

HYDROGEN TODAY

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Page 1

AHA'S HYDROGEN CAR RACING PROGRAM MOVES INTO TESTING PHASE

By Demetri Wagner

TEMPE, AZ. AHA's hydrogen car racing program is moving into an exciting test phase, made possible by the addition of an engine test cell and dynamometer system installed in the Tempe headquarters research laboratory.

This Technology Demonstration laboratory will soon be able to do fuel and equipment evaluation and complete engine dynamometer testing. The test cell has a Quad Four engine currently set up for "benchmark" evaluation, using gasoline.

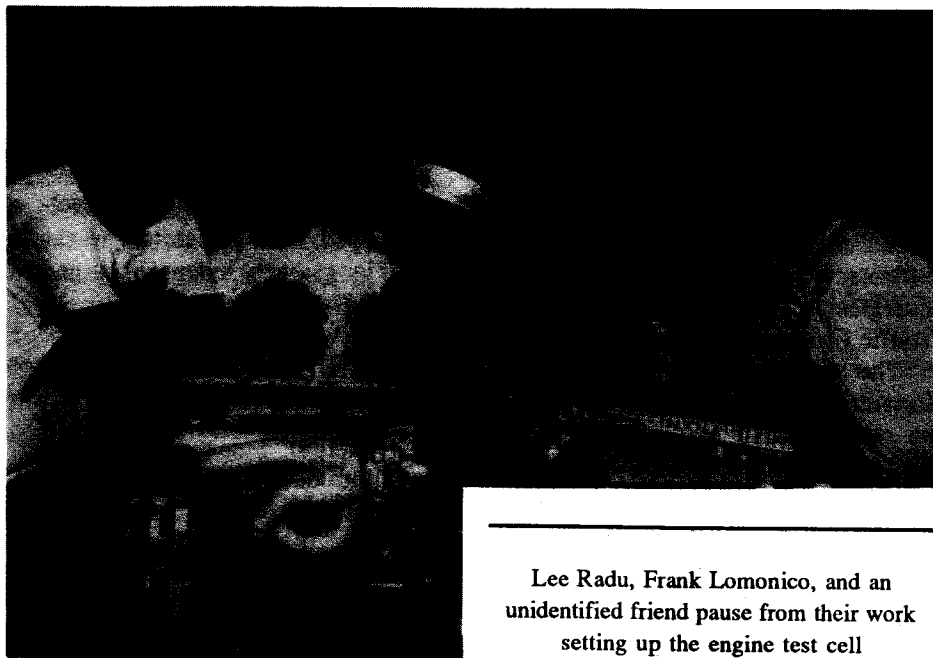
The Quad Four engine and test cell were donated by the World Survival Foundation and Trans Energy Corporation. Included is a complete Quad Four engine, identical to the engine installed in the Oldsmobile Cutlass Supreme donated as a Hydrogen demonstration and racing vehicle. This engine is mounted on a movable test stand and hooked up to an engine cooling system that is mounted remotely outside the test building and connected to the engine with hoses.

Engine controls and monitoring instrumentation are installed in an adjoining room. Data collected on the test stand will be fed into a Macintosh computer system for "real-time" tabulation and analysis.

This test cell development project has involved the dedicated efforts of several AHA members: Claude Colbertson mounted and fabricated many parts for the engine stand; Frank Lomonico and Lee Radu assisted me in the mounting and wiring of the engine's electronic control unit and

related accessories. Ted Honning joined the team to assist in the ongoing efforts to fine-tune the engine and test cell operation.

The test cell will initially be used to collect base data on engine performance and emissions using gasoline fuel. This will be followed up with tests on the engine converted to run on pure gaseous hydrogen.



Lee Radu, Frank Lomonico, and an unidentified friend pause from their work setting up the engine test cell

This laboratory test stand provides the basis for a solid program of systematic engine research and documentation, performed under safe, controlled laboratory conditions. This professional approach provides a strong foundation for the AHA hydrogen vehicle demonstration and racing program. Before a race car ever touches a wheel on the track, its success will be ensured by hundreds of hours of lab and bench testing.

