

Hydrogen Today

"Clean Energy For A Better World"

Official Publication of the American Hydrogen Association • 216 S. Clark Drive, Suite 103 • Tempe, AZ 85281 Vol 4, No. 2 1993

Stretched-Membrane Plastic Technology as a Solar Concentrator

Sandia Technology 1992

A new solar concentrator, a mirror that reflects and concentrates sunlight, promises to reduce the cost of reflective concentrators for solar thermal systems. Sandia and Dallas-based Solar Kinetics, Inc., are developing an innovative concentrator that uses a polymer membrane instead of the traditional glass to reflect the sun's rays. An underlying metal membrane provides the parabolic shape required to focus the



Continued, page 7

What's Inside?

- 2 -
Inside the AHA
 - 3 -
Fuel Cells
 - 5 -
Beloved Newsletter Sponsors
 - 8 -
Hydrogen Business
 - 12 -
Project Energy '93
 - 14 -
DOE 5-Year Plan
 - 17 -
Making Fuel From Waste
 - 19 -
Upcoming Events
- and more...*

NATIONAL HYDROGEN ASSOCIATION SUPPORTS INDUSTRIAL DEVELOPMENT

— by Marcia Presley

Washington D.C.

On March 24-26, the National Hydrogen Association hosted the 4th Annual U.S. Hydrogen meeting in Washington, DC. It was an opportunity for industry people interested in supporting a transition to hydrogen to get together and discuss their progress and goals. The meeting was attended by AHA President Roy McAlister and AHA member Demetri Wagner. It was sponsored by the Electric Power Research Institute, National Renewable Energy Laboratory, NASA, South Coast Air

Quality Management District and the US Department of Energy.

Congressional Champions

A very encouraging sign was the additional sponsorship by nine members of Congress: Senators Daniel Inouye (D-HI), Tom Harkin (D-IA), Harry Reid (D-NV), Jeff Bingaman (D-NM) and Daniel Akaka (D-HI), and Representatives George E Brown, Jr. (D-CA), Robert S. Walker (R-PA), Vic Fazio (D-CA) and Harris Fawell (R-IL). The keynote speakers for the meeting were Senator Harry Reid of Nevada

Continued, page 6

BIGGER, NASTIER AND SCARIER THAN JURASSIC PARK

— by Roy McAlister

Jurassic Park is a scary story about what might go wrong if we expose our grand children to monsters from the age of dinosaurs. We may be doing something on an immense scale that can be even nastier and scarier than bringing back dinosaurs for an amusement park. We are bringing back dinosaur carbon and releasing it to the global environment.

Dinosaur-age carbon is released each time we burn coal, oil, or natural gas.

The result of adding dinosaur-age carbon to our atmosphere may be more devastating than the wildest tale about blood thirsty dinosaurs.

Continued, page 9

Inside the AHA....



— John Gotthold - Secretary, Silicon Valley Chapter

The Silicon Valley Chapter of AHA has made several attempts to attract support for building a demonstration vehicle powered by Hydrogen stored in Hydrides and Fuel Cells.

The initial attempt was based on the fact that General Motors Saturn division had miss-produced several thousand Saturn cars by using a bad antifreeze mix. We and the EAA hoped to get one of those shells donated, because we didn't need the gasoline engine anyway. So we announced the project at SEER 1992. But it didn't happen because General Motors decided to crush up all those Saturn cars.

The second attempt was this spring when we decided to build a mockup of a proposed Hydrogen Powered kit kar base module called the "Hydrogen Spirit". The idea there was for a base frame storing Hydride tanks, four identical independent suspension, wheel break units, and a fuel cell electric motor power pack that could be mounted either in the front or rear of the vehicle. An on board electrolyser was to be the means of refueling and thirteen and one half gallons of water would provide enough Hydrogen to carry the vehicle 1,000 miles at a ten kilowatt rate. We were hoping that Ballard of Canada or Energy Partners of Florida was going to come up with an affordable fuel cell, but so far that hasn't happened so we decided to build what we could, i.e. the Micro Cell, and see if we could attract some support. An ad in the paper got us interviews with a couple of Real Estate based Venture Capitalists, but they couldn't see it as an investment, without being able to take a drive in the car first. Stick to real estate boys!

The third attempt has come about from that ad. A race car developer in San Jose, was looking for something with more pizzazz than just another fast pollute mobile, so we got together and decided to design a Zero Emissions Vehicle based on race car technology. A few meetings with members of the EAA and we have design worked out that will provide a Hydrogen powered electric car that will carry two passengers, have a top speed exceeding 100 mph, and a range of about 500 miles and a weight of less than 1500 lbs. The shell will make it very aerodynamic. Several professional fund raisers are seeking sponsors for the project. Harry Braun's Gen set Consortium is also looking at the project as a possible Hydrogen transportation demonstration project. Unfortunately the car project will not proceed unless we can attract a couple of hundred thousand in sponsorship but the idea has already been created and along with the Hydrogen Spirit kit kar idea they will sometime see the light of day.

More people are beginning to get the idea that the times they are a changing. San Francisco, CA just experienced two days in a row of 99 degree weather, the first time in history. The old Greenhouse Effect is perking along. Vice President Gore is beginning to have an effect with the signature of the Rio treaty by President Clinton, and a Greenhouse emissions reduction plan is supposed to be announced by Gore in August. Hydrogen may yet get the support it deserves. ❖

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

AHA CORPORATE OFFICERS:

President: Roy E. McAlister, P.E.
V.P. Research: Harry Braun
V.P. Engineering: Herb Hayden, P.E.
Secretary: Kathy McAlister
Treasurer: Roland Darr
Accountant: Steven L. Loney, C.P.A.
Newsletter Sponsorship: Kathy McAlister

Hydrogen Today
Official Publication of the
American Hydrogen Association (AHA)

216 South Clark Drive, Ste. 103
Tempe, AZ 85281
(602) 921-0433 • FAX (602) 967-6601

Printed in U.S.A. Copyright © 1993 AHA
Reprinting is permitted with credit given

The Show That Never Ended

— Leroy Essel,
Southern California Chapter

The historic Zweig hydrogen pickup left the Eco Expo L.A. Convention Center with Paul Staples and James Provenzano heading to Washington. The hydrogen pickup was scheduled to be on display at the US Senate Hydrogen Hearing and the National Hydrogen Conference. CNN News showed the hydrogen pickup as a solution to pollution.

Clean Air Now and Xerox Corporation sponsored the crew and the driving expenses. Xerox Corporation plans to construct a solar hydrogen generating facility at the Xerox El Segundo site. This will be a fueling station, open to the public, to power fleets of clean burning hydrogen vehicles. Dr. Zweig, M.D. and President of Clean Air Now, endorses this project as a way to clean up the air in the Los Angeles Basin. Their sponsorship of the hydrogen pickup in Washington D.C. enhances public awareness, acceptance, and aids encourages commercial application, implementation and economic development. Thus making this "The Show That Never Ended" it is Just Beginning.

Nearly ten billion dollars per year in health care costs are related to air pollution in the L.A. region. The South Coast Air Quality Management District (SCAQMD) is responsible for cleaning up L.A.'s smog. The SCAQMD is currently working on a similar project with U.C. Riverside and strongly supports this application at the Xerox El Segundo site.

A big thanks to all. ❖

Hydrogen Today

Edited by: Herb Hayden
Cartoons by: Carolyn Presley
Layout by: Alan Margolis (PC Services)
Printed by: . . . B&B Printery (the B)

FUEL CELLS

— *John Gotthold, Secretary, The Silicon Valley Chapter*

Since starting the Silicon Valley Chapter of AHA in March of 1992 we have been preaching the good word about Hydrogen. In 1992 our chapter put on displays at three shows and this spring we did three more and were enthusiastically received. In fact our booth was the busiest one at most of the shows. We also held our monthly meetings and attracted between ten and twenty-five prospective new members to each. But as our story was told we kept hearing the same complaint over and over. "Great theory but where's the beef?", meaning where are the technological components that would allow a person to actually do something with Hydrogen instead of just talk

about it. So we became determined to make the technology started up the learning curve. The first step was on coming back from SEER last year and thanks to the loan of an Invader hybrid electric sports car by Roy Kaylor of Kaylor Energy Products. in Santa Cruz, CA, and the assistance of several members of the local chapter of EAA (Electric Auto Association) we added Hydrogen to the Invader and had the only vehicle in Silicon Valley capable of running on Electricity, Gasoline and Hydrogen.

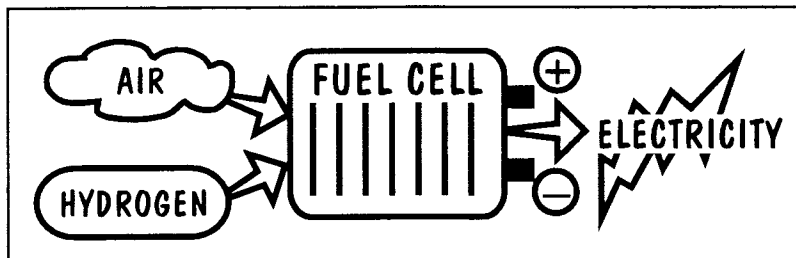
We learned a lot from that effort, but then realized that we had to keep our efforts dedicated to the Solar Hydrogen energy economy as directly as possible. This meant building the basics, Solar electrolyser, Hydride storage, fuel cell, catalytic burner for a complete system. Since none of the parts are available we had to learn the technology from the theory up and then the practicality of the materials to actually build working units.

Once Paul Warsitz of Warsitz Enterprises joined our chapter the practical application started to accelerate. Joe Jowdey got a connection with Los Alamos Labs and I talked us

into an invite to visit. A mad dash to New Mexico and conversations with the Los Alamos transportation fuel cell research team gathered up the public information and means of interpreting it and for the first time we had a practical method to build an affordable PEM (proton exchange membrane) type fuel cell. A few more months of gathering up the materials, then a few more months delay while we did displays for this years shows, and we started seriously working on developing fuel cells in the micro sizes and decided that due to the expense of the materials (since none of them are in production) we would try to spin off a company to build small fuel cells for the education market.

environmental conference in San Jose, and invited him to our meeting. Congressman Norm Maneta, who is the current head of the House Transportation Committee, sent a top staffer, and we were very happy that when called upon to demonstrate our fuel cells both of our models fired right up and spun the electric motors like they knew how.

We did another demo for the American Association for Fuel Cells in Palo Alto and have attracted the attention of Lockheed Corporation, and FMC Corporation as right now our little operation produces the only working fuel cells in Silicon Valley.



We are going to send beta site test units to Tempe for certification and to the Southern California chapter for display by the end of June. A proper celebration for the Fourth of July, to become the only

independent company to ship fuel cells in the United States, that hasn't been supported by millions of Government dollars.

