



Hydrogen Today

"CLEAN ENERGY FOR A BETTER WORLD"

Official Publication of the AHA

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Solar '92 Conference And Beach Week In Cocoa Beach Florida

— By Herb Hayden

What a great place for a Solar Conference ... the warm beaches of the Florida coast. Kennedy Space Center, thunderstorms, Florida Solar Energy Center and all!

The Florida Solar Energy Center was the host for the American Solar Energy Society's National Solar Energy

Conference at Cocoa Beach, Florida held June 15-18, and the activities included the Second Annual Sun Day Challenge car rally, featuring solar, electric, and alternatively fueled vehicles.

The solar production of hydrogen is a prominent target of solar energy development, and in fact it was the subject

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The Florida conference surroundings provided a daily reminder of what renewable energy is all about—Preserving our environment and quality of life.

Ninth World Hydrogen Energy Conference Meets In Paris

— Reported in The Hydrogen Letter by Peter Hoffmann

To subscribe, write to Peter at 4104 Jefferson St., Hyattsville, MD 20781

The Ninth World Hydrogen Energy Conference convened in Paris, France, June 22-25 at LaDefense, a high-rise office suburb in the western periphery of this famous city, near the famed Arc de Triomphe. The confab featured 215 papers presented in 24 sessions over a period of three and a half days and covered a wide range of hydrogen topics, including hydrogen vehicles, fuel cells, dual-fuels (hydrogen/gasoline), hydrogen production advances, storage systems, safety, and environmental aspects of hydrogen. The conference was opened by the welcoming address of T. Nejat Veriroglu, President of the

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"Ten Seconds A Month Can Help Save The Planet"

The National Audubon Society has launched the Solar Brigade "people power" campaign, with the simple goal "to change the world". The Solar Brigade wants us all to send a message to our electric utility companies each month when we pay our bill that "we want 10% solar electricity in ten years".

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Inside the AHA....

AHA CHAPTER REPORT Silicon Valley Chapter

— Interview of John P. Gotthold by Kathy McAlister

The emerging Silicon Valley Chapter of the American Hydrogen Association has had a busy month. We went to SEER, the Solar Electric Expo and Rally at Willits, California and ran a booth. Demetri Wagner brought the hydrogen-powered pick-up that was developed by Dr. Robert Zweig and backdropped our booth with the beautiful AHA transport trailer. A great show except that, even though we had a dozen Silicon Valley members participating at various times during the weekend, we were busy as bird-dogs trying to get a chance to talk to all the great people that were interested in renewable hydrogen.

After we came back from SEER we decided to see if we could get our own hydrogen car on the road. Roy Kaylor of Kaylor Energy Products donated a hybrid gas electric Invader model. Within a week and a half, with the assistance of three Electric Auto Association members and six of our members, we got a compressed hydrogen tank installed in a safety carrier and worked out the hydrogen regulation and water injection requirements. We are currently refining the injection system and getting the car set-up for Rallies around the area. The Invader is a lower and sleeker than a Corvette Sting Ray style of vehicle ... and now it will run on electricity, (0 to 30 in 2.6 seconds), hydrogen, and gasoline. The combined energy range is over 500 miles.

Our inspired crew is on a roll so we looked at what our next project should be. We think the greatest impact should be on showing hydrogen in the best transportation applications. We decided to work with three local electric car makers and try to evolve a design for a small, light weight, two passenger, commuter car powered by a hydrogen fuel cell. We believe that if

geared properly and maxed out for rolling efficiency and aerodynamics, we could achieve 1,000 miles on a single charge of Hydrogen.

Dr. Roger Billings is considering the donation of a Fuel Cell and Hydride tank to our Chapter to help make such a technology demonstrator. Our Chapter is sending a group to the Los Alamos National Laboratory in New Mexico to get an update on their fuel cell technology. They are interested in getting their science out into the hands of people who will turn them into products and get the Hydrogen Revolution rolling.

We have all had to mourn this last few weeks as the Hurricanes blew away the

homes, businesses, and lives of so many of our fellow American citizens in Florida, Louisiana, Guam, and now Hawaii. Most people are shaking their heads and saying "what funny weather." We're looking at those Hurricanes and saying, "Have you ever heard of the GREENHOUSE EFFECT?" If we keep burning fossil fuel, we will keep adding carbon dioxide to the solar-powered atmospheric heat engine that surrounds the EARTH. The atmosphere will accumulate more energy to make more weather extremes. Are we going to try for two or three 160 mile per hour Hurricanes each year!

Ed note: Look for more reports on the SEER event in the next issue of HT.

Southern Cal Chapter Active and Growing

The Southern California Chapter of AHA continues its active programming. In July, its monthly meeting featured AHA member Dr. Robert M. Zweig, who reported on recent developments of hydrogen as a feedstock in the chemical industry and as a clean energy vector. Dr. Zweig also provided a first-hand report on the Paris Ninth World Hydrogen Energy Conference, at which he was a speaker. (Also attending and speaking at the Paris conference was So Cal AHA member Alan Lloyd, Chief Scientist for the South Coast Air Quality Management District.)

Featured also on the July program were speakers on hydrogen safety, who had recently attended the Earth Communications Fourth Annual Entertainment Industry Conference, "Politics and the Environment" at UCLA.

The keynote speaker for the August 11 meeting is Nick Patapoff, Senior Research Engineer for the Solar Division of Southern California Edison Company.