Racing Sponsorship Proposal

On another, parallel effort path, the first draft of the H₂ Racing Sponsorship Proposal is nearing completion. Lee Radu and Rick Smith have designed a knockout color front cover. The fifteen-page proposal also contains many color photographs that greatly enhance the image of the overall package.

Preliminary copies have been given to a few candidate sponsors for initial review, and response has been very favorable. Quality, professional people and companies with excellent automotive and racing background and experience are considering our request to become advisors and sponsors.

(Please See "Racing Program" on Page 3)

AHA PRESIDENT TO ATTEND WORLD CLEAN ENERGY CONFERENCE IN SWITZERLAND

Roy McAlister, AHA President, has been invited to attend and participate in the World Clean Energy Conference in Geneva November 4 -7. The conference, which is sponsored by the United Nations, will, according to McAlister, "focus on climate change and the fact that we won't run out of fossil fuels soon -- but we'll ruin the world by continuing to burn them."

"There was a time in the past," McAlister observes, "when carbon dioxide occurred in much higher concentration that it does today, creating an environment we would consider hostile. Fortunately, green plants have helped to make our planet able to sustain the types of life that inhabit it today. However, humankind has destroyed much of this plant life through development, and the resulting conditions that presently exist threaten man's continued existence."

McAlister will participate in working group/round table discussions as well as attend sessions on "Environmental and Efficiency Improvements with Polluting Energies", "Clean Energy Impacts on Traffic Concepts", and other topics.

The conference's main purpose is to formulate a "Global Energy Charter" to be recommended at the UNCED (UN Conference on Environment and Development) "Earth Summit" in Brazil next June. While the objectives of the Global Energy Charter have already been established, the means for achieving its goals will be proposed at the Geneva conference. All energy options will be examined to determine how they can be made cleaner and safer or if they need to be replaced by other solutions.

Conference organizers hope to devise internationally standardized methods for determining the "external costs of environmental, health, and other damages due to emissions" as well as a system for compensation of those damages by means of an "Ecotax/Composite Indexing System", coupled with a dedicated fund for the financing of environmental-

ly-compatible energy systems and energy efficiency improvements, particularly for developing countries that would otherwise be unable to consider them.

McAlister will present a report on the conference at the November 20 AHA/ASU Chapter meeting in Tempe. (7 PM, Student Svc. Bldg. Amphitheatre.)

H₂ STUDY PROGRAM BEING DESIGNED

The Education Committee of AHA has been working for the past several months on the development of a special curriculum for high school students focused on solar hydrogen energy and renewable resources. At its recent meeting at Ironwood High School in Phoenix, the committee made the following decisions:

- ▶ Three units would be developed, each one to two weeks long, each independent and self-contained.
- ▶ These units would cover Social Studies (including the economic and social costs of energy); Industrial Arts; and Introduction to Science -- All About Hydrogen.
- ▶ Plans for the Science unit include Background Information for the Teacher; Suggested Lesson Plans (with a list of equipment for each activity and a Teacher's Key); Student Information Packets; and Student Activities Packets that will include labs and classwork.

The Education Committee has additional meetings planned during the next month to expand on these plans and develop more details. For more information on this subject, call the AHA office in Tempe.

New AHA Chapter Started In Tucson

September 3, 1991, marked the official beginning of a new chapter of the American Hydrogen Association in Tucson, AZ. A group numbering nearly 100 met at the Nanini Public Library for an organizational meeting. AHA President Roy McAlister was guest speaker.

Jim Wolford, acting as temporary chairman, formed an organizational committee; Steve Dirks was elected committee chairman.

For more information about this Chapter, call Jim Wolford at (602) 742-3126; Steve Dirks at (602) 298-0417; or Al Anzaldúa at (602) 742-0173.

CRISIS IN THE WORK FORCE

Those of you on our Arizona mailing list may note an enclosure with this issue of *Hydrogen Today* of a "Help Wanted" ballot related to increasing the competitiveness of our work force.

This survey is sponsored in part by local Phoenix newspapers, Maricopa Community Colleges, and KTVK-TV.