The technology is very simple and at the same time very difficult. The PEM fuel cells are strange critters and have a water balance problem as bad as a person. They have to drink water along with their Hydrogen and go to the head just as often, but we can make them work, at least on the small scale and they will become available to educate people all over the world as to the reality of turning Hydrogen and air into electricity and water.

We have also proceeded with the design of small electrolyses and Hydride tanks and hope to have both of them working by the end of September. Then the Solar Hydrogen energy Economy will be demonstrable, at least in miniature. ❖

On Saturday, the 8th of May, 1993, after our regular AHA meeting, several members came back to the lab and lent assistance and by ten o'clock that evening we had a fuel cell that actually worked and turned Hydrogen and Air into electricity and water. What a thrill!! The following two months have been spent building production tooling and trying to perfect the production process and to increase the output of the fuel cells. It has not been easy as one step forward has been accompanied by two steps back on several occasions, but progress has been steady and the voltage and amperage output is steadily rising.

The greatest thrill so far was the evening that we had scheduled a demo of the micro fuel cells for the car development team at RACE TECH Engineering in San Jose, and just by circumstance our member Mike Ausollos, ran into Roy McAlister at an

Silicon Valley Chapter of AHA

— John Gotthold

In April the Silicon Valley Chapter of AHA did two Earth Day shows. The Stanford University Earth Day, which would have been great except for the fact that a nice storm was passing through the area and the weather varied from bright sun to high wind to cold clouds and rain several times during the day. Our chapter came equipped with a gazebo tent with a cover so we spent most of the day taking the cover on and off to protect our materials from the rain and wind.

Earth Day, San Jose, was held in the downtown civic center park. The weather was great, except for the higher rate of sunburn due to lack of Ozone in the stratosphere. Many times we heard the comment that the large auto companies, the large oil companies, and the large utilities probably wouldn't let us get started with the technology. Sort of a great feeling of helplessness but universal agreement that something definitely must be done to save the planet.

In May, four of our members attended a meeting of the American Association for Fuel Cells, a non-profit group with an address of 50 San Miguel Ave, Daly City, CA 94015; phone (415) 992-3963. They claim a membership of fifty, mostly people very knowledgeable of the technology of fuel cells, with both a west and east coast branch. They meet the first Saturday of every month at the Peninsula Conservation Center in Palo Alto. The association for Fuel Cells told us that fuel cells are already being sold in Japan that come in a briefcase and act as a mobile power source. Toshiba and Sanyo are both selling them and their market is world wide.

Also some members of our chapter have formed a company called the "Hydrogen Spirit" to see if it is possible to raise serious money for production of the Hydrogen Mobility Platform on which the "Hydrogen Spirit", 1,000 mile commuter car is based. ♦

SPACESHIP EARTH CENTER

— Leroy J. Essel


Associate Producer of
Spaceship Earth Productions
22128 Germain Street
Chatsworth, CA 91311

The Spaceship Earth World Environment and Sustainable Development Center opened on April 22, 1993 at the Queen Mary in Long Beach. The Center's purpose is to be a global center for environmental activities, organizations and projects that are educational, technological and economic solutions to the current state of affairs on our planet-home. It's fundamental mission is dedicated to children and youth, and will be to inspire and empower people and organizations to take personal action to fulfill the goals of the United Nations Earth Summit, known as Agenda 21, and provide them the resources to do so.

The goal is to link together children, youths, and adults, inner cities, non-governmental environmental organizations, the United Nations and sustainable technological and economic systems and solutions. This linkage will help clean-up our local and global environment and harness the energy and voices of all viable environmental groups into a coherent

and credible voice and force of change throughout the world.

The Queen Mary is symbolic in that it floats on H₂O. Below the ship is all the fuel stored in water the world would ever need. It is ironic that all the big oil tankers and oil refineries surrounding the Queen Mary/Spaceship earth choking her with pollution. She patiently waits for mankind to wake-up to use of the safest and cleanest fuel she gently floats her crown on.

We demonstrated the Paul Diegess's hand made electrolyzer at the AHA display on board the Spaceship Earth Center maiden voyage on Earth Day April 22. The audience was mesmerized by the electric current running through the water containing a little electrolyte of Potassium Hydroxide (KOH). The tiny bubbles produced convinced the public that fire can be made from water. The posters of the solar Dish-Gen sets, Ocean Thermal Energy Conversion device and the Hydrogen Tanker pictures really showed how this transition from a fossil fuel based economy to a renewable hydrogen economy could become a reality. 

AHA Bulletin Board News:

The AHA electronic Data Bulletin Board is now on line 24 hours per day at (415) 494-3116 under the careful tutelage of Howard Smith. He has the AHA BBS interted to several other boards and networks like Heart Beat Earth and Eco Net. Hydrogen information put onto the Board will go out around the world electronically in less than 24 hours. The Modem has been upgraded to 14,400 BAUD rate and automatically resets if a lower rate modem calls in. 8 N 1 is still the standard setting. Currently we have narrowed the conferences to twelve and have taken many of the advance operation menu items off the menus so that the decision pattern of operation is simpler for most callers. The Security Levels are still NEWUSER, AHAMEMBER, and SYSOP.

Hydride Available:

There is an unlimited source of Hydride now available from Shieldalloy Metallurgical Corporation, P.O.Box 768 W. Boulevard, Newfield, NJ 08344, Tel. (609) 692-4200, Fax: (609) 692-4017. Their formulation for transportation use is called HYDRALLOY C and can be had either as raw alloy in the passivated condition or as hydride. They also have a hydride tank division and can build hydride tanks to about any description. The Silicon Valley Chapter of the AHA is working with them to develop tanks for the "HYDROGEN SPIRIT", a 1,000 mile commuter car the chapter is building.

AHA Bulletin Board

Fuel Cell Newsletter

The first issue of THE AMERICAN ASSOCIATION FOR FUEL CELLS NEWSLETTER, April 1993, is available. Following is the mission statement: "To bring together in one association both fuel cell experts and non-technical advocates in North American, to promote fuel cells; to improve communication and dissemination on information regarding fuel cells and the fuel cell industry; to promote research and development of all types of fuel cells which show promise; to realize rapid and widespread use of fuel cells for electric power generation and for transportation." There is a \$20.00 fee to enroll as a member of the AAFC, or a \$10.00 fee just to receive the newsletter on an ongoing basis. For more information, contact: The American Association for Fuel Cells, 50 San Miguel Ave., Daly City, CA 94015

AHA Bulletin Board

SHAW'S WELDING

Arc • Acetylene • Heliarc

In Shop Welding
Quality Work at Reasonable Prices

20 E. Southern Ave, Mesa AZ
(602) 964-2120

DESK-TOP PUBLISHING
GRAPHIC DESIGN
TYPESETTING

POSTSCRIPT LASER OUTPUT
CAMERA READY ART
SCANNING

TRAINING CONSULTING

PC Services

Alan Margolis
829-7803

5400 S. Ash St. Phoenix Arizona 85040
829-7803 FAX

Gas Development Resources, Inc.

Gaseous Fuel Development and Utilization

**"Developing American Fuels
for a Clean Tomorrow"**

Natural Gas, Hythane, Hydrogen, LNG, LH₂

8480 East Valley Road
Prescott Valley, Arizona 86312

SOUTHERN CAL CHAPTER OF AHA

ECO EXPO "The Environment: Engine of Economic Recovery"

For those who are unfamiliar with the Eco Expo, let me give you an idea how popular this event is to Southern California. For the third year in a row, the Southern California Chapter of the American Hydrogen Association played the leading role on center stage of the alternative fuels performance. The 1993 show itself offered over 350 varied exhibits which filled the 220,000 square foot Los Angeles Convention Center. Attendance over the three day weekend was approximately 30,000. The paid advertising campaign was over \$500,000. There was also the Green Business Conference that attracted over a 1,000 participants.

Charles Imbrecht, Chairman of the California Energy Commission gave the first morning keynote session. He read a letter from Vice President Al Gore, which set the exciting tone for the conference. Following each of the keynote sessions, sixteen different seminars were presented. Among the best attended were the South Coast Air Quality management's program on transportation alternatives and Green Retailing. A special invitation-only-session was held to discuss the creation of an Environmental Business Council for the Southern California Region.

Internationally acclaimed author Dr. Helen Caldicott, speaking on Nuclear Power and the Environment attracted a large audience. During her lecture she strongly supported solar powered hydrogen production as a clean and safe fuel. She blasted the electrical car industry for her reason that the utility companies would probably build more Nuclear Power Plants to make the electricity for all those electric cars.

Terence J. Kollman "Project Manager", Dr. Zweig, for his lifetime commitment who played a major role behind the scenes, and Leroy Essel, for beyond the AHA Call of Duty, deserve many shouts of "Encore, Encore! Bravo, Bravo! Job well done... Accolades from the friends of planet earth. It was Leroy Essel who drove to Tempe and made a turn-around trip back to California with the historic Zweig hydrogen pickup.

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!

B&B PRINTERY

4214 South 36th Place
Phoenix, Arizona
85040

Helping You Look Your Best

(602) 437-3610

*Friendly Courteous Service
Tailored to your specific needs. Stop
in for a quote.
call 437-3610*

Recycled Paper Available

- Letterheads
- Envelopes
- Business Cards
- Carbonless Forms
- Labels
- Rolodex Cards
- Door Hangers
- Note Pads
- Newsletters
- Flyers
- Brochures
- Announcements
- Posters
- Folders
- Raised Printing
- Graphic Design

AW&CO Arizona Welding Equipment Co.

*Hydrogen & Other
Industrial Gases*

Main Warehouse &
Office Location

4030 W. Lincoln St.
Phoenix, AZ 85009

(602) 269-2151
FAX: (602) 278-8607

HELP! AHA office needs donations to

NHA Supports...

from page 1

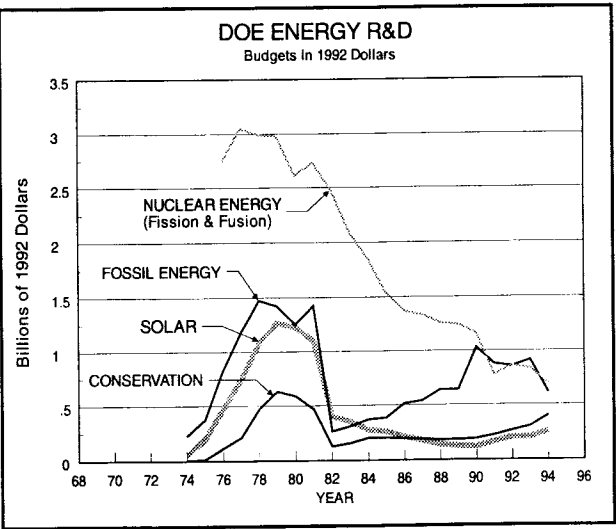
and Senator Tom Harkin of Iowa. Senator Reid emphasized that it is necessary to make the transition to hydrogen sooner than currently planned. The key to making it happen, he said, is for supporters to get involved in politics. He encouraged the formation of a grass-roots effort, and stressed the value of writing letters to congress to inform them that their constituency feels that the time to convert to hydrogen energy is now. Senator Tom Harkin presented his budget plan which would increase funding for the Hydrogen Program from the current \$16.5 million to 87 million in 1994 and \$113 million in 1995. This money would support research and development projects in

to write letters to every Senator, and to keep writing letters, to make our representatives aware of our presence and to let them know that we expect them to support the hydrogen transition.