The So Cal Chapter of AHA has installed its own toll-free 800 phone number to provide membership information — (800) 854-5225. It can also be contacted by writing to Southern California Chapter, 9816 Arlee Avenue, Santa Fe Springs, CA 90670. For more information about joining AHA in Southern California, call Dick Williams at (213) 949-9482 or Leroy Essel at (818) 998-1888 or the 800-number above.

INSIDE THE AHA

M.D. Grace Foundation **\$30,000 DONATION KICK-OFF**

Today an agreement in principal has been reached between the American Hydrogen Association and Global Energy Alternatives for the formation of the foundation for the promotion of renewable clean energy.

The foundation will be administered by AHA with a Board of Trustees to be composed of leaders in the areas of science, energy, finance, management and government.

The foundation has received its first contribution of \$30,000 from a private trust. The funding will be targeted for operation of AHA in the areas of:

- 1) EDUCATION (scholarships for academic pursuits of individuals who meet specific criteria concerning the advancement of renewable resources.)
- 2) RESEARCH AND DEVELOPMENT (in the areas of production and application of renewable hydrogen in transportation, electrical power, household and commercial areas.)

The candidates for scholarship generally fall in two categories:

- 1) SCIENTIFIC (engineering, chemistry, physics).
- 2) MANAGEMENT (marketing, development of pilot projects that will demonstrate economically feasible renewable energy projects.

The initial activities are proposed to be in the areas of housing and transportation. For further information about financial or other donations contact:

The American Hydrogen Association
219 S. Siesta Lane, Ste. 101
Tempe, Arizona 85281.

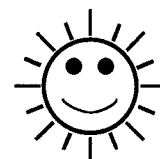
Phone: (602) 921-0433, FAX: (602) 967-6601.

Electronic Data/Bulletin Board *HeartBeat Earth BBS* *Silicon Valley Chapter*

— *Marcus Johnson*

Our Silicon Valley AMERICAN HYDROGEN ASSOCIATION BBS can be reached at (408) 738-4014 and is generally on-line from 12:00 noon to 6:00 a.m. We try to do maintenance and enter more data, early in the morning. The settings are N,8,1 at 2400, or 1200, or 300 baud. We suggest that you try to access it at 2400, as the data will be massive and you'll want to read fast. Currently we have it organized into 15 Conferences, trying to provide space for all levels of Hydrogen interest. All the files are available for down-load. The lowest security level is NEWUSER and that reaches most areas. The second level is AHA MEMBER and that is reserved in some areas for members who are working on specific projects. The highest level is SYSOP and that is reserved for the Silicon Valley Chapter members who are trying to keep it all organized. We just got a new member, who is going to concentrate on getting us hooked into other bulletin/boards all over the USA and Internationally.

The information that shows up can be very interesting. For instance, a recent entry reports that Ferrous Titanium Hydride holds 9.2×10 to the 22 atoms of Hydrogen while Liquid Hydrogen holds 4.2×10 to the 22 atoms and Solid Hydrogen holds 5.3×10 to the 22 atoms. Hydride is neat stuff and safe to boot.



New Display *Needs Help*

— *Chris Lewis*

The American Hydrogen Association is looking for support to build a brand new demonstration display to be used at the many important public events and exhibitions attended by AHA. This display will illustrate key aspects of the solar hydrogen economy that AHA advocates.

The project is envisioned to draw people in and hold their attention long enough to explain what solar hydrogen is all about, and how they can help. And now you are asking, 'what is this incredible display?' It is HYDROGEN COOKING.

The display will contain a renewable energy source, namely PV cells, an electrolyser to produce hydrogen, a water displacement storage system, and a camping stove to cook appetizers for the people. This project should hold the people's attention for about 30 minutes or so while enough hydrogen is gathered from the PV arrays to cook for 5 to 10 minutes. This cycle will repeat itself every hour or so.

The project is on drawing boards, but, it needs your help to become a reality. Many of the supplies are still needed, especially the estimated 2 sq. yds. of PV cells. If you would like to make a donation of supplies, financial support, or simply have ideas for this project please contact:

American Hydrogen Association
219 S. Siesta Lane, Suite 101
Tempe, AZ 85281
(602) - 921 - 0043

We hope to develop a design and sources of materials which can be used to make such a system for each chapter. As this project develops and progresses, updates and recipes will be published in future issues of Hydrogen Today, so that you can directly see what is becoming of your generous donations. Thank you.

Catherine Rickbone Donates Car To Adopt-A-Car Program

— Roy McAlister

Much of what we do is driven by pragmatism and expedience. We buy gasoline because it is convenient although we know that about half of the carcinogenic compounds in the atmosphere come from burning fossil fuels. We know that burning oil drains our economy and threatens our health but we are in a technology trap. Five billion people search for the good life by burning the fossil equivalent of 180 million barrels of oil each day. How could five billion people survive and/or find the good life if we stop burning oil?

Which comes first, hydrogen production or commercial uses? How can the "chicken or egg" problem of supply and demand be answered in the scale required to stem the financial drain of more than a billion dollars per week that the U.S. pays for foreign oil?

Consumers vote with dollars. The industrialized world has been shaped by our purchasing habits. Each dollar each consumer spends tells a supplier

that we have considered the alternatives and chosen their product. We vote for white or whole wheat bread as we shop. We vote for fossil fuels instead of hydrogen when we buy gasoline. If we want hydrogen we have to tell vehicle manufacturers and fuel producers to supply what we want.