We at AHA are keenly concerned about this topic and believe that an educated work force and educated consumers are critical to the future of our country and world. If you find such a ballot, please take a few moments to fill it out and send it in.

Racing Program Proceeds

(Con't. from Page 1)

Of immediate need in this racing program is a reasonably-high-powered Macintosh computer (Mac IIci or better) for use with the engine test stand. Other equipment needs include two light-weight aluminum CNG tanks (one for the racing car and one for the tow vehicle); and an enclosed 30-ft. racing tow trailer that will be needed at race time in 1992. If you can help us with getting donations or special purchase discounts with these items, or know of some sponsoring company or organization that could help, please contact the AHA office in Tempe or myself..

In 1992, many Clean-Air Races are being scheduled. With good support from new and renewing members and sponsoring companies and organizations, the American Hydrogen Association will be able to participate with what promises to be a dynamic entry -- a powerful race car with fast acceleration, high cruise and top speed ... and essentially "zero" emissions.

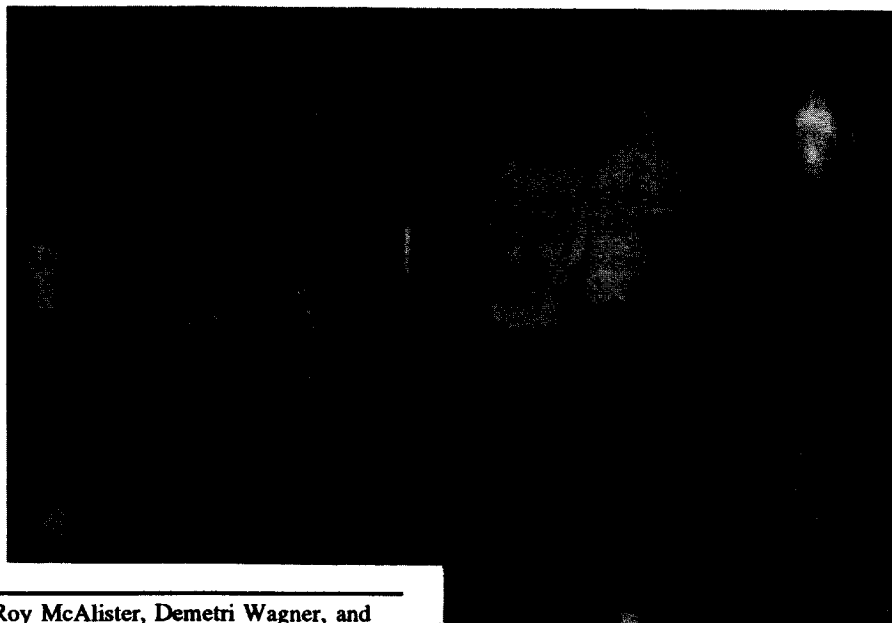
Write me at the AHA offices if you are interested in getting a sponsorship proposal (they will cost \$12 -- color printing is expensive). With your continued support, 1992 will be a winning year for AHA -- in a multitude of ways!

ELECTRIC CARS NOT AS POLLUTION-FREE AS YOU THINK

By Irv Jorgenson /Roy McAlister

During the past month or so, virtually every news magazine, TV news centers, and major newspaper, it seems, has been reporting on electric cars, citing their great virtue of being essentially "pollution-free".

With all these stories and the related news hype that has surrounded the reporting of these stories, it seems important to, as famous news commentator Paul Harvey would say, "hear the rest of the story".

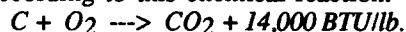


Roy McAlister, Demetri Wagner, and Clara Van Ausdal are shown above working on the Quad Four Engine Test Stand at the AHA Research Lab.

Will we gain anything in the war against pollution by going to electric vehicles ... or will we create another monstrous debacle?

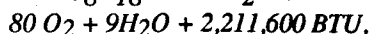
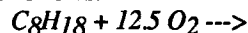
If the electricity were to come from non-polluting energy sources such as solar or hydropower, there wouldn't be a problem. But in many places, a great deal of the power comes from coal-fired power plants.

