

# Hydrogen Today

*"Clean Energy For A Better World"*

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## First Hydrogen Fuel Cell Powered Bus — *Marsha Presley*

The world's first hydrogen fuel cell powered transit bus was designed by Ballard Power Systems, inc. in conjunction with Science Applications International Corp. (SAIC). The bus has been traveling the streets of Vancouver completely free of noxious emissions and notably quieter than its diesel-fueled siblings. The bus runs off of 24 five kilowatt (kW) polymer electrolyte Proton Exchange Membrane (PEM) fuel cell stacks. These provide a total 120 kW in power; equivalent to a 160 HP diesel engine. The PEM developed by Ballard is more compact than its predecessors, with about ten times the power density. While the power density of the PEM stack approaches that of the diesel-powered internal combustion engine, trials have shown the Ballard fuel cell powered bus to be up to two times more efficient than its diesel-fueled counterparts. With heat and water as the only by-products, the fuel cell bus easily meets the California Air Resources Board (CARB) requirements of a Zero Emission Vehicle.

The 24 fuel cell stacks are arranged in three 8-stack series strings that are electrically connected in parallel. The fuel cells combine hydrogen with oxygen from the air to produce water and electric power. An electrically driven automotive supercharger combined with a turbocharger supplies air to the fuel cells. The water produced from the fuel cells is collected and circulated by an electrically driven water pump to cool the fuel cells. Heat is removed with the aid of an air cooled radiator. The tailpipe discharges only steam and excess air.

The bus itself was designed with a standard 32 foot long, 22000 lb chassis built by the National Coach Corporation. The fuel cell system is located in the rear. In this initial phase it is slightly heavier than its diesel counterpart. To accommodate the larger weight the passenger capacity was reduced to 20. A small auxiliary lead-acid battery pack, analogous to the starter battery for an internal combustion engine, supplies the power for engine start-up and a 12 V control system. This battery is re-charged from the fuel cells. The hydrogen is compressed and stored in nine fiberglass-wound

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## NATIONWIDE WIND POWER PROGRAM

### Utilities Selected for Testing Program

— *Deborah Clark EPRI; Ron Loose, DOE.*

Palo Alto, CA — Nov. 1993 — The Electric Power Research Institute (EPRI) and the U.S. Department of Energy (DOE) selected three utilities as hosts for a nationwide wind power plant testing program to evaluate advanced wind turbine technology over the next five years. The new technology should make wind power competitive with electricity derived from fossil fuels in many parts of the U.S.

The utilities selected for the first phase of the \$40 million program are Green

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# Hydrogen Industry . . . .

## A Reliable Hydrogen Supply For The Southeastern U.S.

### Praxair And Olin Sign Agreements For Hydrogen Project

— Victoria Petrock and Alec Houston


DANBURY, Conn., December 8, 1993 — Praxair, Inc and Olin Corporation announced today they have finalized an agreement that will bring a flexible and reliable hydrogen supply to the southeastern United States.

At a ceremony in McIntosh, Ala., Praxair and Olin officials signed final contracts for Praxair to build and operate a 29 ton-per day liquid hydrogen production facility on the site of Olin's chlor/alkalai plant in McIntosh, Ala. The \$40 million project is scheduled to start up in the fourth quarter of 1994.

Representatives from the two companies also completed agreements with state and local officials and the Industrial Development Board of the Town of McIntosh to obtain economic development and site development incentives for the project, which was announced earlier this year.

"This plant will enable us to better meet the needs of our customers in the South and bring new supply and new applications technology to the tight hydrogen market," said Praxair President Edgar G. Hotard. Hotard also added that the Praxair plant,

which will refine and liquefy by-product hydrogen produced by Olin, is a good fit with Olin's operation. "While this project brings new value to both companies, our customers will be the principal winners," he said.

"This project strengthens an important strategic alliance between our two companies and it further enhances the competitive position of one of Olin's key chlor/alkalai facilities," said Leon B. Anziano, Olin Corporation Division President for Chlor/Alkalai products. 

### New EPA Regulation for Hydrogen to Take Effect in February — Margaret Smith, Environmental Services, Inc.

Companies that have hydrogen or 161 other chemicals must comply with new EPA regulation 40 CFR 68 Risk Management Programs for Chemical Accidental Release Prevention. This regulation, currently receiving public comment, is expected to take effect in February of 1994, and will apply to many smaller facilities who have never been regulated by EPA before.

Facilities that have any of these substances onsite in quantities above the regulation's established thresholds will have to comply. The proposed threshold for Hydrogen is 10,000 lbs of chemical hydrogen compounds. Companies will be required to perform many tasks, including documenting the plant's chemical processes and procedures, defining hazards and assessing the likelihood of accidental releases, identifying employee training and equipment modification requirements, developing emergency response plans and coordinating them with state emergency planners and EPA.

The regulation has been covered only briefly here. Additional detailed information is available, including a complete list of the 162 covered chemicals, and a six page EPA Fact Sheet summarizing the regulations. These materials are available free by calling Environmental Services, Inc. at 1(800) 992-7549. A reprint of the entire regulation as published in the Federal Register is also available for \$15.

### The Hydrogen Association

dba The American Hydrogen Association in the United States

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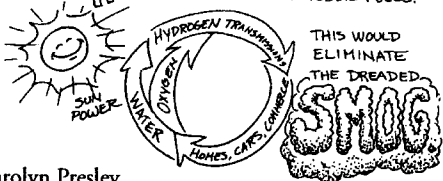
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### DIAL-A-FUEL

The U.S. Department of Energy has established a toll free number hotline giving callers access to data maintained by the National Renewable Energy Laboratory's Alternate Fuels Data Center. The number is:  
**1(800) 423-1363.**

