that will be cheaper, cleaner and more sustainable in the long run.

Ultimately, experts agree, the public will decide which energy scenario our future holds. That's why a coalition of Central Florida research entities, energy companies and governmental agencies is working to make sound choices more obvious. While Fenton and his team

Protection. "Alternative fuels are going to play an increasingly sizable role."

And already, Central Florida is playing a sizable role in investigating and promoting these essential alternatives.

## RENEWABLE RESEARCH

As director of FSEC, Jim Fenton leads research into three alternative energy sources: solar-thermal, photovoltaic and hydrogen fuels. But ask him about this country's search for renewable resources, and he'll give you a story about grocery bags.

"When you go to the grocery store, they ask you, 'Paper or plastic?'" Fenton explains, "and people always have answers."

Although most believe paper bags are better for the environment, Fenton

ment, FSEC's various research arms are mapping a promising energy future. The Center's solar-thermal research arm tests and certifies solar collection systems and provides information on how to use solar-thermal technology to heat water and indoor spaces. FSEC's photovoltaic (PV) researchers use silicon cells to convert sunshine into direct current (DC) electricity — the kind that can power motors and batteries. They're working to develop power conversion equipment that can produce alternating current (AC), which can interconnect to the utility grid and fuel any device that runs on conventional electricity. Its hydrogen fuel cell research has become nationally recognized for advancing hydrogen storage and production techniques. Additionally, its building energy efficiency research program has led to energy code and standards improvements that are saving Florida residents more than \$100 million annually in energy costs.

Fenton says PV technology will be available — and cost effective — in the not-so-distant future, especially as the cost of electricity rises with the price of the fossil fuel used to generate it.

"You're going to find that fossil fuels are going up and up [in price], while photovoltaic costs have been coming down, so the intersection point is much sooner than we thought it would be," he says. "Instead of saying we're going to build coal power plants in the next ten years, maybe we should be putting photovoltaics on our roofs instead."

To hasten that eventuality, FSEC has partnered with Progress Energy and the Department of Environmental Protection to test photovoltaic panels through a program called SunSmart Florida. So far, 29 Florida public schools have been fitted with the roof-top PV cells, and FSEC has placed PV cells on flatbed



trailers that can be moved to supply power to places hit by hurricanes or other power-supply interruptions. Fenton expects the cost of PV panels to decrease enough in the next three to five years that, when coupled with renewable energy credits available to consumers, their price will be almost identical to conventional power systems.

And then there's the Center's hydrogen research, which has generated a lot of buzz and no end of debate. While Fenton admits that affordable, efficient hydrogen power is years away, his 40 research faculty members already have

received eight U.S. patents for hydrogen processes or devices, including a technique for separating oxygen and hydrogen from air, a portable hydrogen generator-fuel cell apparatus, and a method of extracting both hydrogen and carbon from hydrocarbons without producing carbon dioxide.

The nut that remains to be cracked is how to store hydrogen for energy use.

"You can use an internal combustion vehicle and run it off hydrogen, and that wouldn't be much more expensive than what we're doing now," he says. "But we still have a storage problem."

The amount of hydrogen needed to fuel a car or other device requires either a huge tank, he says, or one sturdy enough to hold a load of heavy, pressurized hydrogen.

"Some good things are moving along in that regard," he says, and once again Central Florida is on the cutting edge.

## CORPORATE RESPONSIBILITY

At Progress Energy's Operations Center near Oviedo, hydrogen-powered vehicles are more than the wave of the future; they're a very present reality. Partnering with Ford Motor Company, the petroleum giant BP, and both the Florida Department of Environmental Protection and the federal Department

# Alternative-Energy Primer

The future of fuel lies in three important technologies: photovoltaic (PV) cells, solar-thermal energy conversion, and hydrogen fuel cells.

**Photovoltaic (PV) cells:** These thin silicon panels, mounted on roof tops or on mobile units such as trucks, convert solar energy into direct current electricity by extracting current from light-stimulated electrons. Soon, experts expect such cells to become affordable enough for home use — although consumers will still need conventional electric power for extended time periods when the sun isn't shining.

**Solar-thermal conversion:** Already in wide use, this technology uses the sun's heat — gathered through solar collectors placed on rooftops or other sun-intensive surfaces — to generate hot water for home use or to heat the swimming pool.

**Hydrogen fuel cells:** Inside these fuel cells, hydrogen is split into protons and electrons. The protons pass through a plastic-like membrane that blocks the electrons, which then form an electrical current that travels through a circuit to power motors or other devices.

of Energy, Progress is currently field-testing two hydrogen fuel-cell vehicles and preparing to build a fueling station.