Coal is mostly carbon and it burns according to this chemical reaction:



Each pound of carbon produces 3.66 pounds CO₂, which implies that every 3,825 BTU (14,000/3.66) generates one pound of CO₂.

Gasoline is basically C₈H₁₈ and burns as follows:



which equates to 6,283 BTU/ lb CO₂.

Now, cars are roughly 25% efficient running on gasoline. Power plants are about 35% efficient running on coal; and distribution is about 95% efficient; and electric motors run with about a 90% efficiency -- all of which results in a "BTU to the wheels" indicator for internal - combustion

engines of 6,286 * .25 or 1,571 BTU/ lb. CO₂.

For electric vehicles, running on electricity generated in coal-fired power plants, the same indicator is 3,835 * .35 * .95 * .90 or 1,145 BTU/ lb. CO₂.

All this mathematics proves that burning gasoline makes more propulsion with less CO₂ pollution.

This analysis does not take into account the added pollution in the form of sulfur oxide, nitrous oxide, and particulate matter generated at the power plant site by the burning of coal, nor the impact of strip mining, etc.

By contrast to either gasoline-powered cars or coal/power plant/electric cars, the same vehicles running on solar hydrogen produce almost no pollutants.

Why have an electric car, then? Well, at 4 cents/KWH, the electric utilities will stand to make an additional \$8.4 million in revenue by producing the electricity needed for every 10,000 electric cars. No wonder the public utilities are strongly promoting these things!

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Editorial:

The views expressed below are those of the author and do not necessarily reflect the views of the American Hydrogen Association. Opposing views are welcome.

BAD NEWS FOR THE EARTH'S PROTECTIVE OZONE LAYER

By Harry Braun

Of all of the environmental problems that now threaten the Earth's biological life-support systems, none is more serious than the depletion of the stratospheric ozone layer that shields the Earth from the short wave radiation that would otherwise sterilize the surface of the Earth.

"We've got a deeper ozone hole than we have ever seen before."
--- NASA

Recent reports from NASA have confirmed the fears of most atmospheric scientists that the stratospheric ozone depletion is now reaching critical levels. Concentration of ozone in the upper atmosphere over the South Pole has fallen to its lowest level since measurements began 13 years ago.

According to Dr. Arlin Krueger, an atmospheric scientist with NASA's Goddard Space Flight Center in Greenbelt, MD, "we've got a deeper ozone hole than we have ever seen before." Dr. Krueger is the principal investigator for the Total Ozone Mapping Spectrometer aboard NASA's Nimbus-7 satellite.

Scientists have also reported that for the first time the ozone hole, which is larger than the continental United States, has failed to shrink this year.

The increased ozone depletion is "extremely dangerous".

Dr. Robert Watson, director of NASA's Earth Process Studies, recently participated in a United Nations study conducted by 80 scientists from 25 countries. His report adds more bad news: "We now see a significant decrease of ozone, both in the northern and southern hemispheres, not only in winter, but in spring and summer -- the time people sunbathe, putting them at risk for skin cancer; and the time we grow crops." Watson concludes by saying that the increased ozone depletion is "extremely dangerous".

Other Disasters Reported; More Probable In Future

Within the same week, news reports of disastrous fires in the Oakland (CA) hills killed over twenty-five people and left thousands of families homeless. These fires were the result of unseasonably warm winds and over five years of serious drought that created firestorm conditions -- another scary piece of evidence of major climatic changes that are underway -- changes that are strongly suspected to be the result of atmospheric pollution and a build-up in carbon dioxide and other "greenhouse gases".

What all this means is that the global environmental problems are far more serious than most people suspect, and they are worsening at an exponential rate. In many respects, we are looking down the barrel of a gun. If, as a result of climatic changes, for example, our food supply is dramatically reduced, it is reasonable to

assume that, within a short time, panic will ensue, and chaos will likely follow.