DOE / HTAP update

Previous legislation, namely the Matsunaga Hydrogen Act of 1990, established funding for the DOE to begin developing a research program for hydrogen, and included the establishment of the Hydrogen Technology Advisory Panel to develop goals for the program and to design a plan that can best meet those goals. Two days prior to the meeting were dedicated to a discussion by the DOE and HTAP of their hydrogen program and their progress thus far.

Jim Birk, Chairman of HTAP, stressed that a "vision" is necessary in order to focus research where it is needed, to establish goals with reasonable deadlines, to provide perspective and to ensure consistent and appropriate funding. The vision as presented by Russell Eaton, designated federal official of HTAP, is that environmentally benign renewable energy sources will be used to produce both hydrogen and electricity, which will be the primary energy



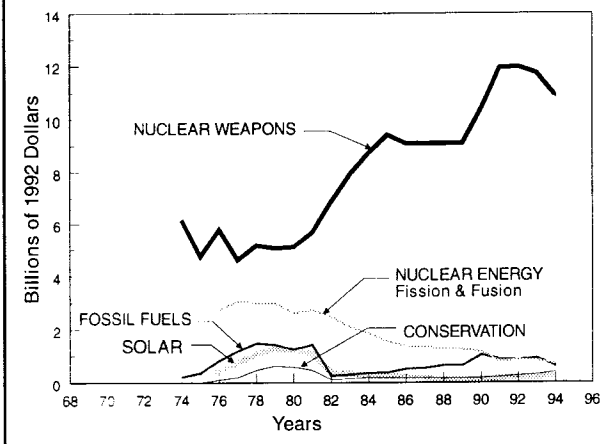
hydrogen production, storage, distribution, utilization and systems engineering as well as integrated systems experiments and demonstrations, pre-commercial scale-up and hydrogen-fueled airplane development. Rep. Robert Walker of Pennsylvania also spoke, assuring the crowd that a parallel bill in the House would ask for \$100 million for the hydrogen program. The increase in funding would not affect the national deficit, as the bill would require funding for fossil fuels research to be reduced by an equivalent amount.

These congressmen all pledged to continue to fight for hydrogen funding. Demetri Wagner said that he was very encouraged by this growing and dedicated support within Congress, but stressed that unless the grass-roots activity continues to grow, we could lose that support. He emphasized the necessity

carriers in the 21st century. Quads (quadrillion BTUs) of non-polluting, competitively priced hydrogen will be used in industrial, transportation, commercial and residential applications.

The general goal presented by both Eaton, and William Hoagland of the National Renewable Laboratory (NREL), is "to encourage and support the development of safe, practical and competitive hydrogen technologies and systems for the private sector to incorporate into promising energy pathways to meet transitional and large-scale energy market needs". To accomplish these goals the 1993 budget of the DOE, as presented by Eaton, allocated 48% of the

US ENERGY R&D VS ATOMIC WEAPONS R&D Budgets In 1992 Dollars

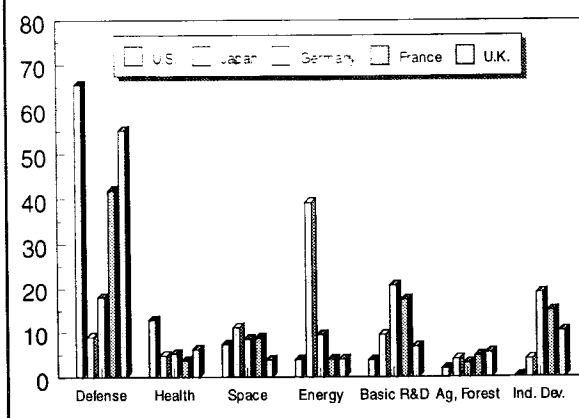


funding to research and development on hydrogen storage, 38% to production of hydrogen and 14% to systems design and development.

The NHA, however, expressed some uncertainty about the DOE plan. (See DOE Plan, this issue) Their primary concern is that the current DOE effort is only a small research effort, primarily with universities, and that not enough funding exists to do major demonstrations or to propose commercial projects. In large part this is due to the lack of Congressional support. The hope is that Sen. Harkin and Rep. Walker can pass their respective bills through Congress in order to expand the DOE's efforts. Grass-roots efforts should seek passage of these bills.

Another concern is that the energy pathway analyses used for comparisons, as conducted by the DOE, pit the new hydrogen technologies against mature fossil technologies. HTAP recommendations, as presented by Eaton, would help offset this bias by

Comparisons of US Japan & German R&D Allocations Government - Funded R&D Percent 1989 Budget



Continued, page 16

Los Alamos Designated Lead National Lab for Auto Technology

The Clinton Administration's proposed energy budget for fiscal year 1994 would significantly boost spending on non-gasoline vehicles, technology transfer, and conversion and efficiency. The budget would encourage the transfer of defense-related and civilian technology to the private sector from the department's national laboratories.

Energy Secretary Hazel O'Leary established task forces to study how the technology transfer process could be improved for seven specific industry groups. Los Alamos National Lab will lead the task force on automobiles. Contact person is Janis Haerer (505) 667-3839. The Clinton Administration hopes to be able to put up as much as \$1 billion for the development of the government/industry partnership.

Representatives of the "Big Three" automakers and various groups expressed concerns:

- Too much collaboration between United States automakers may limit

their ability to compete in the global marketplace if they have to produce a clean car.

- The actual transfer of technology from the U.S. Department of Energy weapons laboratories may not be an extensive as predicted.
- Channeling government funding through as the auto manufacturers are proposing, would eliminate the chance to coordinate efforts in the most strategically significant areas—such as engine technology—which the "Big Three" have purposely excluded.

The Administration is being represented in the discussions by J. Rollwagen, Deputy Secretary of Commerce-Designate, and J. Gibbons, head of the White House Office of Science and Technology Policy. They are talking to General Motors, Ford, and Chrysler and the U.S. Council on Automotive Research (a joint-venture automotive research and development group run by the "Big Three").

Together these groups will work toward producing practical vehicles that run on fuel cells, electricity, or alternative fuels. A joint advisory board will oversee the development of advanced batteries, ultra-capacitors, and advanced gas storage and delivery systems, as well as methanol and hydrogen production from natural gas, municipal or other wastes, and energy crops. The goal is to create new vehicle models that will help preserve U.S. auto industry jobs while protecting the environment.

The task force will also establish an advisory group consisting of key state and federal officials to design a program that will encourage introduction of prototype vehicles, coordinate state regulatory programs designed to require low-emission vehicles or zero-emission vehicles, and proposed federal regulations needed to aid state efforts.

So far the auto industry has been restrained in their response to the proposal, stating that they want to be assured of some measure of control over what technologies they develop. ♦

Stretched-Membrane Technology

from page 1

sunlight at a point. Membrane concentrators weigh far less than those using glass, and it can cost less to manufacture the system.

Sandia first developed stretched-membrane technology in the early 1980's for the heliostats in central receiver systems. A method to form the membrane into an accurate parabolic shape was accomplished in 1989. Sandia and Solar Kinetics have built and tested stretched membrane dishes of 10 meters in diameter, which are large enough to produce 25 kilowatts of electricity from a Stirling engine generator.

The stretched-membrane dish must have a precisely determined parabolic shape to have a fixed focal length. To form the dish, a flat sheet of stainless steel with a thickness of 0.004 inches is fastened to a stout circular metal ring and placed on a forming fixture. Hydraulic pressure is then gradually applied to one side of the sheet, and a vacuum is drawn on the other to deform the membrane. The ring and formed membrane are assembled into a supporting structure that looks like a quilting frame or a bicycle wheel.

A hole is cut in the center of the membrane, and a pipe, flanges on both ends, is inserted; this structure acts much like the hub of a wheel. Supporting spokes are then attached

between the flanges and the ring. An enclosure is formed by covering the back spokes with a layer of reinforced material, similar to that used for the roof of the Superdome. It provides an air-tight seal around the flange, the ring, and the spokes that protrude from the back of the dish.

The last step in the assembly is to seal a very thin conically shaped sheet of aluminized polyester to the rim of the dish and the central hub to provide an air-tight compartment between the reflective polyester sheet and the back enclosure. When a low-level vacuum is drawn on this enclosed volume, the vacuum pulls the metal membrane to a parabolic shape and the polyester membrane is drawn against the deformed metal sheet.

The National Solar Thermal Test Facility in Albuquerque, New Mexico has tested the Solar Kinetic's 7-meter dish. The dish provided 21 kilowatts of thermal power. The slope of its surface at any point deviated less than 0.14 degree from that of a perfect parabola, bettering the design goal of 0.17 degree. The measured optical efficiency was 67 percent. With the same slope error and the projected improvement in optical efficiency from shift from the aluminized reflective film to silvered film, the stretched-membrane dish should perform as well as any glass-metal concentrator. □

Hydrogen Business

The Dow Chemical Company And Ballard Power Systems Inc. Enter Into Collaboration Agreement

VANCOUVER, July 8: The Dow Chemical Company, in Midland MI, and Ballard Power Systems Inc., in Vancouver, British Columbia, announced today that the two companies have signed a Collaboration Agreement for the development and commercialization of natural gas-fueled Proton Exchange Membrane (PEM) fuel cell systems for stationary power plant applications.

Fuel cell systems produce significantly less pollution than conventional forms of power generation because the only by-products are water, heat, and lower amounts of carbon dioxide. The technology is highly efficient, typically producing more electricity from a fuel than combustion techniques. Fuel cell systems can also provide greater flexibility in installation and operations.


The collaboration agreement sets out the scope, terms, and conditions of a joint technology demonstration and market entry plan to accelerate the use of PEM fuel cells. Dow and Ballard will work together on the assembly, production, testing and prototype demonstration of these fuel cell systems.

Initial commercial markets targeted by Dow and Ballard are for natural gas-fueled PEM fuel cell systems for stationary power plant applications such as distributed power generation for commercial, industrial or residential uses. Commercial markets for PEM fuel cell systems encompass transportation, as well as stand-by, emergency and portable electric power generation applications.