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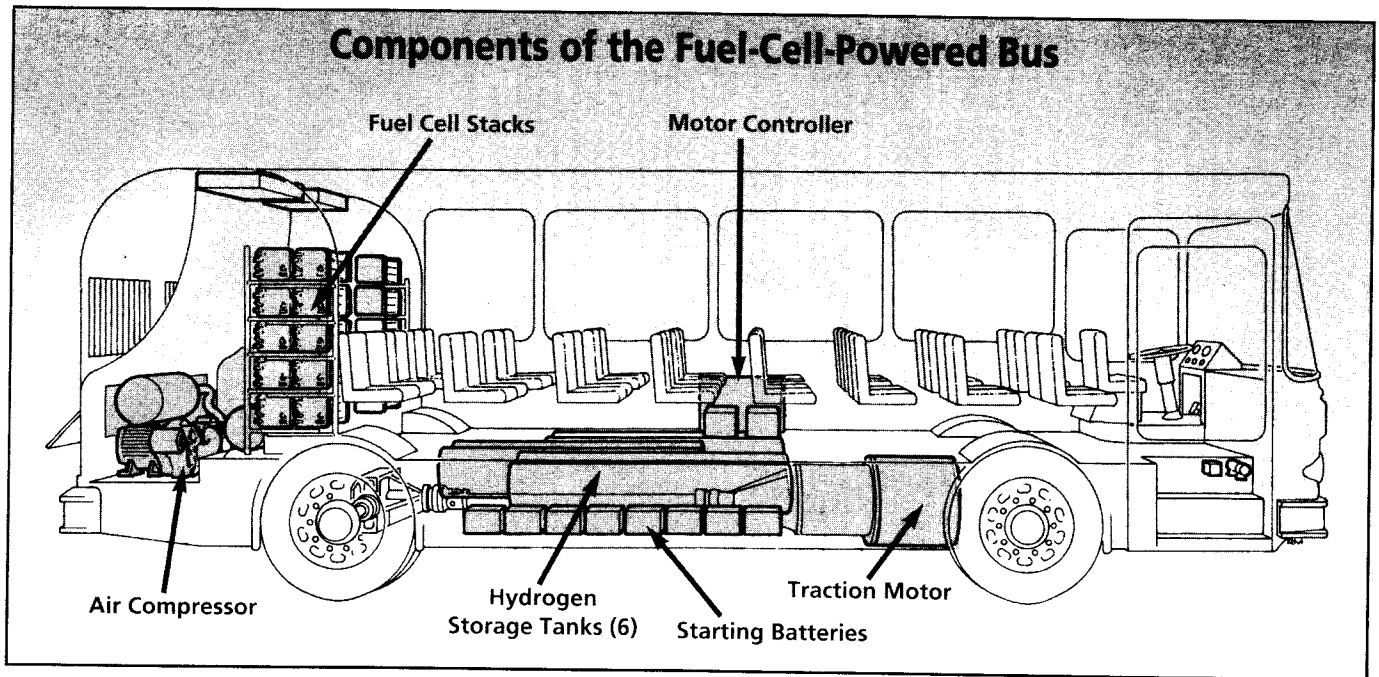
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## First Hydrogen Powered Bus *Continued from page 1*


aluminum cylinders situated under the vehicle. This limits the vehicular range to only about 100 miles. The bus has an on-board gas detector to identify and warn of any hydrogen leaks.

This proof-of-concept bus has been undergoing trial runs in conjunction with BC Transit in Vancouver, British Columbia. The bus was also loaned to UC Davis for display and demonstrations at "Toward a Fuel Cell Future: Planning for the Commercialization of Fuel Cells", a conference hosted by the Institute of Transportation Studies (ITS), University of CA, Davis and the Sacramento Municipal Utility District. Ballard Power Systems, Inc. has also donated a fuel cell stack to the ITS for further research.

The Phase 1 proof-of-concept began development in November 1990 and initial testing was completed in March 1993. With improved technology in both the fuel cells and hydrogen storage, Ballard expects to more than triple the range and the passenger capacity by 1998 when it plans to begin commercialization of the buses. The Phase 2 prototype will use 10 kW fuel cell stacks in conjunction with a 60 kW conventional storage battery that will be recharged by utilizing regenerative braking. The range is expected to reach

175 miles and passenger capacity would increase to 40. Phase 3 will use smaller and lighter 25 kW fuel cell stacks, now under development, together with a 90 kW conventional storage battery. A demonstration fleet will be built with an expected range of 250 km and a capacity of 60 passengers per bus. By Phase 4 — commercialization — hydrogen storage technology is expected to have improved enough to yield a 350 mile range. By storing the fuel-cell and the storage battery beneath the bus chassis, passenger capacity can be increased to 75.

Phase 1 was completed at a cost of 6.3

million Canadian dollars. Besides Ballard and SAIC, this research has been supported by the government of British Columbia; in particular, the Ministry of Energy, Mines and Resources/CANMET and the Ministry of Advanced Education; and the BC Transit Authority. Canada recognizes that hydrogen will become a viable component of the world's transportation network by the turn of the century. The government views the expenditures as an investment designed to put Canada at the forefront of what promises to be a rapidly growing world market. 



*Drs. David Swan and Dan Sperling of U.C. Davis, proudly show off the inner workings of the Ballard Bus.*

# Hydrogen Technology . . . .

## THINK OF BETTER USES FOR CARBON

— by Roy McAlister

Arctic snow cores show that Earth's atmosphere now carries about 30% more carbon dioxide than at any time in the last 160,000 years. Although green plants are greatly stimulated by this increased concentration they have not been able to keep up with the exponential rate that energy intensive human activities add carbon dioxide to the atmosphere.

Increased carbon dioxide in the atmosphere causes solar energy to be trapped in the global air mass. With more energy the atmosphere can evaporate more water from the oceans and cause more damaging floods, hurricanes, and tornadoes.

Burning a gallon of gasoline produces about 20 pounds of CO<sub>2</sub>. An automobile that travels 24,000 miles per year at 20 miles per gallon releases about 24,000 pounds of carbon dioxide from the tail pipe. In other words a 3,000 pound car driven about 65 miles per day and averaging 20 mpg would produce about 8 times its weight in carbon dioxide emissions!


To a great extent, modern food production is conversion of petrocarbons into edibles. This is because fossil fuel is used in farm tractors and other equipment to prepare the seed beds, for cultivation, to harvest, and to dry the crops for storage. Petrochemicals are used for fertilizer, insecticides, herbicides, and crop preservatives. Much more process energy is used along with liberal plastic packaging made from petroleum at the point of converting bulk foods into familiar foods such as bread, cheese, frozen dinners, breakfast food, beer, and all the other marvels at the super market.