Major Changes Required

This reinforces the view that *major* changes must be made. While a transition to renewable solar-hydrogen resources and systems will resolve many of the most serious environmental problems over the long term, the most important short-term actions will likely involve the development of indoor hydroponic agricultural systems that will function regardless of climatic conditions caused by global warming or ozone depletion. Such systems have been successfully demonstrated on a small scale; the challenge is to build enough within the short time we probably have left.

The family of chlorofluorocarbons (CFCs) that are used in most air conditioning systems are the primary chemicals that are dissolving the ozone layer. There are replacement systems available that utilize Stirling engines that can be used to provide air conditioning for automobiles, homes, and industry. These Stirling "cryo-coolers" do not use any ozone-threatening CFCs or any other chemicals that could damage the Earth's atmosphere, and they are already developed for commercial applications.

Survival of Life on Earth Hangs In the Balance

Rather than concentrating on sex scandals, our elected officials should be holding hearings on how best to cope with the series of ecological disasters that now seem inevitable. One thing seems increasingly clear: the existing biological stable-state system is disintegrating, and the survival of life on Earth hangs in the balance.

Ed. Note: Harry Braun is a founding member of AHA and one of its most active leaders. He is also author of The Phoenix Project: An Energy Transition to Renewable Resources, a book that discusses the growing economic and environmental crises resulting from our continued reliance on fossil and nuclear fuel and suggests viable alternatives.

Letters To AHA:

Just What Arizona Needs: An Oil Refinery

Dear Editor:

I recently heard of plans that are under review with the Arizona Department of Environmental Quality for a new oil refinery proposed for Maricopa, AZ south of metropolitan Phoenix. This refinery would be used to refine sour crude oil shipped from California either by tanker or rail. Plans include, according to some reports, the use also of underground storage tanks located on the west side of the city of Phoenix..

No leaded gasoline would be refined in this plant, but asphalt and oxygenated fuels would be.

Sour crude oil has relatively high contents of sulfides and other noxious impurities.

People interested in commenting on this proposal are requested to submit their comments to the Arizona Department of Environmental Quality (DEQ) by November 18, 1991.

My question is this: How come when Arizona has all this sun and everyone wants to go towards renewable, clean energy, and Phoenix (along with every other major city in the world) already suffers from polluted air, why would anyone want to build a refinery for poor grade oil in its own backyard?

A Concerned Phoenician

Dear Concerned:

Apparently there is someone -- the owner(s) of the crude oil or the proposed refinery, for example -- that think Phoenix's backyard is a great place for this type of thing.

You are expressing some valid and logical concerns about these plans, however; AHA is not a political lobbying organization, but you might want to make your own concerns known to DEQ.

Editor

If you would like to write us, please send your letter to our Tempe offices, 219 South Siesta Lane, Suite 101, Tempe, AZ 85281, Attn: Editors - Hydrogen Today. Because of space constraints, we cannot promise that we can print your letter, but we will certainly try.

- Editor.

Hydrogen Handbook: HOW MUCH SOLAR DOES SOLAR HYDROGEN TAKE?

By Herb Hayden, P.E.

Definitions:

Kilowatt (KW): 1,000 Watts.

It is a measure of power being gathered or used at a given moment ... like while the TV is on or while the car is running. It is the most common measure of energy flow, originally used for measuring electricity but also may be applied to solar energy and to the use of fuels such as gasoline, natural gas, and hydrogen.

Kilowatt-Hour (KWH): The total energy if 1 KW is steady for an hour ... or 10 Watts are steady for 100 hours, etc. -- the total amount of power, whether used rapidly or a little at a time. A tank of gas is similar: you have a total amount in the tank available to use when and how quickly you see fit, whether it be crummy old gasoline or, more preferably, hydrogen.

Sunlight energy falls to the Earth's surface in the sunniest areas, such as Arizona, Southern California, Hawaii, Florida, Saudi Arabia, Egypt, and Australia, at the rate of about 1,000 Watts per square meter. In the more northern and southern area of the globe, it is still about 80% of that number, though interruptions by cloud cover may be more common. This rate is equal to about one healthy 100 Watt light bulb or a personal computer per square foot, about one blow dryer or toaster per square yard. One home-sized air-conditioning system consumes about the same amount of power as the Sun lays on your car's parking space in full sunlight.