A complete fuel cell power system includes a fuel supply system, an air supply system, a cooling system and a control system. Within the fuel supply system, common fuels such as methanol and natural gas are first supply system, common

fuels such as methanol and natural gas are first processed into hydrogen which is then supplied to the fuel cell. PEM fuel cells are electrochemical engines which, without combustion, convert hydrogen into electricity. Proton exchange membranes are thin, solid plastic films used as an electrolyte in the PEM fuel cell. Individual fuel cells can be combined into a fuel cell stack, with the number of fuel cells determining the amount of electricity generated. Fuel cell systems may require an inverter or power conditioner to convert the direct current produced into an alternating current required by some electrical equipment and transmission systems.

Dow and Ballard expect that their proton exchange membrane fuel cell systems will be available for sale on a commercial basis before the year 2000. The companies believe fuel cell technology will grow through the next century as public concern and government regulation for environmentally clean power generation increases, and as costs become more competitive with conventional power generation methods. It is estimated that the global PEM fuel cell market for stationary power plant applications could grow to several billion dollars in sales by the year 2010.

Dow and Ballard both bring substantial technology and expertise to this collaboration. Dow is a global leader in the membrane technology used in fuel cells. Dow also provides expertise in electrochemistry, advanced materials technology and chemical processing to the collaboration. Ballard, located in Vancouver, British Columbia, is the world leader in the development and commercialization of PEM fuel cells, and has spent 10 years developing proprietary fuel cell technology. Watch for a report on the Ballard bus, next issue! 

Hydrogen Experts To Convene In 1994

Hydrogen '94, the 10th World Hydrogen Energy Conference, will be held on June 20-24, 1994, in Cocoa Beach, Florida, at the Howard Johnson Plaza Hotel. A highlight of the five-day event is a technical/field tour to NASA/Kennedy Space Center on June 20th.

According to Dr. David Block, director of the Florida Solar Energy Center (FSEC), this will be an outstanding forum for all who seek to develop hydrogen as the global energy system. "We will be bringing together the critical mass of technical, political and economic forces needed to launch

hydrogen power-source for a sustainable future."

Individuals are invited to submit abstracts by July 1, 1993, for papers to be presented and to be published in the conference proceedings. Deadline for submission of papers is January 3, 1994.

Each day of the formal sessions will open with a single plenary session covering the topics of hydrogen production, aerospace applications, storage, and utilization. Technical sessions following each plenary will focus on programs and issues, production, storage and

distribution, utilization, and aerospace application.

Hydrogen '94 will feature an extensive exhibit of hydrogen and renewable energy-related products and services available from an international array of firms, institutions and agencies. Firms and institutions wishing to exhibit are invited to contact: Ingrid Melody, FSEC, 300 SR 401, Cape Canaveral FL 32920-4099; call: (407) 783-0300, ext 139; or Fax: (407) 783-2571. Also see the Hydrogen '94 information, elsewhere in this issue. ♦

JURASSIC PARK

from page 1

Lookout for the next *hurricane-osaurus*, *typhoon-osaurus*, and the giant snake *that crawls across Wisconsin, Missouri, and Iowa called flood-osaurus*. These giants are far more fearsome than the velocorapter or tyrannosaurus. Disasters due to build up of fossil carbon in the atmosphere cross oceans and devastate millions of homes at a time.

Our planet's atmosphere acts as a giant heat engine. Energy is trapped in the atmosphere by additions of greenhouse gases such as carbon dioxide and methane. Today there is about 30% more carbon dioxide and 100% more methane in the atmosphere than at any time in the last 160 thousand years. As more energy is added to this heat engine it does more work in the form of floods, hurricanes, and tornados. We have suffered the ravages of record-setting floods, hurricanes, and tornados that are powered by the increase of dinosaur-age carbon to our atmosphere.

Consider the following evidence of the ability of the atmosphere to collect more energy and do more damage as a result of increased concentrations of greenhouse gases.

1. Closely correlated with the exponential increases of carbon dioxide and methane in the global atmosphere are the six warmest years of the last century. 1980, 1981, 1983, 1986, 1987, and 1988 were the warmest years since 1900. During this 90 year period the global temperature has risen about 0.5°C.
2. The first five months of 1988 were the warmest on record, and March of 1990 set a new high temperature record.

3. North America has had over 600 destructive tornados and extremely damaging floods during the last year. During the last decade new records were set for highest wind velocity in a tornado. (March 13, 1990, at Heston, Kansas.) [6]

4. 1991 was a terrible year for destructive winds in Bangladesh and China. A devastating typhoon and flooding was followed by tornados. Hundreds of thousands of persons and animals were killed and countless more were left homeless as a result of this hostile weather.

5. 1992 set records for hurricane damages on the Atlantic coast of the U.S.

In 1993 record floods devastated the Missouri and Mississippi valleys of the U.S.

We have increased the world's population and dependence on fossil fuels to the extent that we burn the fossil equivalent of more than 100 million barrels of oil each day. Devastating weather extremes are evidence of abnormal solar energy collection by the atmosphere as a result of burning hydrocarbons as we search for the good life.

Depletion of resources causes inflation and conflict in our supply-and-demand economy. This depletion/inflation syndrome leads to economic hardship and suffering. As we deplete fossil reserves we impair our health and suffer from diseases traceable to hydrocarbon combustion contaminants from our industries and transportation system. Health care expenses traceable to pollution of the environment exceed the cost of fuel burned by our cars and industries. [6]

NREL Assigns New Hydrogen Program Manager

The National Renewable Energy Laboratory (NREL) has announced that Dr. Thomas M. Cawthon has assumed responsibility for the laboratory's Hydrogen Program. The current Program Manager Bill Hoagland will continue as a key member of the expanded Hydrogen Program management team.

Dr. Cawthon joined NREL with extensive senior-level technology management experience with the chemical and energy industries, most recently with Kerr-McGee. His formal education includes a Ph.D in Physical Chemistry from Princeton University and a B.S. in Chemistry from the University of California at Berkeley.



Renewable Energy Benefit Golf Tournament

The American Hydrogen Association's First Solar-Hydrogen Benefit Golf Tournament is scheduled for October 14, 1993. The National Golfer's Club, and our Northern California Chapter, will be making the arrangements. The tournament will have celebrities, giveaway prizes, and a hole-in-one prize (new car and \$250,000).

Hal Messimer, of Keystone Service in San Jose, has been the coordinator and inspiration for AHA's tournament. Hal reasoned that all work and no play makes a long day. Hal said, "With planning and teamwork, we can make this a marketing and public relations bonanza for corporate sponsors, renewables, and AHA." Should a corporate sponsor choose to help with

this program, we will do whatever we can to provide the company with the promotional mileage it deserves. We think there is a good fit between golf and clean energy. With the investment in exercise, comes the enjoyment of prosperity without pollution. The golf course is a good place to plan investments in clean renewable technologies.

October is National Renewable Energy Month. AHA plans to celebrate having fun in the sun while teaching others about renewables. In the Spring of 1994, the Second Benefit Golf Tournament will be held in Scottsdale, AZ.

For more information call Hal Messimer or Olivia Sunie at (408) 983-2690. ♦

Florida Solar Energy Center Research Targets Alternative Motor Fuels



— from the Solar Collector Newsletter of the Florida Solar Energy Center

According to the Department of Highway Safety and Motor Vehicles, there are 12 million registered vehicles in Florida. That fact, combined with all the out-of-state vehicles that bring visitors, conjures up a cloudy image of increasing pollution problems for the "Sunshine State."

Fortunately, the Florida Solar Energy Center is addressing the issue in both its hydrogen laboratory and its newly dedicated alternative fuels research laboratory. Research into hydrogen as an alternative transportation fuel surged into high gear with the dedication of the lab in April.

The goal is to demonstrate the viability of compressed natural gas as an alternative motor fuel and the reduction of pollution emissions through the introduction of hydrogen as an additive. According to Dr. Kirk Collier, director of the project, the laboratory is a result of remarkable teamwork.

Our funding is from the Environmental Protection Agency with matching funds from the Florida Energy Office. Energy Partners, a West Palm Beach firm, donated the emissions equipment, and PRAXAIR, Inc. (formerly LINDE, a division of Union Carbide) donated the hydrogen gas and mixing equipment.

The lab will be conducting its work on a variety of engine and vehicles, including a Chevrolet V-8 engine from a GMC pickup truck dedicated to natural gas (methane). A motorcycle engine donated by Kawasaki is also being used as a research tool, and American Honda has promised a Honda VTEC variable-timing engine for still more testing.

Hydrogen and natural gas are the alternative fuels of choice because natural gas is a domestically produced fuel and because hydrogen made from solar energy is a Florida-produced fuel source.

Computer simulations have shown that the cost of a mixture of 20-percent hydrogen made from solar energy and 80-percent natural gas will cost about the same as conventional gasoline, over the life of the vehicles.

Methane offers many benefits over conventional liquid fuels: it has superior anti-knock and cold-start properties, and it does not "wash out" lubricating oils in critical wear areas of the engine.

continued page 13



**ELECTRIC
COURIER
SERVICE**



— Chris Wainwright

On Tuesday morning, July 13, 93, at offices of Arizona Public Service in Phoenix, Dan Parmly, president of Diversified Technical Services Inc., proudly announced the establishment of the Regional Electric Transportation System, a courier service for mail and small to medium size parcels, and its extension to service between Phoenix and Tucson.


Mr Parmly related his experiences in the development of battery-electric vehicles, in particular battery-electric conversion of pick-up trucks (by the installation of a battery pack, an electric motor, controllers etc.). He also related his discovery that operating cost of these vehicles were minimal and that money could be made with a parcel delivery service.

The Regional Electric Transportation System was described as a fleet of converted pick-up trucks and recharging stations. The Phoenix-Tucson extension has a charging station at the half-way point between the two cities.

One of the features of Mr Parmly's electric conversions is his battery swapping system. With this system, a proprietary air glide system enables one person to swap out a 1,500 lb battery pack with a fully charged pack in as little as two minutes.

With this battery swapping system, battery packs can be charged optimally (i.e. slowly) at night when energy rates are lowest. Also, night charging does not add demand to the electric power generating system and hence, does not increase the need for additional generating capacity.

Amanda Ormand of the Arizona Department of Commerce Energy Office addressed the meeting. Amanda Nestler of General Electric, Steven J. Madigan of FS 21 Group, LeRoy Essel of IEDC, Neil Kaminar of SEA, several members of the Solar Electric Racing Association, several members of the Electric Automobile Association and others were present.

After the meeting, Mr Parmly demonstrated his revolutionary battery pack exchange system, which worked smoothly. 