As an example it is estimated that two thirds of a cup of oil is required per cup of milk to grow the fodder, milk the cow,

make the roads, refrigerate the milk, truck the milk to the homogenizer/pasteurizer/bottler and deliver the milk in disposable cartons to the refrigerated stands at your grocery store. If our food selections feature highly refined, ready to eat foods, like distilled beverages, precooked and frozen TV dinners, and ice cream it results in releases of about 40,000 pounds of carbon dioxide per person each year. This is over 13 times the weight of the family car!

Most coal, oil, and natural gas fired electricity production cause stack emissions of about 3.5 to 4 pounds of carbon dioxide per kilowatt-hour. A home using 12,000 kilowatt-hours per year would cause the release of about 44,000 pounds of carbon dioxide at the power plant. This amount of carbon dioxide is nearly 15 times the weight of the family car!

Virtually all of these examples could be brought to virtually zero carbon dioxide emissions by replacing fossil energy with hydrogen and recycling used packaging. If the hydrogen is derived from fossil sources the carbon left over can be used to build better highways, bridges, cars, airplanes, golf clubs, and tennis rackets. This is a much more appropriate use of our technological prowess and natural resources than to tempt more record breaking floods, hurricanes, and tornadoes. It will make you healthier, wealthier and happier. And, future generations will thank you for not wasting Earth's precious fossil carbon reserves.

Support AHA's efforts to demonstrate new and better uses of carbon. The atmosphere does not need it and our economy could be greatly stimulated by making products rather than pollution from carbon. 

## New Book Review:

Title of Book: "Paving The Way To Natural Gas Vehicles"

Author: James S. Cannon

Publisher: Inform, Inc. 381 Park Avenue South, New York, NY 10016-8806

The Author: A.B. in Chemistry from Princeton and M.S. in Biochemistry from the University of Pennsylvania

Availability: From the American Hydrogen Association at \$25.00/per copy plus shipping.

"Perhaps the most valuable contribution natural gas can make to this country over the long term is to provide a clean-burning transition to an energy economy ultimately based on totally non-polluting hydrogen."

This quote from "Paving The Way To Natural Gas Vehicles" is found in one of 25 profiles that establish the path for adopting natural gas in the U.S. transportation system.

— Roy E. McAlister

Cannon has arranged the steps in four categories of initiatives which are research and development, commercialization of a refueling infrastructure, government incentives, and removal of institutional barriers.

Cannon's book examines the widespread distribution of natural gas to 95% of the U.S. population and discusses what it will take to replace petroleum with natural gas.

Transition to natural gas is supported by an established infrastructure and numerous interest groups including primary producers, pipeline companies, and natural gas utilities. Roles of these interest groups are illustrated in each of the four categories of initiatives.

Obstacles are clearly identified and suggestions for overcoming these barriers are made.

*Paving the way* is worthwhile reading because it addresses the issues facing transition from the petroleum economy to renewable hydrogen via the natural gas path.

# What Is Being Made From Sewage?

— Sara Gallagher

According to Joep VanDoorn, of the Netherlands Energy Research Foundation in Petten, "Everyone is talking about biomass (plant, vegetable, and other organic matter) as a fuel of the future." But what is this fuel of the future?

It depends on what fence you sit. Texaco Inc. has developed a 30 minute process for pressure cooking sludge into a clean-burning fuel and a source of recycled chemicals. M. Rashid Khan of Texaco's new technology research unit said, "We're able to treat sludge for 30 minutes and accomplish what takes nature millions of years, turning it into a coal-like substance." Texaco believes that a cleaner-burning fuel can be made from plastics and old tires mixed with coal to produce oil that is nearly sulfur-free.

On the other side of the fence are the Dutch. In Amsterdam, Netherlands, the Dutch are in the process of building a 50 million dollar power station to treat 400,000 tons of biomass waste produced each year by the 2 million inhabitants of North Holland. Household waste, agricultural compost, manure, and dried sewage will be converted into a synthetic gas which will be used to fuel turbines to make electricity. Excess heat will be fed back into the system to dry more sewage. What is this synthetic gas and is it good for the environment?

Synthetic gas is an upgrade from medium BTU gas. Methane, hydrogen, and carbon monoxide are the main components of synthetic gas. Economically, the Dutch are doing quite well. It currently costs \$20 a ton to dispose of household compost and \$30 a ton to get rid of tulip bulb wastes. Therefore, by utilizing their waste products to produce energy they will be using a fuel that has a negative cost. Plus, they will never run out of fuel since waste products are produced year round. However, in the long run, Texaco and the Dutch would do better economically and environmentally if they would use their waste products to produce hydrogen. Then they could sell the carbon as a chemical and make even more money from the sewage and protect the environment better.

The Dutch seem to be approaching the standards that the American Hydrogen Association advocates. Oil that is sulfur-free is not a clean burning fuel. Carbon dioxide is one of the most damaging greenhouse gases. The only clean burning renewable fuel is hydrogen. Converting biomass into energy and obtaining valuable chemicals is a superb idea. It is very important to know what the end products are and how they will affect the environment. The American Hydrogen Association encourages everyone to produce hydrogen and carbon products from biomass.

## WIND POWER

*Continued from page 1*

Mountain Power, Vermont., Central and South West Corp., Texas, and Central Maine Power. EPRI and DOE made the selections based on the progress of each utility in its plans for wind power development. Other factors included geographic diversity, differing utility grid conditions, and environmental factors such as extremes in weather conditions.

The new turbines to be tested in the program incorporate improvements including more efficient blades, lighter materials, streamlined designs, and fewer parts for reduced weight and cost.

"This is a major step towards a national effort in accelerating windpower commercialization and its environmental and energy benefits," says Kurt Yeager, EPRI's senior vice president, Technical Operations.


"The EPRI/DOE program represents a significant milestone in utilities' active participation in the development, operation, and evaluation of the latest wind power commercial technology."