The ADOPT-A-CAR program of the American Hydrogen Association is showing how to solve the problem by converting vehicles to operate on hydrogen. In a recent example Catherine Rickbone decided to show what one consumer can do to change the world. She donated a Mercury to the ADOPT-A-CAR program. A recent transplant from Kansas City, Missouri, Ms. Rickbone is a professional sales consultant and trainer for Robinson's in the Phoenix area. Before she heard about the American Hydrogen Association at a meeting, she stopped using the car that she donated. She decided to vote against cars that use only gasoline. Catherine Rickbone

voted to walk, use mass transit, and to car pool. Catherine Rickbone does not want to continue buying gasoline and repairing a car that produces pollution from petroleum products.

And, Ms. Rickbone voted for the American Hydrogen Association's demonstration program by donating her car. In addition to having the satisfaction of casting a vote against cars that are dedicated to gasoline, Ms. Rickbone can deduct the value of the car that she donated on her IRS income tax return.

The ADOPT-A-CAR program evaluated the donated Mercury and determined the cost of repairing it and adding a hydrogen conversion kit. After a sponsor is found to cover the repair and conversion costs the car will be leased with provision for showing it at schools and public events. Catherine Rickbone has volunteered to show the car at public events and to tell others about how she voted for a car that can use hydrogen.

What They're Saying

Who's Got A Hydrogen Fuel Cell That Works???

— Demetri Wagner

Paris, France - The opening of the 9th World Hydrogen Energy Conference was a grand statement French Style. Thundering theme music from the movie 2001: A Space Odyssey and references to the French greats of hydrogen like Jules Verne set the stage for a jam-packed four day hydrogen information extravaganza.

Three technical sessions happened at once. This means you had to schedule yourself carefully to hear and meet the author of a paper you were interested in. The first day I decided to stay with the Hydrogen Engine Session.

BMW reported that after many years of research, they feel the time has come and the public is ready for dual-fueled vehicles. They see a gasoline/hydrogen vehicle as the best choice of combinations. Hydrogen fuel would be used for inner city driving with gasoline as a backup fuel and for driving long distances between cities. They say they have the technology ready. Proven internal combustion engine systems and liquid or hydride storage systems are ready to be mass produced. BMW research shows that liquid hydrogen

is the best way to go. With new tank designs, filling is close to 100% efficient taking as little as fifteen minutes. Boil-off pressure release time is being extended to weeks. Overall, LH₂ is more efficient dollar-for-dollar. The LH₂ fuel is more expensive but it is light weight, about 95 lbs full, with a range of about 190 miles. Hydride fuel systems are less expensive but are heavier. For the same range a hydride tank would weight 650 lbs. The extra weight of hydride systems lowers MPG thus raising fuel costs not to mention lowering performance. Mercedes-Benz, despite extensive hydride research, is in agreement.

Many fuel cell projects were talked about. While many small advances were reported no one had a "complete FC system" that really works. All the major types are experiencing problems in some area. Experts predict it will be 5 to 10 years before we see a reliable fuel cell for electric cars. This is partly why BMW and Mercedes believe the dual-fueled, hydrogen/gasoline IC engine will remain the power plant of choice well into the 21st century.

“Fuel Cells - Realizing the Potential”

“Fuel Cells - Realizing the Potential” was chosen as the theme for the 1992 Fuel Cell Seminar to be held in November focus attention on the opportunities and challenges involving fuel cell products at this critical stage in their development and application. Early commercial fuel cell power plants are currently providing user experience and feedback to manufacturers. Meanwhile, pilot manufacturing facilities for future fuel cell power plants are producing test units which are being evaluated in cooperation with prospective users. Intense research and development activities continue which are aimed at further reducing costs and more fully satisfying users need. Fuel cells offer great potential for making important contributions to world energy needs in ways which are economically and environmentally attractive.

This seminar aims to provide opportunities for information exchange among those engaged in development, manufacturing and marketing of fuel cells and related technologies.

The Fuel Cell Seminars will be held Nov. 9–Dec. 2 at the Westin La Paloma, 3800 East Sunrise Drive, Tucson, Arizona 85718. Registration is \$350 before November. For more information call: (202) 639-4994, Fax: (202) 347-6109.



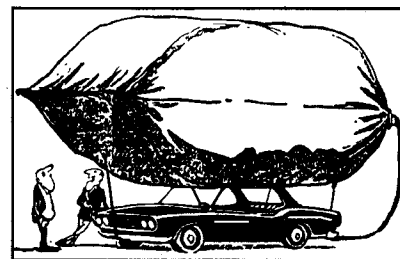
• • • A Fuel Cell That Works???

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The second day I stayed with the Environmental Session. Without a doubt, study after study came to the same conclusion—making a transition to a renewable hydrogen energy system is the only way to stop global warming. Studies estimate that the transition to a hydrogen system could eliminate 80% of all the global environmental problems. Thanks to Dr. Robert Zweig and others, a resolution was passed by the International Hydrogen Society to coordinate with the United Nations for the realization of a global hydrogen energy system. The UN has shown interest in hydrogen by proposing the development of an International Hydrogen Center. Turkey has offered to build the Hydrogen Center as the host country.

The third day I was with the Hydrogen Safety Session. Hydrogen has properties we are not used to. Yet if handled correctly hydrogen is intrinsically the safest fuel. Non-toxic to man and the environment hydrogen is the ideal energy carrier and basic feed stock for industry. Crash tests with liquid H₂ vehicles are to be carried out in Munich and safety recommendations will be made from the findings. EC transportation codes are being studied for the introduction LH₂ vehicles in Europe.