The Sacred Earth Network adds AHA to E-Mail Listing

Reprinted from the Russian-English newsletter:

The Sacred Earth Network

by: Bill Pfeiffer/sacredearth@igc.org

Sacred Earth Network's (SEN's) role in locating the enthusiasts and specialists in this area and then assisting them to work together has been a key ingredient in mapping out the beginnings of a solution. Many of these activists, living on different continents, are using electronic mail (email) to collaborate. This issue focusses on SEN's other activities with the former Soviet Union (FSU), all of which use this remarkable means of communication to make our work more effective. We look forward to playing the same role in the emerging debate on how to move towards a sustainable energy future. This is why the most basic element is featured in our lead article... The Editors

HYDROGEN HOPES

As the demand for non-polluting fuels increases so does the prospect for a solar energized future. In fact, fossil fuels, like coal and oil can be thought of as a much denser form of solar energy but they emit dangerous by-products in the combustion process. The most benign of these byproducts is carbon dioxide (CO₂), but considering the sheer numbers of engines and power plants pumping CO₂ into the atmosphere, the climatic consequences of "business as usual" is catastrophic. Because of the build up of CO₂ and other greenhouse gases it appears we humans are being forced to go directly to the source, the

Sun, and bypass digging up the Earth in order to move around and stay warm.

"Solar energy is fine" the critics say, "for people living in sunny climates, but what about the rest of us"?


At the American Hydrogen Association (73677,3633@compuserve.com), based in Tempe, Arizona, the enthusiastic response is: "What's needed is a hydrogen revolution" to solve solar's problem of storage and transportability. They emphasize that the current natural gas infrastructure, which is relatively safe, could easily be adapted for hydrogen. As sustainable, primary power sources like wind, tidal, mini-hydro and photovoltaic technology (the ability to directly convert sunlight into usable energy) become more efficient it becomes less expensive to extract hydrogen from water. Previously, the energy costs of extraction have been too high to justify the energy gained. Now, the lure of a fuel that not only is derived from "ordinary" water, but when burned leaves only water as a byproduct, is a compelling reason to bring down the price of solar-initiated extraction.

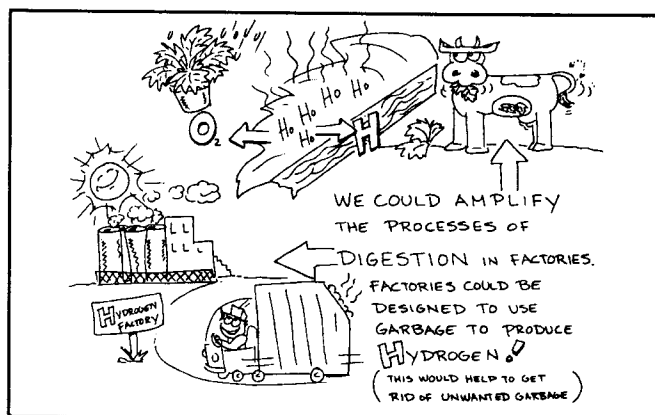
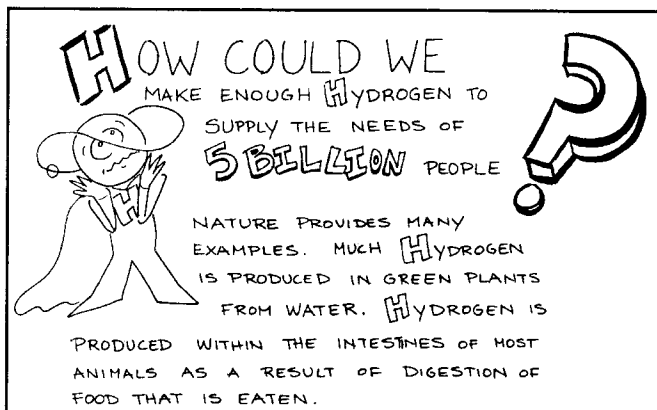
Gary Beckwith, writing for Real Goods Company (realgoods@igc.org), the largest supplier of small-scale alternative technology in the world, claimed that if automobiles were using hydrogen gas as a fuel they "would actually be purifying our air..., rather than polluting it".

In Russia, Lydia Popova (clearh@glas.apc.org), energy specialist for the Social Ecological Union states that solar derived hydrogen (not

produced by fossil or nuclear fuels) "has tremendous potential" and Stanislav Malyshenko (spm@litp.ivtan.msk.su), a pioneer in the hydrogen field at the institute of high Temperatures of the Russian Academy of Sciences points out; "Russia has already completed a significant amount of hydrogen research. Cooperation and investment from the West in this area could catalyze an enormous economic recovery effecting the entire world".

Finally, Ted Taylor (steps@bigvax.alfred.edu), formerly a nuclear physicist and now president of the Southern Tier Environmental Protection Society in western New York, emphasized that "solar-derived hydrogen, was not a panacea but the most effective way to decentralize energy production and distribution in the cleanest way possible". He proposes a globally cooperative investment of several tens of billions of dollars to mass produce the most efficient photovoltaic cells...comparing and testing along the way. He said this was a "minor sum relative to the amount used by the petroleum and nuclear multi-nationals to generate energy". He stressed the urgency of democratic and grassroots participation in order to reach this goal before the turn of the century.

The EcoNet conferences: en.energy and sci.energy contain dozens of participants with knowledge about hydrogen issues. Sustainable Technologies International (solar@igc.org), located in Colorado offers 1 week courses in giving "hands-on" experience generating and using hydrogen. 



Cartoons from "Star of Life," an educational cartoon coloring book available from the AHA.

Project Energy '93 Annual Hydrogen Conference Draws Worldwide Experts



The International Academy of Science

— Roy McAlister

Energy executives, engineers, scientists, business leaders, and government policy representatives from all over the world attended *Project Energy '93* on June 21-23 in Kansas City, Missouri. This conference was organized by Roger Billings and his capable staff of the International Academy of Science. Those of you who have attended previous conferences of Dr. Billings will be glad to know that *Project Energy '93* attracted interesting speakers from all over the world and that this conference saw another "first" by Dr. Billings. *Project Energy '93* introduced "Compressed Digital Video Conferencing" (CDVC) as a method for saving enormous amounts of jet fuel and carbon dioxide pollution to the atmosphere.

To show world shrinking capabilities of CDVC we were treated to a demonstration by Carlos Nones Sucre, Chief of Science Technology Branch of the United Nations (in New York), John R. Brodmann Acting Deputy Assistant Secretary of International Affairs, DOE (in Washington D.C.), Sir Hal Miller, Chairman and Chief Executive, Cosmopolitan Holdings, Ltd. (in London), and Christopher J. Rooney, President, Sprint Data Services Division, (Kansas City) and Dr. Billings at the Conference. Their CDVC demonstration went well in every way except it did not enable the CDVC attendees to continue discussions with us over lunch or between sessions. However, I had that privilege and had delightful interviews with the following persons that attended *Project Energy '93* in person.

Christopher Flavin, *Vice-President for Research, WorldWatch Institute*. We visited about Mr. Flavin's new book and his realization that mass-manufacturing approaches will replace

economy-of-scale for meeting growing demands for clean electricity and transportation energy.

Mass-manufactured modular wind generators, photovoltaics, and solar dish equipment will replace giant boilers and steam turbines making central power plant electricity.

David S. Scott, *Director, Institute for Integrated Energy Systems, University of Victoria, Canada*. Dr. Scott discussed hydrogen and natural gas as low-carbon replacements for coal and oil. Dr. Scott is committed (as we are at AHA) to assisting investors, industry, and nations avoid "pop mythologies" and perpetual motion ideas that camouflage the true reasons for adopting low carbon fuels. It was great to visit again with Dr. Scott.

Olof Tegstrom, *founder of Tebetron Company in Sweden consultant to the U.N. as an alternative energy expert*. We talked about TiO₂ photovoltaic cells that Mr. Tegstrom claims will achieve up to 12% efficiency and can be manufactured in your kitchen. More will follow after I build some of these cells according to the recipe that Mr. Tegstrom is sending to me.


Dr. Alexei Tupolev, *past head of the Tupolev Design Bureau and Chief Designer of the Soviet Supersonic Transport, TU 144*. We had lunch together and conversed through an interpreter that happened to work at the restaurant of the Adams Mark hotel where the conference was held. Our conversation centered on Dr. Tupolev's TU-155 which demonstrated the use of liquid hydrogen as a replacement for jet fuel.

Dr. Marieta Mattos, *Advisor to the Secretary of Technology in the Brazilian Ministry of Mines and Energy and Coordinator of Research Activities at the Laboratory of Electrochemistry, Institute*

of Physics and Chemistry of Sao Carlos University of Sao Paulo Brazil. We talked about how the standard of living in Brazil and neighboring countries will be rapidly improved by low-cost electricity from hydroelectric plants on Brazil's new dams.

Michael A. Kuliasha, *Associate Director of the Energy Division of Oak Ridge National Laboratory*. We talked about Dr. Kuliasha's work on energy conservation technology. Of particular interest was the work Dr. Kuliasha is doing on measuring insulation values in real-life situations. For example, freon-filled urethane loses insulative value. Dr. Kuliasha believes the life cycle insulation value should be reported instead of the beginning value.

Willis Hawkins, *Senior Advisor to the Lockheed Corporation after retiring as Senior Vice President - aircraft and Director of the Corporation, and President of the Lockheed California Company*. We visited about advanced approaches for storing hydrogen. It was particularly interesting to compare notes about how to stimulate a "product envy" race in the ground transportation sector. Willis Hawkins envisions the product envy race starting with luxury cars that are better because they run on hydrogen.

Richard Post, *Senior Scientist at the Lawrence Livermore National Laboratory*. Dr. Post is incorporating high-strength carbon fibers and magnetic bearings in improved flywheel designs. Advantages of the flywheel storage system compared to electrochemical batteries include 30 year life (compared to 5 years) higher charge and discharge rates, no penalty for deep discharge and higher efficiency. 

Alternative Fuels

from page 10


In addition, methane is readily available within the United States, and the infrastructure (production, storage and distribution) necessary for its use is already in place throughout much of the country.

The major drawback to the use of natural gas is that the nature of its harmful emissions is not compatible with present catalytic converter technology now used to clean engine exhausts.

The approach taken by the researchers is to incorporate a concept known as "lean burn." That is, introducing much more air to the engine than is theoretically needed for combustion. Unfortunately, natural gas alone cannot take advantage of lean burn because "misfiring" occurs before oxides of nitrogen can be successfully reduced.

The key is the addition of relatively small amounts of hydrogen (10 to 20 percent) to the methane. This extends the excess air that can be successfully burned to the point that all of the major pollutants are reduced to extremely low levels.

Hydrogen, readily available from water, is the cleanest-burning of all alternative fuels since it produces no carbon emission when burned or chemically recombined to produce energy. The Florida Solar Energy Center is presently conducting experiments on hydrogen production using solar-powered electrolysis.

Florida's economy is driven by tourism, so passenger transportation is vital to the state's economic health. Research into clean-burning fuels is equally vital to Florida's residents. 