"This program can well serve as a model of joint government/industry cooperation," according to Robert San Martin, DOE's acting assistant secretary for Energy Efficiency and Renewable Energy. "By bridging the gap between technology development and full commercialization, it will strengthen utility confidence in wind power as a reliable, cost effective electric supply option. DOE's commitment to this effort reflects our changing priorities, which include increased support for renewable energy technologies."

A primary goal of both DOE and EPRI's overall wind power programs is to assure commercialization of wind power systems capable of delivering

electricity at a competitive cost. Today, most of the nation's 17,000 wind turbines are providing electricity at 7-9 cents/kWh. With continued improvements in the technology and wind power plant operations, this cost is expected to approach 4 cents/kWh for most of the country by the end of this decade.

Spearheaded by EPRI's and DOE's advanced wind turbine developments, utilities are taking advantage of this technology and a recent federally-legislated 1.5 cent/kWh energy production incentive.

A total of 21 other utilities have indicated an interest in the next phase of the program, for which EPRI and DOE plan to select two or more projects for funding in 1994. The objective, similar to the first phase, is to have a minimum of a 6 MW windpower plant with 20 advanced wind turbines at each selected utility site. 

## Drive An Electric Car

— From Southern California Chapter's Newsletter!



Want to know what it would be like to drive a hydrogen powered fuel cell electric vehicle? You may have the chance to drive a car very close to it. General Motors and the nation's leading electric utilities have announced plans to form an industry-government partnership to launch a two-year test drive of electric vehicles by more than 1,000 motorists. Beginning this spring, the GM "PrEView Drive" will allow electric utility company customers in 12 cities to drive GM's two seater "Impact" electric car. For two to four weeks at a time, customers will drive Impacts in real-life situations. They will be required to maintain daily log books of vehicle use and other factors such as the weather. A total of 30 Impacts will be shared nationwide among 12 cities selected to take part in the program. Each city will receive 10 Impacts for six months during the two-year program. Drivers can volunteer for the program by calling a toll free number. In Los Angeles, the first of the 12 locations, those interested in learning more can call 1(800) 467-7384.

## Hydrogen Energy Demo Kit

Well it has finally arrived at the Northern California Silicon Valley Chapter of the American Hydrogen Association. Warsitz Enterprises has delivered a Demo kit of the whole Solar Hydrogen Energy Economy. What AHA has been preaching for years is now available in micro reality. It works just like AHA always said it would.


The micro solar array captures enough sunlight energy to power the micro electrolyzer, producing Hydrogen and Oxygen in little bubbles. The Hydrogen and Oxygen are fed into the micro fuel cell and out comes electricity and water vapor. The electrical output was measured at .9 Volt and 50 plus milliamps, enough to spin the micro motor with its fancy propeller into a blur. Running some of the hydrogen from the electrolyzer into the micro catalyst burner got it hot enough that you couldn't hold your finger on it. The neatest thing about the whole system is that its all transparent so that you can see the Hydrogen and Oxygen bubbles being created and moving through the fuel cell.

This Hydrogen Energy Demo kit makes quickly understandable the process by which sunlight and water can be turned into Hydrogen, and the Hydrogen then turned back into electricity and heat with absolutely

no pollution. It will be wonderful for education and it is a system that even the kids can afford at \$129.50.

The Micro Solar Hydrogen Energy Kit also has display boxes and carrying boxes. The full kit comes with everything needed to hook it up and get all the parts running to display the energy system that even the oil companies now promote as the future fuel...Hydrogen. You can order the system and components for \$129.00 or just the catalog for \$2.00 from the AHA.

The official product launch was at the Fuel cell conference in Sacramento, CA on September 2nd & 3rd, 1993. The conference was called "Toward a Fuel Cell Future" and had all the big names in Hydrogen Energy presenting or attending and some very exciting demonstrations including the Energy Partners Fuel Cell powered Green Car, and the Ballard Energy Systems (Canada) fuel cell powered bus.

The conference was sponsored by UC Davis and was on of the biggest Hydrogen conference for the rest of this year. Lets hope that educators will get a boost by actually having some safe Micro-hardware to demonstrate the Solar Hydrogen Energy Economy in all its non-polluting glory. 


## Arizona Clean Air Act

— Scott Meyer,  
Don't Waste Arizona, Inc.

Under the threat of economic sanctions (loss of highway funds) from the federal government, the Arizona state legislature passed emergency clean air legislation this mid-November, 1993. Primary pollutants targeted were carbon monoxide, ozone, and PMT (particulates). Most of the carbon monoxide and a good deal of the ozone were attributed to gasoline powered cars.

Though far from ideal, the Arizona Clean Air Act breaks ground where other states have failed. Along with a more comprehensive, and more expensive emissions test is subsidies for the poor. Many of those who can least afford a newer, less polluting car or extensive repair are now eligible for a state grant. Only those who receive food stamps are eligible, which leaves about two thirds of the poor out in the cold. It's the thought that counts though.

Even more significant is the funding of mass transit and the mandate for alternative fuels. Expect to see more buses, and buses powered by natural gas. This piece of legislation sets a timetable for conversion of municipal, county, and state fleets, up to ninety percent, by the end of the decade to alternative fuels. An escape clause on costs provides an out if costs rise 10 to 30% above traditional fuels. This shouldn't be a problem for natural gas, for some 700,000 of such vehicles are already on the road. What is important is the government conversion should help provide an infrastructure of fueling depots, thus encouraging the public and the car manufacturers in participating in alternative fuels. Another significant part of this legislation is that individuals and private companies can take a state tax deduction of the cost converting to alternative fuels (up to \$10,000 and \$5,000 per vehicle, respectively.)

With a natural gas infrastructure in place, one half of the hydrogen equation will be in place. Conversion from natural gas to hydrogen will simply be the next logical step. It's suddenly not such a big leap. Consider this latest piece of legislation a big foot in the door for alternative fuels and renewables. 