The fourth day, I was with the Hydrogen Futures Session. William Hoagland P.E., Manager of the Hydrogen Program at the National Renewable Energy Lab, Golden Colorado gave a paper outlining America's bridge to Hydrogen/electric economy. That bridge is going to be natural gas. It is proposed that North America's natural gas grid be used to store and deliver hydrogen - up to 15% by volume. Very little modification needs to be done to the national pipe-line system to allow 15% hydrogen. Gradually, the pipe-line will be upgraded to handle 100% hydrogen by the mid-21st century. General users of natural gas will find little difference with the 15% hydrogen added but the fuel will offer reduced emissions. Hydrogen and natural gas can be separated easily allowing users to have pure natural gas or pure hydrogen. The airlines may be the first big commercial users of hydrogen in liquid form. The LH₂ infrastructure would build-up around airports first, then spread into ground transportation. As you can tell this is very advanced thinking for America. The only problem is that California hasn't thought of it yet!



“... Then, when the bag is full of hydrocarbons and noxious gases, you simply take it off and throw it away!” First printed 1968 Denver Post

Ten Seconds

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The Solar Brigade also wants participants to register by sending in an information coupon, so that the Brigade can publicize the ever-increasing numbers of participants to the press, legislatures and utilities. Their aim is to mobilize 1,000,000 members.

John Beyea, a Physicist with the National Audubon Society, is the mastermind behind the Solar Brigade. “How do we get public change to come about?” asked Beyea when he spoke at the National Solar Energy Conference Plenary Session on Solar Policies. “The Solar Brigade is a way for the public to speak. It gives ordinary people a way to make a difference.” Beyea, a physicist, believes that public activism is at least as important today as is scientific effort.

According to the National Audubon Society, if 10% of our electricity were from solar by the year 2002, about 170 million tons of carbon dioxide would be eliminated each year, and we would be on the road to environmentally sound, sustainable energy.

The Solar Brigade effort reflects a belief that solar energy is the safest and cleanest energy available to us, and it is time we stop taking “no” for an answer. The electric companies should “jump-start” solar energy by beginning to convert now, for a brighter future tomorrow.

You can join this effort by registering with the Solar Brigade, National Audubon Society, Dept AB, 950 Third Ave., New York, NY, 10022, and by inserting the message “We want 10% solar energy in 10 years” every month in your electric bill. Become a Solar Brigade leader and hear the latest count of participants by calling (212) 759-6354. Word of mouth is the key!

Subject Solar '92

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of Wednesday morning's Solar Hydrogen Symposium. Industry, government and university researchers here and abroad are pursuing a diversity of approaches, but they share the vision of a solar hydrogen fueled future. Here's what the session presenters had to say:

"We can make hydrogen from various renewable sources, and use it in many ways," said Joan Ogden of Princeton University. "Now PV (photovoltaic-produced) hydrogen is at about \$15 (per gallon of gasoline equivalent), but when produced from gasifying biomass, it could be lower in cost than natural gas. There are plenty of world resources for solar hydrogen, and solar PV hydrogen is the lowest user of land and water, requiring only 2% of the desert globally. There are only four states where the demand would exceed the supply. PV could be commercialized in the next 10 to 20 years at \$2 to \$3 per gallon equivalent, and since hydrogen fuel-cell vehicles will be two to three times as efficient, there will be a lower cost per mile than with gasoline. Instead of looking only at the fuel cost, look at the lifecycle cost."

"It is in the national interest to develop hydrogen resources from renewable energy, according to the 1990 Matsunaga Act," said Bill Hoagland of the National Renewable Energy Lab. The focus of NREL is on hydrogen storage and renewable hydrogen production. NREL will identify the pathways of production and use which make sense, as being efficient and economical, and "for the environment". Direct photoconversion, coal gasification, hydrogen purification, biomass, lightweight compact storage (the single largest technical impediment), highly efficient low cost storage for utilities, fuel cells, catalytic and heat engine usage, including hythane injection, are all of interest under these criteria. Thermochemical production of hydrogen, though, is not a high U.S. priority, but a lot of research is happening in Europe, according to Hoagland.



Electric vehicle owner and builder, Rick Michaels, ran his sharp Triumph Spitfire EV, which he recently completed with the help of the Solar Electric Corporation. It is a simple and reliable car, with plenty of pep, but with limited range. Rick is interested in hydrogen fuel cells to add range to the batteries, and expressed interest in becoming an AHA member on the spot.

For photobiological production, using organisms like blue-green algae, the University of Miami is screening 5,000 strains of Cyano bacteria, perhaps to separate the hydrogen-producing enzymes and put them to work. And for storage, polyhydride systems can store 5% of their weight in hydrogen, which is quite a practical amount. "The perceived safety problem is not justified, and will be address by ongoing research," concluded Hoagland.

From Humboldt State University, Ron Reid reported on the ongoing Schatz Solar Hydrogen Project in Arcata California, where photovoltaic hydrogen and fuel cells are being installed to run the air pump system at the Teleochner Marine Lab. Due to delays in obtaining a suitable fuel cell, the Project is initiating development of their own fuel cell system built upon cell technology provided by Texas A&M University. (Ed. Note: See article on Humboldt project in the next issue of *Hydrogen Today*.)