Unfortunately, we aren't able to catch the full amount of sunlight energy when we convert it to electricity or to hydrogen fuel. Using the common photovoltaic ("PV") solar panels readily available these days to the

consumer, we convert about 10% of the Sun's rays into electricity. With some of the more advanced solar-thermal systems such as a "power tower" and dish-Stirling generators, we can get significantly more power converted ... from 15 to 30%. This means that the above examples of sunlight area required would upped by four to ten times those amounts. It becomes a square yard to run a computer, and a home air-conditioning system needs about 1,000 square feet (or about the average home's rooftop area).

The length of time that the sunlight falls and a device is running also figures in. During any day, the air conditioner may operate for a greater or lesser time than the Sun shines, so we gather the total amount we need while the Sun is shining to carry through the whole day -- and night, through storms, solar eclipses, etc.

(Please see "Handbook" on next page)

Hydrogen Handbook: HOW MUCH SOLAR DOES SOLAR HYDROGEN TAKE?

(Continued from previous page)

Now what about running our cars? A gallon of gasoline contains about 120,000 BTU's (British Thermal Units) of energy. This is about 35 KWH per gallon. To put 10 gallons worth of energy into your car, then, would take about 350 KWH. In hydrogen, that's about 21 pounds.

If we want this fuel to be made from the Sun, 10 hours a day, over the course of a week, we need 5 KW, or 5,000 Watts of sun-gathering PVs or dish-Stirling generators working for us by courtesy of the power utility, by a co-op or independent power provider, or at our own home. That's 5,000 Watts just for the car. Two hundred to five hundred square feet, depending on your choice of technology. Double that amount, or another 10 KW, would also provide for the typical household energy as well.

Anyway you look at it, this will require a large chunk of your roof (and possibly then some) or a patch of collection area at a utility generating field equal to about 20 feet by 50 feet. This amount of land would free a single household (with one car) from fossil fuel, from oil importation, from air pollution, and from oil spills. It also would eliminate emissions testing stations and performance-robbing smog pumps and catalytic converters from our car.

Current PV prices, after years of commercial availability, is maybe \$5 a Watt; so \$50,000 is needed here. Dish Stirling systems now becoming available are projected to be about \$2,500 per Kilowatt in the near term; this amounts to about \$25,000 to meet our one-household need. In the longer term, however, these are expected to fall into the \$1,000 -1,2000 per KW price range. With the current financing rates

being offered and allowing for maintenance, perhaps a bill of between \$150 and \$200 per month for solar energy would be a typical consumer's total energy bill.

For your car, you could use the services of an electrolyser and compressor installed either at your home or at the filling station. Although these are fairly expensive right now, they potentially can be pretty economical ... and could be spread over many vehicles if they were installed at service stations. These devices would allow you to convert solar energy into hydrogen fuel by electrical separation of water molecules, effectively storing the Sun's energy in your fuel tank, ready whenever you are.

These are rough numbers, and "real-world" installation and maintenance costs will vary depending on the stage of development of the technology and hardware and the degree of application. Storage of the energy, in hydrogen or batteries, is absolutely essential to this scenario as well, and some energy is lost in the process. But since both hydrogen and electricity are more efficient than gasoline, the real energy value can be more than regained.

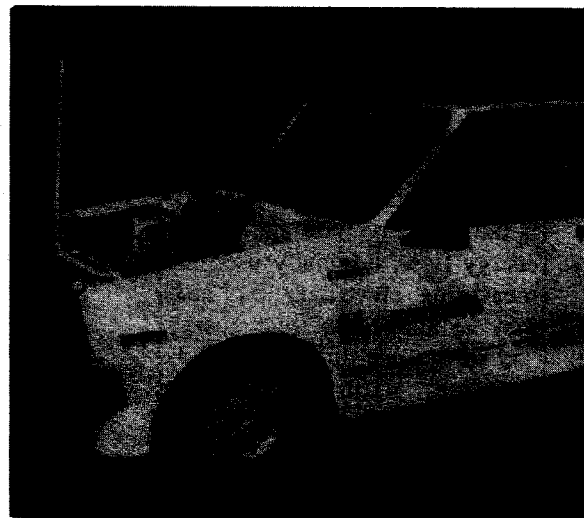
Where do you purchase these items and services? A very good question. They have been bogged down somewhere between research and the market. Our commercial marketplace has not yet addressed our need for 100% renewable, non-polluting energy.