# Hydrogen Research At UC Davis

— Marsha Presley

The high-wheeled "ordinary" on the official seal of the City of Davis symbolizes this university town's long-standing love affair with the bicycle. Such dedication to alternative energy made the University of California (UC) at Davis a natural focal point for the solar research boom of the 1970's. The legacy of that research can still be found in such places as the city's housing development of "Village Homes". The alignment and design of these houses utilizes passive solar energy concepts. Active solar energy powers at least the water heater in each residence and supplies total energy needs to many of the homes.

It should come as no surprise, then, that UC Davis continues this alternative energy tradition, with the current emphasis on hydrogen, through the Institute of Transportation Studies (ITS) directed by Dr. Daniel Sperling, Dr. Marshall Miller, who also serves half-time with the Union of Concerned Scientists, Dr. Mark DeLuchi, and Dr. David Swan comprise the faculty of this group.

The ITS was formed at UC Davis in 1986 (originally as the Transportation Research Group) and has dealt with a wide range of transportation topics. The emphasis has been on how public policy and individual needs and behaviors affect transportation, transit-related business and fuel preference. Within this framework the benefits and weaknesses of all alternative fuels have been addressed. In publications by Dr. Dan Sperling and Dr. Mark DeLuchi hydrogen stands out as the environmentally preferred fuel.<sup>1,2,5</sup> Dr. DeLuchi particularly has extolled the virtues of hydrogen fuel cells.<sup>3</sup> Dr. Marshall Miller coordinated a conference on hydrogen fuel cells, held in Sacramento, CA last September, that was hosted jointly by the ITS and the Sacramento Municipal Utility District. With the recent arrival of Dr. David Swan<sup>4</sup> from Texas A&M and the establishment of their new fuel cell laboratory, UC Davis can now boast the largest hydrogen fuel cell research group in the country.

Ballard Power Systems, Inc., the developer of a fuel cell powered bus for British Columbia, Canada (see article, this issue), has donated a fuel cell to the ITS for further study. Dr. Swan will spearhead research on the hybridization of the fuel cell with a standard battery.

The activity at the University has helped to increase awareness of hydrogen's potential.


This was demonstrated when California Governor Pete Wilson was asked to submit four proposals to Washington for projects to help regenerate California's flagging defense industry. Two of the four proposals were for expanding research of hydrogen fuel cells. Allied Signal, Aerojet and Lockheed have all expressed interest in hydrogen projects. Representative Vic Faxio (D-CA), who represents the district that includes UC Davis, was one of the nine members of Congress who sponsored the 4th Annual U.S. Hydrogen meeting in march (see article, previous newsletter). This increased awareness is especially important in California, where the state legislature recently passed a law which, beginning in 1998, requires 2% of all new vehicles sold within the state to be emission free. By 2003, 10% of all cars sold by any company with a market share larger than 35,000 cars in California will have to be zero emission vehicles. Other universities and governments would do well to follow California's lead.

<sup>1</sup>Sperling, D. (1988). *New Transportation Fuels: A Strategic Approach to Technological Change*. University of CA Press, Berkeley.

<sup>2</sup>DeLuchi, M.A. (1989). Hydrogen vehicles: An evaluation of fuel storage, performance, safety, environmental impacts, and cost. *Int. J. Hydrogen Energy* 14 (2), 81-130.

<sup>3</sup>DeLuchi, M.A. and J.M. Ogden (1993) Solar-hydrogen fuel-cell vehicles. *Transportation Research A* 27A (3) 255-275.

<sup>4</sup>Swan, D.H. and Appleby (1992) Fuel cells for electric vehicles knowledge gaps and development priorities. *Proc. Urban Electric Vehicle Conf.*, Stockholm, Sweden, may 25 to 27th 1992, Published by the Organization for Economic Co-operation and Development, Paris.

<sup>5</sup>Sperling, D. (1994) Future Drive: Clean Cars and Sustainable Transport. *Island Press*, Washington D.C. 

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## News From AHA

— Kathy McAlister


Starting in February for six weeks, AHA will have its first class on gaseous fuel conversions. The cost is \$250.00 per person. AHA will show you systems for hydrogen, natural gas and other gaseous fueled vehicles. This course is designed for those who are serious about learning how to use alternate fuels. Call AHA at (602) 921-0433 for more information. This course will be repeated as often as interest dictates, so inquire and sign up!

AHA has E-mail access on the Internet (rod@indirect.com) and a bulletin board system (BBS). Howard Smith from the AHA Northern California Chapter met Rod Gallagher in Las Vegas to give AHA National two computers for the bulletin board. Rod is working with Howard Smith to make the hub of the BBS housed here in Tempe. Rod said the two computers donated to AHA will help the chapters become regional BBSs. Thanks Howard and Rod, AHA has joined the computer age!

AHA wants to thank you for the support in 1993. Your membership and renewals have been helpful to our success. The media coverage has been tremendous. Thanks.

AHA's goals for 1994 are:

1. Create Solar-hydrogen Fuel from bio-waste demonstration systems.
2. Helping the automotive and energy industries to adopt clean hydrogen technologies into their business plans and product designs.
3. Starting of the AHA Research & Development Laboratory.
4. Planning of a facility at Arizona State University's research park.

With your help, we can enter the transition to the Hydrogen Economy. 

## New Chapter!

— Dick Peterson

A new chapter of the American Hydrogen Association has been formed in Phoenix, Arizona. The **Hydrogen Mechanical Association**, sponsored in part by Lerner Machine, Inc., a well-known Aerospace component engineering and manufacturing company.

Projects that are currently under development by the Hydrogen Mechanical Association include several types of electrolyzers, parabolic collectors that operate mechanical devices including Stirling engines, the Radax 2-stroke engine, a concept engine fueled with hydrogen, as well as conversion of existing internal combustion engines to hydrogen operation. Chapter members plan to convert their personal cars and trucks to operate on hydrogen produced by electrolyzers.

Also under consideration is a chapter Limousine that will be available for hire. This luxurious car will clean the air as it delivers you in style.

With Lerner Machine's expertise in using the latest processes, technologies and materials for the aerospace industry, the Hydrogen Mechanical Association can now develop products to make, store and use hydrogen as a clean, inexpensive fuel for the home, automobiles and industry.

For further information about this new chapter contact Dick Peterson at (602) 265-9029.