"Germany will continue to import energy, so it should be clean energy," said Hartmut Steeb of the joint German-Saudi Arabia Hysolar Project. "Saudi Arabia could export the equivalent to today's energy exports using only 5% of their land area." The Hysolar project uses 350 KW of PV

at Riyadh, directly coupled to electrolysis to develop large scale manufacturing techniques. There are also two 50 KW dish-Stirling systems on-site. At Stuttgart, Germany, 10 KW of photovoltaic power is used to fill hydrogen bottles, which are sold to a local utility, who delivers them to their customers.

Sandia Labs Is Serious About Solar Thermal

Another area of heightened activity and great excitement is the new effort to commercialize solar thermal power systems by Sandia Laboratories, which hold the promise of large scale solar energy production within the next few years.

The Solar One Power Tower electric generating plant at Barstow California will become Solar Two with the addition of molten salt thermal storage tanks, as part of a \$39 million dollar joint research project between Sandia Labs and several utilities. The new thermal storage tanks will make the 10 megawatt system more reliable and enable the plant to keep generating electricity into the late afternoon.

According to Project Manager Daniel Alpert of Sandia Labs, the original design would shut down for at least a half hour whenever a cloud would interrupt the direct sunlight. With the new thermal storage improvements,

Alpert believes that the system will be available over 60% of the time, which will help to bring the electricity costs to within 1 to 2 cents per kilowatt hour of the cost of electricity from coal plants. Full-sized 100 megawatt solar power-tower plants, which hopefully the utilities will build after the Solar Two project, should be able to beat the cost of coal-fired power plants. The plan is to begin building the larger plant in 1996 through 1999, to enable commercial plants to be built after 2001.

Sandia also is advancing Solar Dish Stirling technology in a new Commercialization Joint Venture program to involve utilities and industry beginning later this year. According to Sandia's Paul Klimas, "**Dish Stirling generators are a proven, modular and efficient way of generating solar electricity. This program will be designed to let industry lead their own commercialization effort with technical and financial support from Sandia and NREL.**"

Noteworthy manufacturers such as McDonnell Douglas, United Stirling, Cummins Engine and others have demonstrated up to 30% solar-electric conversion efficiencies. Such industries are ready to phase up to commercial production over the next few years, if utilities, government and the public are there to support it.

In the Photovoltaic Plenary Sessions, photovoltaics were covered from the lab, to market growth trends, to field experience on a utility scale.

Texas Instruments Marketing Manager Eric Graf announced plans to begin low volume production of TI's new low-cost Spherical Silicon photovoltaic module for Southern California Edison (SCE) within the next 12 months. "One kilowatt of photovoltaics could generate one-third of a home's needs in southern California," said Graf. "**Our goal is to help America lead in renewable technology for jobs, balance of trade, and the environment.**" Graf indicated that SCE plans to use the new PV modules to serve their customers right from their rooftops.

Don Osborn of the Sacramento Utility District (SMUD) announced that SMUD is already a leader in renewable energy, committed to 800 MW of conservation and 400 MW of renewable and advanced energy by the year 2000, as well as the 2 MW of photovoltaic power they have already installed as part of the PVUSA program. SMUD already has aggressive efficiency and solar hot water programs in place and plans to eliminate the barriers to solar energy and work with industry to drive solar costs down through the sustained, orderly development of solar technologies.

"The utility can serve the needs of the customer and community at large by providing access to cost-effective solar applications. In the process, the utility can act as a catalyst for the accelerated development of solar energy systems."

Conference Quotes About Solar Hydrogen Technology:

"Lead acid, nickel iron, and nickel hydride batteries all will fall by the wayside as the fuel cells come along, all on the way to the hydrogen economy."
—*Doug Cobb of the Solar Car Corporation*

"We have seen natural gas use grow 20% in the last five years, as we move from liquid fuels to gaseous fuels. This brings the ultimate excitement, for it lays the groundwork for the hydrogen economy. Once you can handle methane (natural gas), you have

essentially prepared for hydrogen."
—*Christopher Flavin of the World-watch Institute*

"The only real danger to this country is that we may be leapfrogged by the European countries and the Japanese. We need to be ready to lead this energy revolution in this post-Rio era. Ozone depletion was barely a theory 20 years ago. Now there is an unprecedented effort to reduce CFC production, but ozone depletion will continue for 10 years. Greenhouse gases, such as CO₂, will cause climate change. But we are on the edge of an energy revolution in the years ahead. We need to convince the public at large, and the media, of what technology can offer..

"We use 115 billion gallons of fuel in US transportation every year, which means a lot of US dollars are going offshore. Though today transportation costs less than ever, we need to show the economic benefits in solar energy and energy efficiency.

"We are moving to alternative fuels in this country. Amoco is converting waste paper to alcohol, and we're seeing electricity, biomass, and hopefully eventually hydrogen. We need to support this information to the public."
—*J. Michael Davis, Assistant Secretary of the US Department of Energy*

Ed. Note: J. Michael, at AHA we'll help anyway we can.



Even General Motors was there with their new electric Geo, which they plan to have in production in the mid 90's. According to Julie Jeremy, GM Coordinator of Public Affairs, "there is a lot of support and enthusiasm at GM for the new Electric Vehicles."

• • • Conference Meets in Paris

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International Association of Hydrogen Energy. "It is befitting that one of the World Hydrogen Conferences should be held in the country where hydrogen

was named and where the Hydrogen Energy System was predicted by two famous Frenchmen, one a great scientist and the other a great visionary," noted Veziroglu.

"Yes, my friends, I believe that water will one day be employed as fuel..."
—Jules Verne (in *The Mysterious Island*), 1874.