McMaster-Carr Supply Company

P.O. Box 54960
Los Angeles, CA 90054-0960

Serving Industry Since 1901

Telephone:
Sales Desk & Customer Service (310) 692-5911
All Other Departments (310) 695-2449
Fax: (310) 695-2323

Midwest Renewable Energy Fair

— Roy McAlister

June 16-20 at Amherst, Wisconsin

It rained every day at the Midwest Renewable Energy Fair but this did not stop determined crowds from coming to learn about renewable energy. This fair did not disappoint the friendly people that walked through mud puddles and often stood through rain showers to talk about renewable energy. The fair runs on electricity from wind generators. Exhibits, demonstrations, and organized discussions on wind machines, Stirling engines operating on heat from wood or solar energy, photovoltaics, and supporting equipment like inverters, batteries, were in abundance.


The American Hydrogen Association's hydrogen-powered pick-up was well received in this farming area. Most of the questions centered on how to convert biomass, wind, or photovoltaic energy to fuel for appliances transportation or farm equipment. David Booth, Kent DeVilbiss, and I gave seminars on how to safely make, store, and use hydrogen.

David Booth talked about what can be done with hydrogen, how to use it safely, and encouraged developments in hydrogen fuel cells. Kent Devilbiss is another AHA member from Carbondale, CO and specializes in helping small businesses, homeowners, and farms convert to renewable energy systems. He brought a van full of tools and demonstration equipment to the Fair. Kent showed how to convert natural gas or LP appliances to operate on hydrogen. From what I could see Kent was ready to help with electrical and mechanical equipment installations ranging from hydroelectric plants to refrigeration systems.

Several homes in the Amherst area demonstrated renewable energy practices that allowed off-grid self-reliance. These homes were designed and built as energy efficient homes that could use photovoltaics for primary electricity generation. Typical of renewable energy homes of the area was Nancy Washburn's home which is very modern and comfortable. She has about 650 Watts of Solarex panels on her roof along with a Kohler propane generator as a backup which is rarely used. Nancy's wood heating and cooking stoves use locally abundant logs of "saved" solar energy. Energy efficient appliances are a must and Nancy takes good advantage of passive gain and window quilts that are used to prevent heat losses.

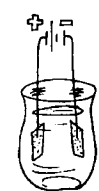
In many ways these off-grid renewable energy homes and their owners reminded me of my Grandparents and their ranch homes in the Flintheills of eastern Kansas. My Grandparents were off-grid. Both Grandfathers built their homes and for many decades had no electricity. Lighting was by coal-oil or acetylene lanterns. (Acetylene was made by reacting calcium-carbide granules with water.) Heating was by wood stoves. Ice was cut from ponds and hauled to straw-insulated ice houses for making ice-cream on the 4th of July and celebrating summer birthdays. In the summer and fall great quantities of food was canned and root cellars were stocked. The pride and joy of being self-reliant was evident in Amherst as it was with my Grandparents. ♦

OTHER NATURAL SOURCES OF MATERIAL TO PRODUCE HYDROGEN ARE DISCARDED GREEN PLANTS.




CORN STALKS, CEREAL GRAIN, STRAW AND SAW DUST

ARE EXAMPLES OF RENEWABLE BIOLOGICAL MATTER — OR "BIOMASS" — THAT COULD BE USED IN DIGESTION PROCESSES TO PRODUCE HYDROGEN.



ANOTHER WAY TO PRODUCE HYDROGEN IS BY ELECTROLYSIS OF WATER.



$H_2O = H_2 + \frac{1}{2}O_2$

DOE Starts 5-Year Plan with Call for Research on Hydrogen Storage

— William Hoagland, National Renewable Energy Laboratory

Fourth Annual National Hydrogen Association Meeting
Washington D.C.

A 5-year plan initiated by the United States Department of Energy (DOE) addresses hurdles and seeks to provide a realistic framework for deciding where the use of hydrogen can result in beneficial payoffs. The plan has been expanded to incorporate the specific requirements of P.L. 101-566, the Spark M. Matsunaga Hydrogen Research, Development and Demonstration Act of 1990 (Matsunaga Act).

The comprehensive plan is based on an energy pathway analysis. Pathway analysis is the consideration of all elements of an energy delivery system: required energy input, conversion, transmission, storage and utilization. A pathway can determine the quantity of primary energy necessary to produce and use hydrogen and identify the processes where energy losses are the greatest. The analysis helps to focus research and development investment for potential improvement in the highest areas.

In both the transportation and utility applications, the attractive options are coal gasification, direct solar to hydrogen, and biomass to hydrogen. Critical technologies will need to be developed in the mid- and long-term:

- Direct photoconversion production of hydrogen,

- Biomass growth, harvesting, and conversion to hydrogen,
- Fuel cell powerplants suitable for vehicle propulsion,
- Lightweight, compact storage for on-board vehicle use, and
- Efficient, low-cost storage for utility (stationary) use.

Currently in advanced stages of development and expected to reach commercial readiness in the near term are:

- Coal gasification and hydrogen purification,
- Fuel cell systems for stationary applications, and
- Catalytic and heat engine conversions for transportation and industrial application.

The high-priority technology needs for increased hydrogen utilization in energy applications are:

Hydrogen Production:

Steam reformation of biomass, thermochemical gasification of biomass, coal gasification, direct solar production and anaerobic digestion of municipal solid waste (50% bioconversion and/or 15% photoconversion efficiency)

Hydrogen Storage:

Compact lightweight vehicle storage for multiquad vehicle use (volumetric energy density of 240 kBTU/ft³ and gravimetric energy density of 4 KBTU/lb (interim targets); and low-cost, low-loss bulk storage for utility use (storage efficiency of 75%

and added cost of 50% of delivered hydrogen)

Hydrogen Utilization:

Hydrogen combustion in internal combustion engines for vehicle use, proton exchange membrane fuel cell, and molten carbonate and solid oxide fuel cells.

As a result, the hydrogen program is issuing a "letter of intent" solicitation for research proposals in hydrogen storage technology.

Other milestones specifically established in response to P.L. 101-566 include:


1994— Refine pathway economic evaluation to incorporate operating or life-cycle costs; establish specific cost and performance targets for hydrogen storage.

1995— Characterize transmission and safety issues related to large-scale hydrogen use.

1996— Select the most promising direct solar hydrogen production system for further development and establish specific goals for a 1999 3-kilowatt system test.

1997— Define a bioconversion subsystem that can support a 1999 3-kilowatt system test.

1998— For 1999 system test: select either bioconversion or direct solar hydrogen production technology

1999— Demonstrate a 3-kilowatt, direct solar or bioconversion-based, hydrogen production and storage system. 

Japan Plans Thirty-Year Hydrogen Development

According to the June *Clean Fuels Report*, Japan's Agency of Industrial Science and Technology (a part of MITI) plans "a huge long-term international project whose ultimate target is utilization of hydrogen energy for power generation on a global scale." The project is called the "WE-NET Project" (World Energy Network), and it would invest a total of US\$2.5 billion over the period up to 2020.


One basic goal is to reduce the world's CO₂ levels by 10 percent and 20 percent in 2010 and 2050, respectively.

Japan plans to improve technologies related to hydrogen production, hydrogen storage and transportation, and power generation using hydrogen. The program is part of the "New Sunshine Program," budgeted at around \$11 billion.

The New Sunshine Program includes:

-Acceleration projects, expected to lead to practical use of emerging technologies such as photovoltaics and fuel cells

-Systems projects like WE-NET, expected to achieve breakthroughs by the synthesis of key technologies

The WE-NET Project aims at constructing a global energy system which accords with ecosystem principles while also creating new industries related to hydrogen. 

NREL to Fund Hydrogen Storage Research

The DOE may be getting serious about hydrogen energy. In May, the National Renewable Energy Laboratory (NREL) is studying proposals for research and development of advanced or innovative hydrogen storage. According to the Lab, "The lack of convenient and cost-effective hydrogen storage devices is one of the major limitations to large-scale use of hydrogen," and is seeking projects that "offer the potential of significant improvement over conventional methods from an energy efficiency, environmental or cost viewpoint."

For utility applications, bulk hydrogen storage technologies are needed that can store multi-quad (quadrillions of Btu's) of energy and are cost effective with minimum energy losses. Transportation applications need lightweight, high energy density storage.

Hydrogen Storage Performance Goals

DOE's long-range storage goals for transportation include weight and volume storage densities comparable to gasoline.

For transportation applications, approximately 6.81 kilograms of delivered hydrogen would be required before refilling, based on a 2,200 pound vehicle consuming 3,000 BTU per mile with a 300 mile range. The specific performance goals for hydrogen storage are defined as follows:

Transportation Pathways:

- Volumetric Energy Density = 240,000 BTU per cubic foot (2,500 kilowatt-hour per cubic meter)
- Gravimetric (weight) Energy Density = 4,000 BTU per pound (2.5 kilowatt-hours per kilogram)

Utility Pathways:

- Storage efficiency of 75 percent and added cost of 50% of delivered hydrogen

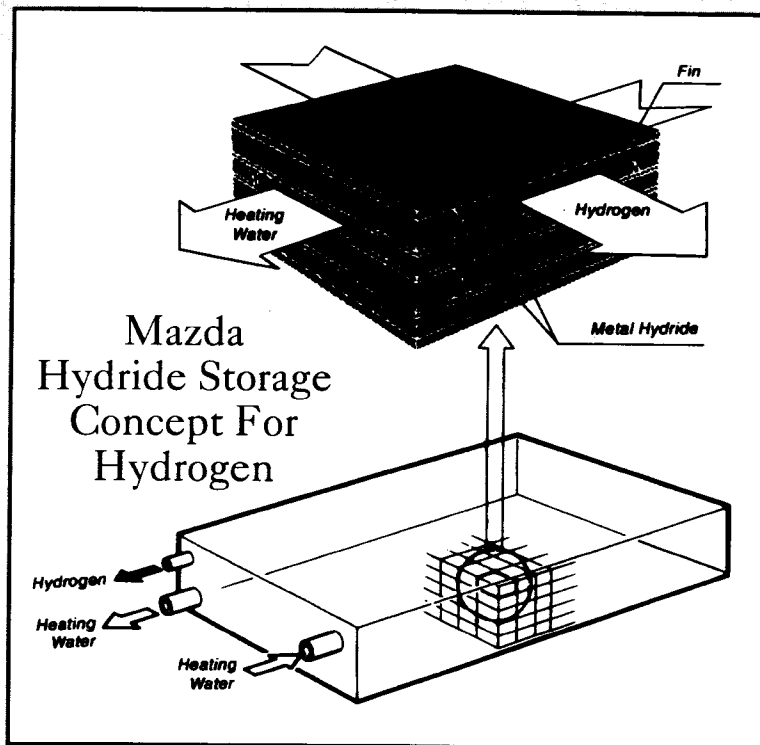
While it is uncertain that the above goals will be achieved, the proposed research must define programs that have a high probability of achieving significant improvements.