## Silicon Valley Chapter 1993

### Report

— John Gotthold, Secretary

To start the year off, Howard Smith became the SYSOP for the AHASVC Hydrogen bulletin board which is now connected to Internet, Earth Net, Eco Net etc, and tied in all over the Globe. In October Howard traveled to COMDEX in Las Vegas and met Rod Gallagher and Sara from Tempe to donate a dedicated computer. Howard worked with Rod Gallagher on setting up a AHA parent BBS. The two are now tied together, so messages can be input on any BBS, compressed and shipped to Tempe cheaper than they can be mailed. Fantastic work Howard. Hopefully by the end of next year all AHA chapters will be tied together on a Nationwide Hydrogen Net.

Our first activity for March, 1993 was the Santa Clara Automotive Services Show at the Santa Clara Convention Center, where we had a booth and displayed a mock-up of the "Hydrogen Spirit", a small fuel cell/battery commuter car design. Our monthly meeting was held at the show and our message was well received. The audience, of about 5,000 wanted hardware.

The second show was held at Stanford Earth Day in April in a big field on the Stanford campus. We provided space under our tent for Tom Dickerman of The American Association for Fuel Cells, who has turned out to be a staunch ally. The Stanford students were knowledgeable and very curious. About 1,500 people saw our displays.

Earth Day in downtown San Jose, CA at the city center park was well attended. About 5,000 saw our displays. Comment over and over was, "The oil companies won't let you do that!"

The UCLA fuel cell conference started our serious effort of advertising and building more prototypes.

By mid-year, our efforts of working on micro fuel cells turned to building another prototype. We advertised in the Mercury News for investors for the "Hydrogen Spirit", got us in touch with a Race Car development team in San Jose. We are confident in raising \$300,000 in sponsorship money to build a Hydrogen Electric race car and run it across the US for maximum publicity.

At the REDI conference in Willits, CA in June, we displayed our running micro fuel cells and first saw a 20 watt fuel cell from H-Power. A

*Continued Page 11*



## What Happens To Your Estate When You Die?

— Rod Gallagher

What happens to your estate when you die? Many people think that it goes directly to the heirs with possibly a little bit of taxes taken out. It turns out that a much bigger chunk of an estate is removed by the government than many think. It is very possible that the heirs of an estate could end-up with as little as 20% of what it originally was. And if the estate is passed on to grand-children, look-out. The government could take as much as 96% before it even reaches them!

### *What can be done about this?*

The government actually encourages taxpayers to avoid taxes by making generous contributions to charitable or educational organizations. You can get a current tax deduction, avoid capital gains tax, receive a life-time income, and get the benefit of tax-free growth within a contributed estate.

There are several different options, with one of them being the donation of your estate to a charity and your heirs. Very simply, what happens is that an estate is given in a charitable remainder unitrust in exchange for a lifetime income equal to 5% or 10% of the trust assets each year until you die. At that point, the charity gets the estate. If one were to receive this amount for 10 or 20 years, they would receive all of the money they donated back in the form of the lifetime income from the trust.

You also would get a tax deduction for the value of the FUTURE gift to the charity. This deduction can then be used to purchase life insurance for your heirs. In certain cases the life insurance can even go to your heirs without paying any estate taxes! They would already be ahead of the amount that they would have received had the estate been simply handed to them upon the donors death. Plus the donor can receive income of 5-10% of the principal to live on.

There are some qualifications to putting your estate into this kind of program and having the IRS find it acceptable. First and foremost, you must convince the IRS that your primary motive is to help a qualified charitable organization. If they are not convinced of this, then they have the power to deny you the tax benefits. They have this power under the tax laws.

Secondly, there are some restrictions on the tax-payer. They are:

- 1.) The gift must be voluntary.
- 2.) The gift must be a contribution of money or property. No deductions are permitted for a contribution of services.
- 3.) The gift must be to a qualified organization, as defined in the tax law.
- 4.) The value of income received by the donor must not exceed the value of the gift.
- 5.) The gift generally must be made in the same tax year as the deductions. There are some exceptions that apply.
- 6.) Appraisals by "qualified appraisers" are required for most non-cash gifts if the claimed value exceeds \$5,000.
- 7.) The gift must be made by the taxpayer that is claiming the deduction.

What it all boils down to when one is planning their estate is where they would rather see their money go. The choice is to the IRS or to a qualified charity. One can maximize the amount that their heirs would receive by choosing the charity and setting up a trust as has been outlined in this article.

Placing an estate in a trust is not a quick or easy thing to do. Before utilizing a trust, please consult a tax professional for advice. Call the American Hydrogen Association (602) 921-0433 if you are interested in placing your estate in a trust for AHA.

**AHA Tempe BBS**  
**(602) 894-8403**


— by: Rod Gallagher

The main headquarters in Tempe, AZ have added a computer bulletin board system to their operations. It is linked nightly with the BBS that currently operates through the Silicon Valley chapter and will soon be linked with many other bulletin boards as well. We also are exploring the option of connecting the BBS to the internet for exchanging e-mail and discussing hydrogen related topics.

The BBS is mostly devoted to discussion on Renewable Energy type of fields. There currently are 62 different conferences that users can be a part of and range from fuel cells to a solar hydrogen economy. There also are sections for each individual local chapter so that the callers from that area are able to interact with any local business that may be relevant.

Many thanks go out to Howard Smith who donated the computers, modem, and software that was needed to run this system. We are currently looking for sponsors if anyone would like to help out with this project. For as little as \$5 per month you can be a sponsor of this important tool. We also are looking for donations of equipment and people to donate some time.

Our goal is to get a string of bulletin boards around the country that exchange mail. This would allow a great number of people to interact with each other and to keep in contact with what is current in the field through a more local call. We also will be attempting to set up computers that can be used by the public to connect with the bulletin boards so that the public without computers and modems can access the BBS.

The phone number for our new BBS is (602) 894-8403, the settings are 8-N-1. Give us a call and let us know what you think! Call Rod Gallagher with any questions at (602) 921-0433, or Internet rod@indirect.com. 