For the good of our own economic security and technological future, let's make sure, however, that we learn to meet our own needs using these products and the abundant solar energy around us ... before we again find ourselves too dependent upon others. It's simply a matter of choice.

AHA Attends, Participates In Project Hydrogen '91 Conference

"Project Hydrogen '91 -- Launching Our Sustainable Energy Future" was the title of a technical conference held this past September 16 - 18 in Kansas City, MO. The confab was presented by the International Association of Hydrogen Energy, the American Academy of Science, the US Environmental Protection Agency, and the Missouri Department of Natural Resources Energy Division.

Attending the conference from AHA were Roy McAlister, Herb Hayden, Demetri Wagner, and Tony Goen. McAlister, who is AHA President, also chaired a Technical Session on Hydrogen Energy Technologies and presented a paper on "Direct Hydrogen Injection in ... Internal Combustion Engines".



The conference featured the LaserCel 1 prototype vehicle (pictured above) developed by Dr. Roger Billings and the American Academy of Science under a grant from the Pennsylvania Department of Energy. This vehicle incorporates an advanced design hydrogen fuel cell.

CALENDAR OF UPCOMING EVENTS

- October 23 - ASU/AHA Chapter Meeting, 7 PM, Student Svcs. Building Amphitheater, ASU Campus, Tempe, AZ
- October 27 - 29 - New Transportation for a New Century Conference, Los Angeles, CA
- November 4 - 7 - World Clean Energy Conference, Geneva, Switzerland. AHA President Roy McAlister is presenting a technical paper of Hydrogen at this major world confab.
- November 6 - 7 - 2nd International Conf. on Automotive Industry & the Environment, Brussels, Belgium
- November 12 - Transportation Fuels Workshop, American Institute of Chemical Engineers, Los Angeles, CA
- November 14 - 16 - Southwest Border States Solar Conference, El Paso, TX
- November 20 - ASU/AHA Chapter Meeting, 7 PM, Student Svcs. Bldg. Amphitheater, ASU Campus, Tempe, AZ.
Report on Geneva World Clean Energy Conference by Roy McAlister; film on "Bringing Solar Energy To Earth".
- November 21 - 22 - NGO Symposium on Food Security & the Environment, Arizona State University, Tempe, AZ
- December 18 - ASU/AHA Chapter Meeting, 7 PM, Student Svcs. Bldg. Amphitheater, ASU Campus, Tempe, AZ.
Guest speaker is Fred Ninotti from Salt River Project; topic is "SO₂ Emissions Credits for Utilities".

Some Key Events Coming Up in 1992:

- April 17 - 19 - Route 66 Cannonball Run, A Race for the Environment, celebrating the 66th Anniversary of Route 66 with a World Class Environmental and Technology Exposition, international competition of alternative-fueled vehicles, and science fair.
- April 22 - Sun Day, 1992. AHA joins Public Citizen (founded in 1971 by consumer advocate Ralph Nader) in launching Sun Day, 1992. This day highlights a major campaign advocating a national energy policy that reduces total energy use by 10% and triples the current contribution of renewable energy technologies by the year 2010.
- June 22 - 25 - Ninth World Hydrogen Energy Conference, Paris, France.
- June 26 - July 3 - Sixth World Conference on Transportation Research, Lyon, France

\$2,000 DONATION ADVANCES AHA EFFORTS

In mid-October, the American Hydrogen Association received a \$2,000 cash donation from the Haskell Fund of Cleveland, OH. Mark Haskell, a director for the Fund, noted that "In the past, most of our charitable funding has gone towards hospitals and medical research. But we have come to see the real need to fund organizations like AHA that offer real solutions to our addition to fossil energy. Hydrogen produced from solar energy is a way to end greenhouse warming and clean the air. We praise AHA for its efforts to inform the public about the benefits of hydrogen and think AHA's programs will show everyone that renewable hydrogen is the way to go."