Jules Verne, observed Veziroglu, further noted "...there will be no want of either light or heat as long as the productions of the vegetable, mineral, or animal kingdom do not fail us. I believe, then, that when the deposits of coal are exhausted, we shall heat ourselves with water."

New International Centre for Hydrogen Energy and Technology in a surprise announcement, Veziroglu reported that the Vienna-based United Nations Industrial Development Organization (UNIDO) has decided to establish an International Centre for Hydrogen Energy and Technology, to be located in Turkey, which he says has agreed to host the center. (UNIDO's New York office

was unable to confirm or add details to the announcement, but said it would check with Vienna headquarters.)

According to Veziroglu, the new UNIDO center will survey hydrogen energy manufacturers and R&D organizations and establish a data bank; conduct R&D in areas close to commercialization; study possible niches for hydrogen energy applications; oversee implementation of pilot projects; train engineers and technicians; organize short courses, seminars, symposia and conferences; and cooperate with other UN centers as well as private and public organizations in these areas.

Other Highlights

In contrast to previous World Hydrogen Conferences that focused on theory and long-range hydrogen technology developments, this Paris conference clearly indicated that hydrogen energy technology can be applied practically in the near-term future. A particular emphasis of the material presented at WHEC-9 was hydrogen in transportation applications.

Ed Note: AHA was represented at the Paris conference by Demetri Wagner, Dr. Robert Zweig, and Alan Lloyd. See a personal report on the conference by Demetri Wagner in this issue of Hydrogen Today.

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Letter From The Editor

This is my final edition as Editor-in-Chief of Hydrogen Today. Some two years ago, when the American Hydrogen Association was just getting started, I agreed to edit a newsletter that could be taken to Hawaii to the WHEC-8. I didn't think at the time I was signing up for eleven more editions.

It has been a great pleasure and honor to serve the noble efforts of AHA in this way for the past twenty-six months. This task, however, requires and deserves more hours than I have to give.

Looking back over these past two

years, I am impressed with all that has changed. When the first edition of "Hydrogen" (as the newsletter was called at first) came out, few people outside of chemistry labs knew much about this material. Today, there are a number of major legislative programs, including the 1990 Matsunaga bill, for example, that provide funding to support hydrogen development programs. Many solar-hydrogen production plants are under development or construction in Canada, Saudi Arabia, Greenland, and elsewhere; several schools have programs to produce and use solar-hydrogen in practical ways;

several major world automakers have introduced cars that run on hydrogen.

AHA has also grown substantially and is forming a foundation for the development and promotion of renewable resources. Its members have participated in dozens of large environmental fairs and events; and have probably presented the concept of the solar-hydrogen economy to hundreds of other smaller groups, school classes, special meetings with government or business leaders. Literally tens of thousands of brochures, handouts, and — yes — newsletters have been distributed to

Continued, page 10

— By Robert B. Liden

Upcoming Events . . .

Have an event for our calendar? Write us and let us know!

- Sept. 20-25, Madrid, Spain — 15th Congress of the World Energy Council Contact: Eileen Murray, 202-331-0415 ext. 3006
- Sept. 23-25, Long Beach, California — Conference of the Society of Automotive Engineers
- Sept. 24, Tucson, AZ — "The Fuel Cell - An Update on the Status of an Exciting New Design", Tucson Chapter AHA monthly meeting - Contact Mike Baker (602) 469-5554
- Sept. 29-Oct. 1, Orlando, Florida — American Gas Association NGV Conference Contact: Carl Ericson 703 841-8661
- Sept. 30-Abstracts due for Project Hydrogen '93 (see June 20, 1993)
- Oct. 6-9, St. Louis, Missouri — Biobased Products Expo '92 301-530-7122 - Fax: 301-571-1837
- Oct. 9-11, National Conference on Environment Entrepreneurship, Prescott, AZ. Presented by the Common Ground Project of Prescott College. Call (602) 778-2090 for details and registration.
- Oct. 12-16, Montreux, Switzerland — 11th European Photovoltaic Solar Energy Conference and Exhibition
- October 13, Southern California Chapter of AHA monthly Meeting, Town Center Hall, 11740 E. Telegraph Rd. Santa Fe Springs, CA, Contact 1-(800) 854-5225.
- Oct. 13-14, Sao Paulo, Brazil — Society of Automotive Engineers Mobility Technology Conference 412-776-2103 or Fax: (55)(11) 288-6599
- Oct. 15-18, Santa Monica, Long Beach, Pomona, Riverside, CA "1992 Electric Grand Prix" - Tel: (310) 430-9779, Fax: (310) 431-2052
- Oct. 18-21, Chicago, Illinois — American Gas Association American Gas Conference Contact: Julie Stewart, (703) 841-8667
- Oct. 19-22, San Francisco, California — Society of Automotive Engineers. International Fuels and Lubricants Meeting and Exposition (412) 772-7148
- Oct. 19-23, Windpower 92, Seattle, WA. Contact American Wind Energy Association. (202) 408-8898 or Fax (202) 408-8536
- Oct. 21, Tempe, Arizona — Arizona State University and American Hydrogen Association monthly meeting. Contact (602) 921-0433.
- Oct. 25, Tempe, AZ - UN Day - "Earth Summit, Looking Forward in a World of Change" ASU Memorial Pima Room 218, 2:00 p.m., Contact: Kathy at AHA
- Oct.-29, AHA of Tucson, U. of A. Optical Sciences Center Main Auditorium on the Southeast corner of 3rd St. and Cherry. 7:00 p.m. Contact: Mile Baker (602) 469-5554.
- Nov. 1-6, Miami Beach, Florida — American Institute of Chemical Engineers Fuels and Petrochemicals Division Meeting and ALChE Annual Meeting (303) 231-1753 or Fax: 303-278-3692
- Nov. 8-12, Anaheim, California — Solar Hydrogen Energy Systems Session, American Society of Mechanical Engineers Winter Annual Meeting Contact: Prof. S.A. Sherif, Fax:(904) 392-1071 or (904) 392-7821
- Nov. 8-13, Anaheim, California — Winter Annual Meeting of the American Society of Mechanical Engineers Contact: Prof. S.A. Sherif, Fax: 904 392-1071 or (904) 392-7821
- Nov. 16-19, Orlando, Florida — 1992 International Gas Research Conference (312) 399-8300 Fax: 312-399-8170
- Nov. 16-19, Toledo, Ohio — Society of Automotive Engineers International Truck and Bus Meeting and Exposition
- Nov. 18-21, Hamburg, Germany — Trade Fair and Exhibition for Renewable Sources of Energy, New Energy Technologies and Energy Management. Contact: Forum fuer Zukunftsenergien e.V. Godesburger Allee 90, 5300 Bonn 2, Germany
- Nov 27-29, Scottsdale, AZ "A Festive Gathering of Friends Promoting Environmental Awareness through the Arts" - Earth Rally, Contact: (602) 585-4408
- Nov 29-Dec 2, Tucson AZ, 1992 Fuel Cell Seminar— Westin La Paloma Hotel, Registration is \$350 before Nov. 5th. tel: (202) 639-4994
- Dec. 7-9, Miami, Florida — Tenth Miami International Congress on Energy, Environment and Economics, Contact: Clean Energy Research Institute, University of Miami, P. O. Box 248294 Coral Gables, FL 33124
- Dec. 30-Jan.2, 1993 — Cairo, Egypt — Third International Conference on Renewable Energy Sources Dr. Abdullatif I. Sel-Sharkawy, Cairo International Conference on Renewable Sources, National Research Center, Dokki, Cairo, Egypt.
- Jan 25, 1993, Papers Due For Solar '93 (See April 22, 1993)
- April 22-28, 1993 - Washington DC, Solar 93 - ASES Annual Conference - Contact (303) 443-3212.
- June 20-23, 1993 - Kansas City, Mo. Adam's Mark Hotel, Project Hydrogen '93. Contact: (816) 229-3800, Fax: (816) 229-1000