"Orlando was selected as one of three places in the country that would be piloting these vehicles, because Florida is positioned to be a leader in this technology," says John Masiello, Progress Energy's manager of demand-side management and alternative energy strategy. "We were positioned properly because of what we already have here — our universities, colleges and high tech industry — working on hydrogen."

The modified Ford Focus models — only 30 of which have been manufactured worldwide — cost about one million each, an expense shared by Ford and the DOE.

"Research is necessary and comes at an expense," Masiello says, "but it looks promising. We've been talking about fuel cells for many years, but this is the first time I can actually tell you that we have the vehicles."

While he concedes that hydrogen storage, manufacturing and infrastructure costs remain to be conquered, he says, "These are things that we can do. It's just a matter of time, as we continue the research."

Dividends are already being seen at another Progress Energy hydrogen project, a sustainable hydrogen generating facility at Florida's Homosassa Springs State Park. Using electrolysis, PV panels mounted on the park's educational pavilion collect sunlight, which is turned into electrical energy. Hydrogen is then extracted from this energy and run through a fuel cell, which in turn powers the pavilion.

"This may seem circular — using solar energy to make hydrogen to put in a fuel cell to make electricity," Masiello says. "But hydrogen is an energy carrier, so storing hydrogen from solar or other renewables has potential. The project at Homosassa could make hydrogen during off-peak electric time and then use the hydrogen during peak demand periods, thus maximizing existing generation and improving efficiency."

Masiello says the project also has the potential to solve another piece of the hydrogen fuel puzzle: how to process the element from renewable sources rather than fossil fuels.

"Right now, you can reform gas and take hydrogen out of it, but if you're

gen fueling station just as you would pull up to the gas station."

## H2 FLORIDA

Central Florida will get a foretaste of that storied day in late 2006, when the state's first hydrogen energy station

opens near Orlando International Airport.

The project is the cornerstone of Governor Jeb Bush's H2 Florida program, an energy initiative designed to promote hydrogen technology through financial incentives, demonstration projects and market expansion efforts.

"Being able to generate energy from within our state boundaries is important," says Allan Bedwell of the Florida Department of Environmental Protection, a partner in the project. "And making sure the energy we generate is clean is important, because Florida is one of only three states east of the Mississippi that meets federal clean-air standards."

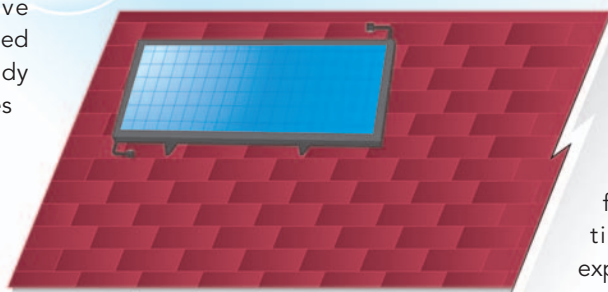
Because hydrogen fuel cells emit only water, not exhaust, using hydrogen to fuel formerly gas-guzzling vehicles can help dramatically reduce air pollution while providing sustainable, renewable energy to increase fuel independence.

The airport hydrogen station — whose funding partners include ChevronTexaco, Ford Motor Company and Progress Energy — will be used to fuel buses that take travelers from the airport to Central Florida's popular hotels and tourist attractions. Concurrent studies will measure the vehicles' costs and efficiency, as well as the costs and production capacity of the hydrogen station itself.

"Ultimately, Florida's fuel supply depends on worldwide supply and demand," says Bedwell. "On the transportation side, we consume over eight billion gallons of gasoline and diesel fuel a year, and that is growing by 300 million gallons a year."

Any measure to reduce those stag-

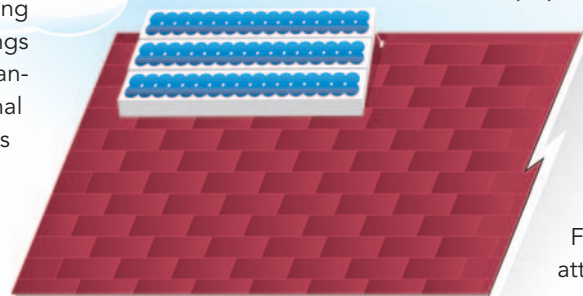
Solar-thermal conversion



using gas to make hydrogen, you're back where you started," he says.

Progress and others are also keeping an eye on alternative energy research, such as converting biomass — that is, plant materials and agricultural waste — into alternative fuels.