Demetri Wagner, Project Director for AHA, observed that "This marks a great moment for AHA and all people working to implement natural energy technology. Momentum and a sense of urgency is growing. People understand that a change in our choice of energy sources needs to begin now. Like natural foods, natural energy is the energy of choice. Pollution from fossil

fuels is harming the biosphere at a rate far greater than it can repair itself. That's why hydrogen from renewable energy sources, despite its initial high cost today, is seen by many as a solution that needs to be developed now."

The donation from the Haskell Fund represents one of the largest single donations made to AHA in its 20-month lifetime. AHA during this period has grown to about 850 members throughout the US and from 10 foreign countries.

So Long, SERI ... Hello, NREL

The Solar Energy Research Institute (SERI) located in Golden, CO, has been renamed and reorganized as the National Renewable Energy Laboratory. NREL Research will focus on energy efficiency and renewable energy technology development in the four major energy use sectors: buildings, industry, transportation, and utilities. It will support the Assistant Secretary for Conservation and Renewable Energy of the US Department of Energy.

AHA congratulates our nation's newest premier research facility for the study and development of clean, safe, renewable energy resources.

Advertisement

World Power Technologies

Introduces the Whisper line of wind generators. Available in one, three, and 0.6 kilowatt models. The Whisper line is designed to supply power where commercial power would be either unavailable or too costly. As Dianne Eppler of the American Wind Energy Association noted, "There is great need in the Third World for the fulfillment of basic needs: clean water, unspilled food, vaccinations, etc., many of which require or can be facilitated by electricity. Wind generation systems such as the Whispers can help meet those needs." The Whisper line of wind generators require neither scheduled maintenance nor spare parts, further facilitating their use in remote locations.

The Whisper wind generators require only 7 MPH of wind to being producing electricity but can withstand 120 MPH storms, harsh marine environments, and extreme temperatures.

*Free brochures are available from
World Power Technologies
19 North Lake Avenue
Duluth, MN 55802
(218) 722-1492*

BECOME A RENEWABLE RESOURCE -- RENEW YOUR AHA MEMBERSHIP NOW

You may be a member who has been with the American Hydrogen Association for a long time, or perhaps you have just recently joined us. Either way, you should know that you are a vital part of AHA ... and that your membership is an essential ingredient to our organization.

Your membership contribution helps pay for something more than the printing and mailing of this newsletter. It helps us provide free information to the public at large, and lets us tell others about non-pollution, renewable hydrogen fuel, and clean solar-based energy. Your membership helps make others aware of the opportunity for a better worldwide economy and a world with a bright future based on technologies and lifestyles of a sustainable civilization.

It will take a lifetime of work -- to build the solar energy and hydrogen fuel systems and to change our cars, homes, industries, and farms to become benign to the environment. The members of AHA realize it is *our* challenge, one that cannot be done with a single year's support. Please keep your AHA membership current ... and help us lead our country and world to a brighter and more durable future.

The Hydrogen Association
dba The American Hydrogen Association in the United States

AHA CORPORATE OFFICERS:
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British Columbia: J.H. (Joe) McAlister (604) 627-1650

**LOGOS, T-SHIRTS, BUTTONS, AND
BUMPER STICKERS**

If you have a great idea for a logo for the American Hydrogen Association, or have a new T-shirt or button or bumper sticker in mind that will help promote clean solar-hydrogen energy in a fun way, send us a sketch of that idea. If we select your suggestion, we'll offer you \$100 to prepare the logo or T-shirt artwork or give you \$25 for a button or bumper sticker design ... plus a few freebies.

The best ideas are colorful and deliver a message in a simple way. Send your ideas to AHA ARTWORK at the AHA office in Tempe, AZ.

It's art for renewable resources!

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