Current Hydrogen Storage:

Currently, the two principal hydrogen storage approaches are physical storage such as compressed gas or liquefaction, and chemical storage, such as gas-on-solids adsorption and metal hydrides.

Compressed gas storage systems have high weight-to-volume ratios due to heavy pressure containers, although new, light-weight graphite composites are promising. The other alternative, cryogenic storage, carries with it significant energy penalties because of the energy required to liquefy the hydrogen and to maintain it in the liquefied state.

The volumetric density of hydrogen adsorbed onto a solid can be higher than compressed storage, and hydrogen stored using activated carbon is being investigated.



Metal hydride storage remains a possible option, although currently available, low-cost hydrides need high temperatures to liberate the stored hydrogen, and hydrides needing only low temperatures have too low a capacity. Polyhydrides are a promising new approach for hydrogen storage. Phase-change materials to maintain the thermal balance of hydride storage systems have also shown promise.

Scope of Work:

The scope of work is open to research in all areas relating to hydrogen storage that lead to clearly defined goals or "proof of concept," and the emphasis is on safe technologies with high efficiencies at reasonable cost. It is anticipated that awards for multiple projects will be made, with total funding in the range of \$700,000 to \$850,000. ■■

National Hydrogen from page 6

augmenting pathway analyses to include life-cycle costs and environmental effects. The NHA also believes that there is too much emphasis on hydrogen storage research at the expense of the development of hydrogen systems and infrastructure. Accordingly, Eaton said that HTAP recommends that the 1994 budget would allocate only 29% of the budget to storage, 31% to production, 15% to near-term applications development and 25% to systems design and development. HTAP also recommends including demonstrations in the 1996 budget.

Finally, the NHA was concerned that production of hydrogen by splitting water with electricity (electrolysis) was being discounted. Birk points out that hydrogen produced from fossil fuels is much more cost competitive right now. Moreover, hydrogen can be produced more efficiently and less expensively from fossil fuels than from electricity. In the near term, then, HTAP feels that it is non-productive to illustrate that we can make expensive hydrogen. The logical approach would then be to develop ways to demonstrate the use of inexpensive hydrogen. However, no one in HTAP or DOE was willing to support the demonstration of non-renewable hydrogen either. Such a standoff could severely thwart efforts to seriously demonstrate the usability of hydrogen, regardless of the source.

Progress and Plans - U.S.

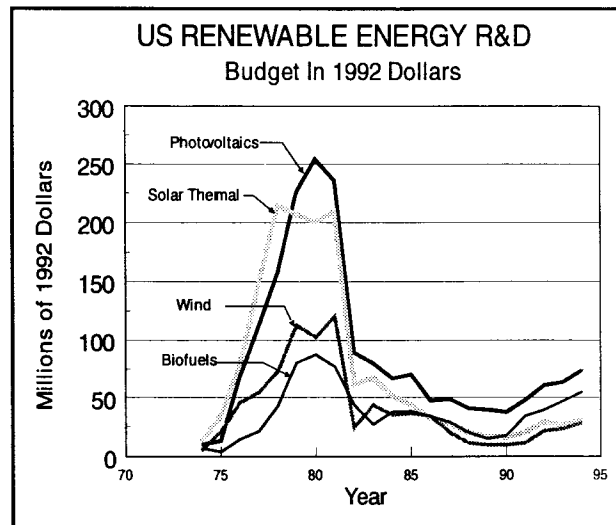
Current research activities and progress from NREL were presented by Hoagland. One objective is to develop practical systems for storing hydrogen. Research is focussed on improving hydrogen storage technology to meet energy density and safety requirements and on identifying storage materials for advanced systems, such as aerogels and C60

(fullerenes or buckeyballs). Progress is being achieved on the development of a high pressure gaseous storage container for mobile application, low cost, high efficiency systems for bulk storage and distribution, and application-specific chemical storage technology, such as carbon and hydrides. NREL expects to identify a candidate hydrogen storage compound that will provide better than six percent weight capacity for hydrogen for transportation application by September of this year.

Another objective is to develop new hydrogen-producing processes that have the potential to produce very large quantities of hydrogen, with a focus on photoconversion research including photobiological, photochemical and photoelectrochemical processes. Specifically, the objectives are to improve electrode materials to increase their stability and solar efficiency, improve organisms for photobiological hydrogen production and optimize hydrogen production from the gasification or partial oxidation of organic material. Photoconversion reactors, hybrid systems that use both biological and synthetic materials to split water into hydrogen and oxygen, small-scale reformer technology to produce hydrogen from natural gas and the testing of photoelectrolysis cells are being developed. Photoelectrochemical hydrogen production projects have been completed and NREL expects to have an illuminated tandem cell producing hydrogen from water at greater than 10% efficiency by September of this year.

Additional research is focussed on conceptual design and engineering of hydrogen systems, technical and economic analysis, technology assessment, systems tests and prototype development, safety evaluation and research and environmental analysis as well as application analyses designed to identify hydrogen technologies for the future.

Other speakers, including Dr. James Lents, south Coast Air Quality Management District, CA, Dr. Venkat Raman, Chairman, NHA Transportation Committee, Air Products and Chemicals, Inc., and Dr. Daniel Sperling, Director, Institute of Transportation Studies, University



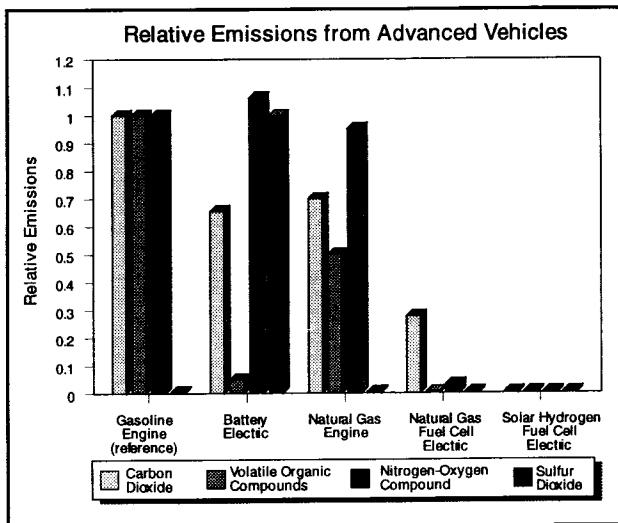
of CA, Davis, talked about ongoing projects within the U.S., such as the use of hythane (natural gas - hydrogen mixtures) and the development of fuel cells for transportation purposes.

Progress and Plans - International

Enthusiasm for international hydrogen research projects was muted by the sluggishness of the world economy. Both Japan and Germany, world leaders in hydrogen research and development, have scaled back or slowed down their efforts to match the economic realities. Nevertheless, Dr. C. Watanabe and Dr. S. Katayama, both from MITI, Japan, presented Japan's New Sunshine Program and the WE-NET Project, which aim to establish an international clean energy network using hydrogen conversion.

Dr. Helmut Buchner of Daimler-Benz, AG, Germany, spoke about the technology behind the hydrogen-fueled Mercedes Benz, and Reinhold Wurster of Ludwig-Boelkow Systemtechnik, Germany, spoke about the status of the Euro-Quebec Hydro-Hydrogen Pilot Project. Hydrogen will be produced in Quebec, using hydroelectricity to split water. The hydrogen would then be shipped to Germany in two specially designed liquid-hydrogen tankers to be built in Canada. One destination of the fuel will be the world's first liquid-hydrogen-fueled buses, which Munich plans to have running by 1995. Demetri Wagner related that the Germans came to the U.S. primarily to encourage Americans to join the global movement towards hydrogen and to seek joint projects with the U.S. similar to the Euro-Quebec Project.

While the slowdown in international activity was disappointing, it was nonetheless heartening to see progress in large-scale projects, and to see a growing enthusiasm towards global cooperation. [E]



Making Fuel From Wastes

Roy and Sara McAlister

Burning coal, oil, and natural gas releases carbon dioxide to the atmosphere. Since the discovery of oil drilling and refining technologies there has been a steady build up of carbon dioxide and methane in the atmosphere. The amount of CO₂ and methane in the atmosphere have exponentially increased over natural processes of biomass decay.

This build-up of CO₂ correlates to additions from the combustion of some 25 billion barrels of oil each year. Nature's green plants have been stimulated but they have not been able to utilize the extra carbon dioxide since about 1900. The atmosphere has been changed by burning so much fuel and now contains 25% more carbon dioxide and 100% more methane than at any time in the last 160 thousand years. This is proven by testing arctic snow cores.

In order to restore the carbon dioxide level to the natural state that existed before the Industrial Revolution we must convert wastes such as sewage, garbage, farm animal and field wastes to hydrogen.

The carbon that is left over in this dehydrogenation process should be converted into new materials. Nitrogen and other remaining minerals should be returned to the fields and gardens as soil nutrients.

The weights and measures are compelling. More than 400 hundred million cattle, pigs, and chickens consume vegetable matter to produce over two billion tons of manure each year. If concentrated in one place this

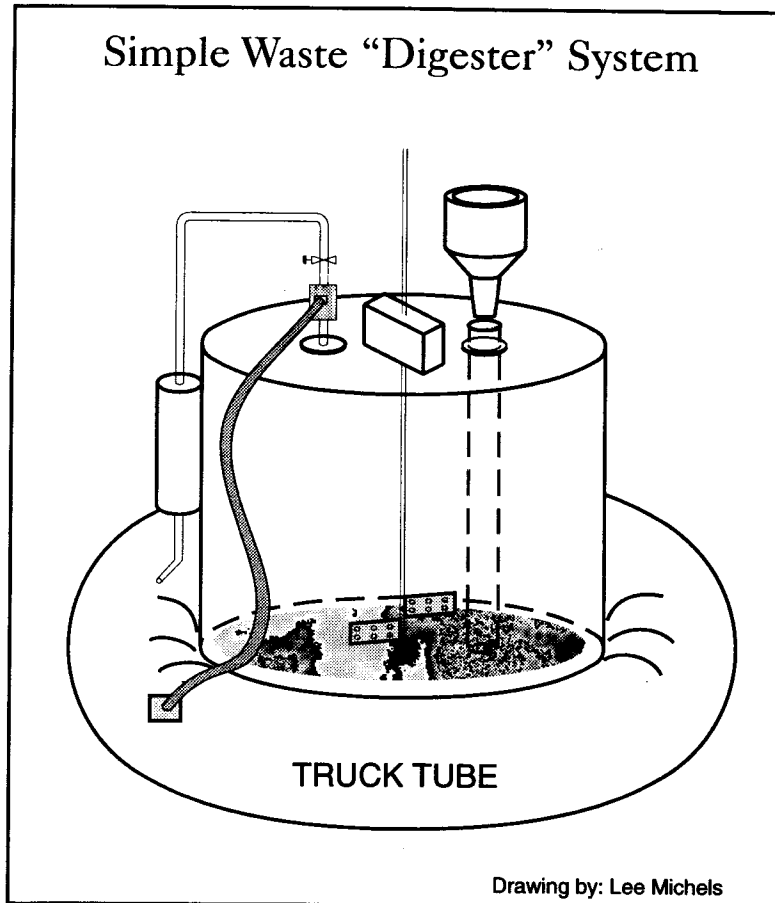
would cover an area of 1,000 square miles to a depth of two feet.