Photovoltaic (PV) cell



"There are obstacles to overcome, but it looks promising," Masiello says. "It will take time, but hopefully, the day will come when you pull up to a hydro-

gering numbers must be seized before the oil prices increase as a result of worldwide demand for petroleum, he says.

"I'd say we're about fifteen years from having hydrogen vehicles you can drive off the showroom floor and be affordable," Bedwell says.

When that day comes, he expects the state's new hydrogen fueling station to have competition from other hydrogen stations, many located at the same gas stations that now dispense fossil fuels.

"You'll see gas stations carrying hydrogen in another ten to fifteen years or so," he says, "to where you'll have an effective network of hydrogen stations for everyone to use."

And hydrogen is only one of the alternatives state and local governments and their agencies are exploring. The Central Florida Regional Transit Authority already uses compressed natural gas to run Orlando's free downtown LYNX Lymmo bus service, and the Authority is investigating hybrid, electric and other alternative fuel vehicles

for future bus routes. MV Transportation, which operates buses for Orlando International Airport shuttle service, currently is testing hydrogen fuel vehicles under the H2 Florida program, and the bus system's managers are carefully monitoring the program's progress and potential, says Brian Martin, LYNX's director of media relations.

"We'll study what they learn and how it works for them, to see if it's more difficult or costlier to refuel these vehicles," he says.

Meanwhile, LYNX is pricing out the cost of replacing its aging fleet of company cars, with hybrid vehicles that save gas and, hopefully, taxpayer money.

"There are a lot of options out there," Martin says. "We'll make our decision based on [initial vehicle] price and the cost of maintenance."

## THE POWER OF ONE

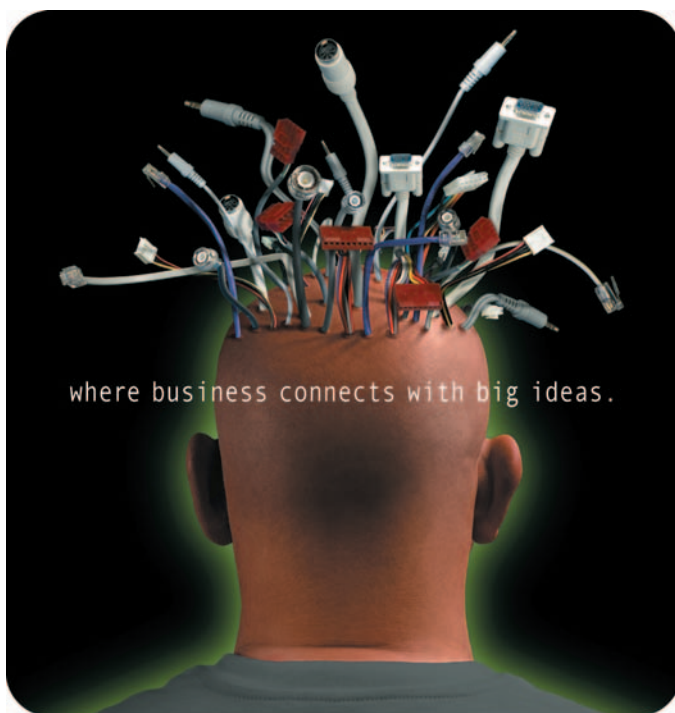
In the end, all parties agree that the most critical factors in our nation's fuel future

are the everyday decisions made by individual consumers. They contend that, while government can reduce regulatory barriers to research and provide consumers with money-saving energy credits, and while corporations and research entities can test experimental fuels and patent new technologies, it's up to each of us to monitor our energy use and to speak up for solutions to the current energy crunch.

"The most important thing people can do is to reach out to the companies that provide them with services and products and let them know that this is important," says the DEP's Bedwell. "They can reach out to their legislators and be active consumers, get educated about these issues, and make decisions about what they think is important."

Those decisions include ponying up for energy alternatives — and urging legislators to do the same.

"By making expensive decisions now," says FSEC's Fenton, "we may solve a lot of other problems later." ❌



where business connects with big ideas.

Technology. Creativity. Innovation. Building not just the world's favorite playground, but a hotbed for technology and business. Throw in a skilled workforce, enviable climate and bustling economy, and you can see why Orlando's turning so many heads.

Putting imagination to work<sup>®</sup>  
ORLANDO

CALL 888.TOP.CITY  
OR VISIT ORLANDOEDC.COM



**The nation's only telehealth company focused on delivering services to persons with autism and other developmental disabilities via interactive video applications:**

*Supported Services:*

- Behavior Analysis
- Special Education
- Psychology
- Psychiatry
- Speech pathology
- Case Management

[www.cnowinc.com](http://www.cnowinc.com)