# Letters . . . .

## Dear Sara & Rod, Kevin, Mike, Tim and Kathy,

Thank you for all your time and expertise on our class trip to the American Hydrogen Assoc. Lab. Your efforts provided hours of enthusiastic discussions among children. They loved seeing the equipment and hearing from real scientist the concepts we have studied in class. All of you are very special people. You have contributed to fostering the love of science, and the pursuit of clean energy uses in children. This love and interest may last a lifetime for many.

With appreciation,

Annette Barnard  
Kyrene de las Lomas School  
4th & 5th Grades

*On October 15, '93, sixty 4th & 5th graders visited AHA. We had five work stations: an informational video defining the problems with answers; electrolyzer station; bioconverter; hydrogen truck; and a scientific experiment. AHA volunteers were impressed with the level of knowledge these students had about hydrogen and renewables. If your school wants to visit AHA, call Rod at 921-0433. AHA may be able to provide a speaker to your school.*

## Silicon Chapter

*Continued from page 8*

good conference organized around the idea of trying to get major funding for alternative energy startup companies.

More work on fuel cells. We made every wrong turn in the book and had to invent a few new ones. Then we decided to make the simplest possible cell and make it out of plastic for see through visibility.

Sixth effort was a run to LA to CALSTART to talk to the RVON Motronics company about their brushless DC, 100 HP electric motor and a further run to Anaheim to talk to Goric Hosepian at Allied Signal about their PEM program. Allied Signal is pouring approximately \$1.5 million per year into trying to develop a fuel cell of fifty KW that weighs under 100 lbs, fills less than a cubic foot, and costs \$300 off the production line. They are reinventing all the components to make it happen.

Seventh effort was attendance at the "Toward a Fuel Cell Future" Conference, sponsored by UC Davis in Sacramento, CA. Three hundred fuel cell folks gathered to talk serious about

what was the beef. We met top people from H-Power, Energy Partners, and Ballard. The real highlight of the show was a ride on the Ballard Hydrogen fuel cell powered bus...Clean and Quiet and Powerful. Nice enough to make one want to actually use public transit. Toured the UC Davis fuel cell lab with Dr. Snow.

Some concepts jelled at that conference so we came back to the lab and built another prototype to complete the parts for our Solar Hydrogen Energy System Experimenters Kit. Just in time, orders were coming in and Warsitz Enterprises shipped the first Kit to an AHA customer on 19 September, 1993.

Two other conferences have rounded out the year. The first NGO (non-governmental) conference in San Francisco was a great break from the technical routine. The Association of World Citizens is the lead group. All NGOs around the world are aiming to make a great deal of noise April to June 1995 for the 50th anniversary of the United Nations and the 25th anniversary of Earth Day. The idea is to add a

## Dear Keith Thomas,

Thank you for writing. I appreciate hearing your views regarding my Administration's energy policy.

To meet the many challenges of the coming century, we must reorder our nation's priorities. My Administration has developed a comprehensive strategy that considers the fact that our energy future, our economic future, and the future of our national security are closely linked. This strategy will help develop renewable energy resources, promote economic growth, and strengthen national security.

I am committed to working for clean, renewable energy sources that cost less and preserve the environment. By transferring research funding from defense to civilian programs, America's powerful research and development capabilities can be reoriented. In this way, America's vast domestic natural gas supplies and our renewable resources can both be developed. These proposals will also help to improve energy efficiency and conservation for individuals, businesses, and governments.


To ensure sustainable, environmentally sound economic growth and to protect our national interests, this comprehensive energy strategy must be implemented. I hope I can count on your support.

Sincerely,  
Bill Clinton  
The White House  
Washington, D.C.



Peoples General Assembly to the UN and have it elected. Then, whatever the UN does the people of the Earth will have a voice in insisting that they make SUSTAINABLE choices to try and save the planet from biological destruction.

So the year ends with some solid progress. The idea of building a Hydrogen car is still aborning because no one can yet supply a fuel cell that works any better than the micros. Reality is that Nafion based PEM cells will put out 50 milliamps per square centimeter sustainable and a really cost effective fuel cell needs to have an output of 1 amp per square centimeter. Major work needs to be done on improved membranes and better storage methods and so far only the Japanese and Germans are making anywhere near the effort required.

This year...1994...efforts will be ongoing to educate the public, build bigger fuel cells, move into Natural Gas (then Hythane) and do whatever else will advance the cause of Hydrogen. 

# Upcoming Events . . .

- January 23-26 -- New Orleans, Louisiana -- Energy Sources Technology Conference, American Society of Mechanical Engineers. Contact: (212) 705-7722.
- January 25-26 -- Dearborn, Michigan -- Second Conference on Electric Vehicles, The Engineering Society of Detroit. Contact: (313) 995-4440.
- February 8; March 8; April 12; May 10th -- Southern California -- Chapter of AHA monthly Meeting, Contact Dick Williams (800) 854-5225. (Second Tuesday of each month)
- February 9th -- Tempe, AZ -- Gaseous Fuel System Conversion. Contact Roy McAlister (602) 921-0433 \$50.00 deposit. Total cost \$250.00 due by February 5, 1994.
- February 16; March 16; April 20; May 18th -- Tempe, AZ -- A.S.U./AHA Chapter monthly meeting 7:00 to 9:00 p.m. Student Service Building, A.S.U. Contact: Kathy (602) 921-0433.
- February 24; March 24; April 28; May 26th -- Tucson Chapter Meeting for this date. (Chapter meetings normally the 4th Thursday of each mth.)
- March 17-20 -- Phoenix, AZ -- Solar & Electric 500, Phoenix, International Raceway, Contact: Holden @ (602) 953-6672.
- March 23-25 -- Washington D.C. -- 5th Annual U.S. Hydrogen Meeting & Exhibition -- "The Bridge To Sustainable Energy", Hotel Washington. Contact: Angela Barbara (202) 223-5547. National Hydrogen Association 1800 M Street N.W. Ste 300, Washington DC 20036
- March 29-31 -- Phoenix, Arizona -- 2nd Annual Utility Photovoltaic Group Meeting - "Electric Utility opportunities in Photovoltaics" - Sheraton San Marcos Hotel. Contact: Angela Barbara, Meeting Coordinator, Utility PhotoVoltaic Group. (202) 857-0898, FAX # (202) 223-5537.
- April 8-10 -- Anaheim, California -- 1994 Alternative Road Rally. Sponsored by The International Elctric Gran Prix Assocation. Contact: (310) 443-9779.
- April 11-13 -- Stamford Conneticut -- RENEW '94, Sheraton Stamford Hotel., Contact: NESEA 413-774-6051