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Energy Politics

“The Earth Summit” —A Golden Opportunity Lost

— By Kathleen A. McAlister

By now, you've all read about the Earth Summit in Rio de Janeiro this past June. You saw the major headlines and know that President Bush backed down under pressure from the oil and other corporate interest groups and undermined significant agreements to reduce Global Warming. I can only add my observations from my own week at Rio.

The goal of Rio was to set-up a variety of UN agencies whose duties would be to collaborate Worldwide strategies on the environment. To support UN policies and authority would require planned use of energy and resources through a sense of planetary community and commitment. The Riocentro, headquarters for the gathering of the Earth Summit, had the sobering task of uniting the world by treaty agreements and to set the right priorities for all nations. The meetings of Rio centered around two basic protocols: the Earth Charter, and Agenda 21.

The Earth Charter declared the responsibilities of all nations to protect the Earth's ecosystem. The document calls for effects to eliminate global poverty, and proclaims the principle of sustainable development. The Earth Charter serves the ethical standard for the development of Agenda 21.

Agenda 21 provided the blue-prints for negotiations regarding climate changes, biodiversity, poverty and many other environmental topics. The main objective was to set out rules of economic and environmental conduct for the nations of the world in the 21st century.

The 128 Southern Hemisphere nations, known as G-77, started off the negotiations with demands ranging from debt forgiveness, free technology transfer; and fixed cartel prices for oil and other exports, to 1% of wealthy nations' GNP to be put into a Global

Environmental Facility account for the UN' "Agenda 21" programs. The U.S. uses 6.2 billion barrels of oil each year. 58% of it is imported, mostly from nations aligned with G-77.

Another political theme sung at this conference was support for the nations of the former Soviet Union. Some \$6 billion was raised to prop up the ruble; and a scheme was rumored to be underway to provide several billions in aid to fix up the decaying nuclear reactors of the oil Soviet Union. Distressingly, most of these funds are purportedly slated to keep existing nuclear plants operating rather than, for example, clean up or at least contain Chernoble. It was noted that the dismantling of Russia's nuclear weapons could provide a large inventory of enriched uranium that could be sold to and utilized in some 330 nuclear power plants worldwide. This would enable the world to continue using nuclear energy...despite the imminent danger of radiation and pollution from the spent fuel, accidents at plants, etc.

Unfortunately the Rio conference did not produce a leader to bring the countries together under the Earth Charter and Agenda 21. The environmental groups that assembled either collapsed under a lack of leadership and debt, or were vague and incomplete in their solutions. Southern hemisphere countries were more interested in moving the UN environmental agencies (and maybe the entire UN) to Africa or Germany than the important protocols being envisioned. And the one country that could have lead the world was left impotent by 50 of the Fortune-500 CEOs. That country was the US, lead by George Bush. To our embarrassment, the US eliminated most of the paragraphs on renewable energy from the conference recommendations. Many of the oil

companies were said to be negotiating for access to some of the oil fields in former USSR countries; but little if any mention was made about the need for oil companies to clean up their own pollution...or to move towards non-polluting hydrogen for fuel purposes, leaving their oil reserves for petrochemicals, polymers, medicines, and other more durable and noble uses.