- April 24 -- SUN DAY 1994... do something Green.
- May 21-28 -- New York, New York -- 1994 American Tour de Solar and Electric Car Championship. Contact: NESEA, (413) 774-6051.
- May 29-June 1 -- Kansas City, Missouri -- Liquid Fuels, Lubricants and Additives from Biomass, American Society of Agricultural Engineers. Contact: (616) 492-0300.
- June 20-23 -- Milan, Italy -- 19th World Gas Conference. Contact: (39) 2 5202-3030 (fax).
- June 20-24 -- Cocoa Beach, Florida -- Hydrogen '94. Contact: Ingrid Melody, Florida Solar Energy Commission. (407) 783-0300, ext. 139
- June 24-July 3 -- Manchester UK -- Cities and Sustainable Development...Global Forum '94, Tel: (44-61) 234 3741 Fax: (44-61) 234 3743. e-mail: Geonet:mcr1:gf94-centre; Greenet: gf94@gn.apc.org; Internet: gf94-centre@mcr1.geonet.de x400: c=de; a=dbp;p=geonet; o=gf94; ou=centre.
- June 25-30 -- San Jose, California -- 23rd American Solar Energy Society Annual Conference. Contact: (303) 443-3130.
- July 6-8 -- Reading, England -- World Renewable Energy Conference III. Contact: (73) 43 18588.
- November 9-13 -- Springfield, Massachusetts -- 11th Annual Quality Building Conference - Making Sustainable Building Standard Practices: Practical Solutions for Good Business, Massachusetts Monach Sheraton Hotel. Contact: NESEA, (413) 774-6051.
- November 28 - December 1, 1994 -- San Diego, CA -- 1994 Fuel Cell Seminar. The Town and Country Hotel, Contact: Annmarie Pittman, (202) 639-4994, Fax: (202) 347-6109.



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**Do You Have A Comment?  
 A Suggestion?**

**Hydrogen Today**  
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 Cartoons by: . . . . . Carolyn Presley  
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**Sponsors NEEDED! Hydrogen Today needs sponsors to help pay for publishing costs! Please contact Kathy McAlister at (602) 921-0433**

**Remember, sponsorships are Tax-Deductible!**

**MEMBERSHIP APPLICATION**

**YES**, I want to join the American Hydrogen Association and help make a transition to clean Hydrogen energy.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone - Home: ( ) \_\_\_\_\_ Office: ( ) \_\_\_\_\_

Occupation and/or Areas of Special Interest \_\_\_\_\_

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 Enclose check or money order and mail to:  
 American Hydrogen Association, 216 S. Clark Drive, Ste. 103, Tempe, AZ 85281

# 10th World Hydrogen Energy Conference & Exhibition

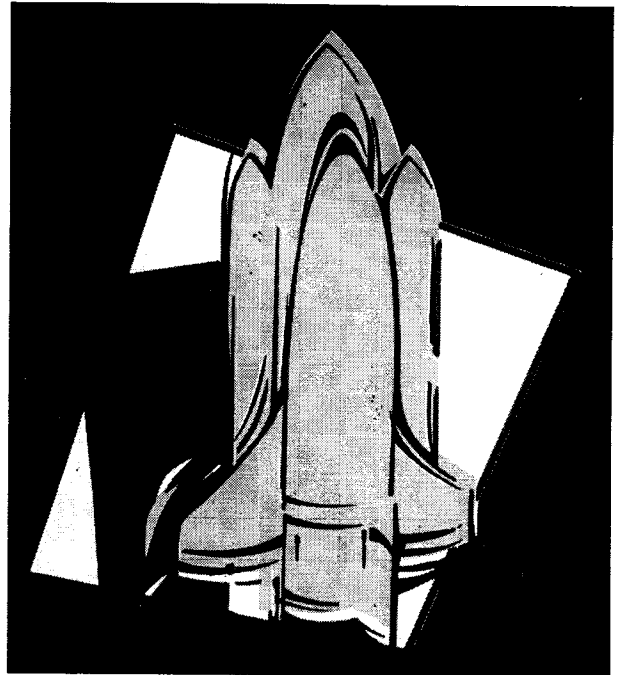
June 20-24, 1994


Cocoa Beach, Florida, USA

Next year's World Hydrogen Energy Conference, organized by the International Association for Hydrogen Energy, will spotlight the industrial, academic and governmental players that are launching our hydrogen energy future. On hand will be producers of hydrogen and other industrial gasses, solar, wind energy system manufacturers, storage tank, dewar, compressor and hydride manufacturers, hydrogen energy storage researchers, members of the aerospace industry, automobile manufacturers, conversion companies, renewable energy transportation researchers, fuel cells, chemical gases and feedstock users, members of government agencies and laboratories, clean fuel proponents and environmental consultants. These people will also be the opinion leaders and decision makers who are directing the transition from the Fossil Age to the Hydrogen Era.

This is a bi-annual event which is held at locations around the world, with the past three meetings held at Paris, Hawaii and Moscow.

The Cocoa Beach Hilton Hotel and Towers is located on the Atlantic Ocean's edge in a resort community that specializes in serious business as well as family fun. Register now and become a part of the critical mass of technical, political and economic forces gathered together to launch our sustainable, hydrogen-powered future. For more information call Ingrid



Melody, World Hydrogen Energy Conference, Florida Solar Energy Center 300 State Road 401 Cape Canaveral, FL 32920-4099 USA. Telephone: (407) 783-0300, ext. 139 Fax: (407) 783-2571. The American Hydrogen Association has reserved an exhibitor's booth and the President, Roy McAlister will be one of many great speakers. 

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