A new commitment to renewable energy resources should have been the most important news in Rio. Instead the agenda from the UN calls for policies that would induce the world to increase its productivity and efficiency. But this suggests that the wealthy will use even more resources, currently fossil fuels and nuclear energy. The UN agenda would have conservation the key instead of non-polluting fuels, and in a few decades we will be in the same boat again.

What was clear from Rio was that the problems, political and otherwise, facing the world are acute; and the need for immediate action is critical. The American Hydrogen Association can only suggest the solution — Hydrogen; from solar, wind and biomass and other renewable energy resources. The challenge, then, is to move the world to understand and adopt this solution. Maybe the next Rio will change the world with this solution.



interested readers throughout the U.S. and to over a dozen foreign countries.

It is particularly striking to me that, as I notice what was discussed at WHEC-8, two years ago, and compare it with some of the key topics of WHEC-9 just completed, that there has been a significant change. Two years ago, the topics of discussion among the world's leading scientists and authorities on hydrogen were largely still academic, with the highly-technical jargon interspersed with lots of "possibly's" and "potentially's". By contrast, the focus of talk at Paris this past June was reports of what's been done, the thousands of kilometers of road testing with hydrogen-powered vehicles, the successful generation of thousands of kW's of solar electricity and, ultimately, large quantities of liquid hydrogen, etc. And the prevalent words were in phrases like "commercially feasible" and "in the market in 1994".

I would like to think that we at AHA have played a role in helping this theory-to-practice transition begin. It is, of course, only a beginning. Much more needs to be done to get the world to adopt the clean, renewable solar-hydrogen solution. I am pleased to have been a part of this pioneering effort, and I hope my efforts in helping chronicle the progress have been useful. And finally, I am particularly grateful to the many people who have helped by contributing articles, editing and proofing, putting the issues together, and making sure they reached the membership and the public.

Dear Bob,

AHA never says good-bye. We only say thank you for all that you have done. You have given of time, talent, and money to help AHA get started. AHA has a special sticky glue - our hearts - and when you start to miss the action...or just miss us, we'll still need you.

AHA and the Hydrogen Today staff.

The Hydrogen Association

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Hydrogen Handbook

Get Ready To Run Your Car On Hydrogen!

— Herb Hayden and Roy McAlister

An excellent question, often asked at AHA, is how can one begin his own hydrogen revolution by converting his own car to run on hydrogen, and stop emitting carbon dioxide and other hydrocarbon pollution products. Many different engines and cars have been converted to run on hydrogen. In fact, engines were tested on hydrogen before World War II. Unfortunately, most of the engine conversions used devices designed for natural gas or propane, which do not work well with hydrogen. These engines invariably suffered from backfiring, because the hydrogen/air mixture would ignite in the intake manifold, and had less power than with gasoline. Water usually was added to the mixture to prevent the backfiring, but this made the vehicle more complicated, and did not help the power problem.

But many engines have been successfully converted with better design approaches. A most notable example is the Zweig Hydrogen Pickup Truck, which was converted to pure hydrogen operation in 1975, and has run on nothing but pure hydrogen since then. This conversion took advantage of a unique engine with an extra intake valve which was used to handle the hydrogen separately from the air, thus eliminating the backfire problem. The hydrogen is stored in a simple pressure tank in the bed of the truck. This vehi-

cle runs smoothly and reliably, and shows that hydrogen vehicles do not have to be complicated or expensive, but just have to be designed and made properly. The Zweig Hydrogen Pickup now is an AHA demonstration vehicle, and appears at many AHA public exhibits.

Another newer approach has been demonstrated by Mazda using their rotary engine. The rotary engine design also keeps the hydrogen and air separate until introduction into the combustion chamber. This car stores the hydrogen in a "hydride" tank, which uses metal powder to absorb the hydrogen and so has a smaller volume than a pressure tank.

A more promising way to convert existing cars to run on hydrogen is being prepared for demonstration by AHA. Standard piston engines will be fitted with hydrogen fuel injectors which will efficiently deliver the fuel to the cylinders exactly at the moment needed, similarly to the way a Diesel engine works. This approach is expected to demonstrate hydrogen performance and efficiency superior to regular gasoline operation - and the exhaust will be pure steam!

Later, carbon absorption technology will be used to make lighter, longer-range fuel tanks. And hydrogen fuel cells, which convert hydrogen directly into electricity, will be used to replace

heavy batteries in electric vehicles and permit quick refueling instead of slower recharging.

Fortunately, the majority of parts for converting cars to natural gas such as the storage tanks, pressure regulators, and delivery tubing are often suitable for hydrogen. Therefore, we can suggest that if you decide to purchase or convert a vehicle for natural gas, make sure that the fuel tank and entire fuel system is rated for hydrogen, and has the highest tank volume and pressure rating available. This way, the fuel system will be ready when a hydrogen engine conversion is available. In the meantime, natural gas, which the fuel most nearly like hydrogen, can be tuned for low emissions, and can be mixed with about 10% hydrogen, called Hythane, for even lower emissions.

Soon AHA will publish the results of emissions and performance tests of mixtures of hydrogen with natural gas. Following this we will publish results of operation on 100% hydrogen. As the demand for pollution-free energy grows, the hydrogen products and services will soon become available. So let your car company and energy supplier know that you are ready now!

Watch for future articles with more about how to convert your car to run on hydrogen.

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