In 1871, an exhibition in London introduced technology for producing gaseous fuel from organic wastes. By 1905 a large plant produced gaseous fuel from city wastes in Bombay, India. Biogas is a mixture of methane, hydrogen, carbon dioxide, hydrogen sulfide, and small amounts of other gases. One standard cubic foot of

of methane or hydrogen produced by anaerobic digestion depends upon the bacteria introduced, the carbon to nitrogen ratio, the temperature, and acidity or Ph of the slurry.

The most common goal for temperature control is 90 to 100°F for bacteria like those found in the intestines of animals. These bacteria work well at about neutral or slightly basic condition of pH 6.8 to 8.0.

Simple Waste "Digester" System



Drawing by: Lee Michels

Adding too much vegetable matter (too rapidly) drives the bath to lower pH numbers making it too acidic. The goal for the carbon to nitrogen ratio is about 30:1. Fermentation stops if nitrogen is depleted. This balance can be maintained by using about 3 gallons of liquified manure with 30 gallons of dry grass clippings, and shredded leaves.

Suitable manure includes pig, cow, chicken, cat, dog, and human excreta. If urine is used it will greatly enrich the nitrogen content and less solid waste is needed to maintain the 30:1 carbon to nitrogen balance.


Figure 1.

1. Mix manure, chopped yard wastes and other

biomass to 30:1 carbon to nitrogen ratio.

2. Add chlorine-free water to make 7 to 9% solids slurry. Pour into tank. Stir to mix.

3. Keep at 90 to 100°F.

Tanks, tubes with appropriate fittings, agitators, and other hardware for your biogas generator can be homemade or purchased from various suppliers including STARMEC Corporation, (602) 921-2788. 

biogas releases from 300 to 600 BTU, depending on the ratio of hydrogen to methane. One pound of dry leaves release seven cubic feet of biogas by anaerobic fermentation.

One pound of dry cow dung produces about one cubic foot of biogas. One cubic foot of biogas per day is enough to cook meals for four people. About 225 ft³ of biogas is equal to a gallon of gasoline. Most engines can run on this much biogas to produce a horsepower constantly for 10 hours. The amount


EARTH SUMMIT'S ONE YEAR BIRTHDAY

On June 14, the birthday of the Earth Summit, President Clinton named the President's Council on Sustainable Development to help develop policies that would encourage economic growth, job creation, and environmental protection. The 25 member Council primary goals are to:

- Develop policy recommendations for a national strategy for sustainable development that can be implemented by public and private sectors.
- Respond to the recommendations in Agenda 21 (a pledge to global environmental action agreed upon at the 1992 Rio conference), and contribute to the U.S. plan to be submitted to the United Nations Commission on Sustainable Development.
- Sponsor projects that demonstrate the Council's recommendations and that encourage comprehensive approaches.


The Council will divide into committees to develop strategies in specific areas such as:

1. Sustainable agriculture and land use,
2. Efficient energy and transportation systems,
3. Environmental justice,
4. Eco-efficient manufacturing,
5. Environmental education, and setting environmental priorities.

The Council's first formal meeting will be in September, followed by quarterly meetings held over an initial 2-year term that may be renewed for another 2 years. In December, the Council will recommend a strategy for how the U.S. might achieve sustainable development goals in some of the critical areas identified in Agenda 21. In June 1994, the Council will identify specific actions that should be taken to pursue the national sustainable development strategy. 

AHA WILL BE AT REDI

REDI is the Renewable Energy Development Invitational Conference on August 6, 7, and 8th at Willits, CA, called the Solar Capital by its sponsors. This conference continues the tradition of the Solar Energy Expo & Rally in providing discussions between a broad range of companies in the field of renewable energy, with an opportunity for business with financing, utility and governmental agencies. Wind, solar, hydro, biomass, and other renewable energy potentials will be represented at these conferences. This beautiful northern California wooded locale is certainly a great place to talk solar.

Last year's Willits Solar Fair events included a great panel discussion between Dr. Peter Lehman, hydrogen project leader at Humboldt State University, Dr. Walt Pyle, hydrogen researcher and scientist with Chevron, David Boothe of the Sustainable Technologies Institute, and our own Roy McAlister, President of AHA, discussing the progress and future of hydrogen energy with the audience. 


Earth Day Executive Order from President Clinton

On Earth Day, April 21, President Clinton signed Executive Order 12844, which requires the U.S. Federal Government to acquire 50 percent more alternative fuel vehicles than specified in the Energy Policy Act of 1992 for the years 1993 through 1995. A Federal Fleet Conversion Task Force, headed by Texas Land Commissioner G. Mauro was appointed to head the task force that will advise Energy Secretary Hazel O'Leary on the implementation of the Executive Order. The task force is to publish a recommended implementation plan within 90 days and will oversee the interagency effort for a period of 1 year.

The task force held its first meeting in June during the fourth annual Alternative Vehicle Fuels Market Fair and Symposium in Austin, TX. The main objective of the task force, as defined at these meetings, is "to

develop and recommend a coordinated public and private sector plan for accelerating the commercialization and market acceptance of alternative fueled vehicles nationwide. The 32-member task force was divided into four working groups:

- A federal, state and local program and regulation working group,
- A vehicle production and conversion working group,
- A refueling infrastructure and technology working group,
- A program economics working group.

The defeat of President Clinton's economic stimulus package in April, resulted in a loss of \$10 million for the project... but \$18 million is earmarked for converting and purchasing AFVs for the federal fleet. 

Thanks for the graphs,

"The graphs on pages 6 and 16 were supplied by U.S. Senator Tom Harkin (Iowa). Many thanks to Senator Harkin and Legislative Assistant C.E. Thomas."

Upcoming Events . . .

September 1-3 – Vail, Colorado – Ninth Annual Mobile Sources/Clean Air Conference., Contact: (303) 491-7767

September 2-3 – Sacramento, California – Toward a Fuel Cell Future, Planning for the Commercialization of Fuel Cells – Holiday Inn Capitol Plaza. (916) 752-1914; Fax: (916) 752-6572.

September 9-10 – Sacramento, California – California Collaborative Workshop on Integrated Fuel Cell Commercialization., (916) 732-5254.

September 11-16 – Reading, United Kingdom – World Renewable Energy Congress III., Contact: (73) 43 8667.

September 12-15 – Denver, Colorado – American Gas Association, Natural Gas Vehicle Conference., Contact: (703) 841-8667.

September 13-16 – Seattle, Washington – 23rd International Electric Propulsion Conference., Contact: (202) 646-7200.

September 13-17 – Chiang Mai, Thailand – Small Engines & Their Fuels., Contact: Dr. Piyawat Boon-Long, (66 53) 210320.

September 13-17 – Aachen, Germany – 26th International Symposium on Automotive Technology and Automation, ISATA., (081) 681 3069.

September 14 – Southern California – Chapter of AHA monthly Meeting, Contact Dick Williams (800) 854-5225. (Second Tuesday)

September 15 – Tempe, Arizona – A.S.U./AHA Chapter monthly meeting 7:00 to 9:00 p.m. Student Service Building, A.S.U. Contact Kathy McAlister, (602) 921-0433. (Third Wednesday of each month)

September 20-21 – Chicago, Illinois – Alternative Fuels Seminar. Contact: Carol Harwell, (800) 729-6742.

September 21 – Sante Fe Springs, Cal – So. Cal AHA Meeting, Hydrogen Energy Futures Presentation: "Hydrogen Powered Car Design" by Merkle Weiss, Instructor of Automotive Engineering, Art Center College of Design, 6:30PM at Town Center Hall 11740 Telegraph Rd.

September 23 – Tucson, Arizona – Chapter meeting of AHA. Contact Mike Baker (602) 469-5554. (4th Thursday of each month.)

September 24-26 – Bologna, Italy – Fifth Metanauto, European Conference on NGV Systems., Contact (051) 260 798.

September 26-29 – Morgantown, W.Virginia – Alternative Fuels, Engine Performance and Emissions., American Society of Chemical Engineers.

September 27-30 – Dearborn, Michigan – SAE Worldwide Passenger Car Conference and Exposition., Contact: (412) 772-7148.

September 29 – October 1 – Tokyo, Japan – The World LPG Forum., Contact (33) 1 4409 0156.

October 1-3 – Boston, Massachusetts – Eco Expo., The World Trade Center. Contact: The National Marketplace for the Environment, 14260 Ventura Blvd, Suite 201, Sherman Oaks, Cal 818-906-2700.

October 4-8 – La Rochelle, France – Clean Vehicles: Realities and Prospects of the Electric Vehicle., Contact (33) 1 4449 6060.

October 6-8 – Washington, D.C. – National Conference on Clean Air Implementation and Reformulated Gasolines., (202) 554-0614.

October 10-13 – Washington, D.C. – American Gas Association Annual Meeting., Contact: (703) 841-8667.

October 12 – Southern California Chapter of AHA monthly Meeting, Contact Dick Williams (800) 854-5225.

October 14 – San Jose, CA - AHA "Renewable Energy Benefit Golf Tournament" Olivia Sunie (408-983-2690).

October 15-16 – New York, New York – New York Solar Coalition's Second Annual Conference., Contact: Jim Hurt at (212) 861-0100, FAX: (212) 861-0101.

October 17-21 – Knoxville, Tennessee – Separation Science and Technology for Energy Applications., Contact (615) 574-4934.

October 18-21 – Dearborn, Michigan – Automotive Technology Development Contractors Coordination Meeting., (703) 754-0066.

October 18-19 – Boston, Massachusetts – Alternative Fuels Seminar. Contact: Carol Harwell, (800) 729-6742.

October 18-22 – Seoul, Korea – Fifth International Energy Conference, phone 042-861-6230

October 19 – Kuala Lumpur, Malaysia – International Association of Natural Gas Vehicles, Emissions and Engine Efficiency Seminar, phone 60-32753974, Malaysia

October 19-21 – Scottsdale, Arizona – Electric Power Research Institute Electric Vehicle Infrastructure Conference

October 20 – Tempe, Arizona – A.S.U./AHA Chapter monthly meeting 7:00 to 9:00 p.m. Student Service Building, A.S.U. Contact Kathy McAlister, (602) 921-0433. (Third Wednesday of each month.)

October 21-23 – Boston, Massachusetts – Sustainable Transportation & Solar and Electric Symposium, World Trade Center, Boston MA, Northeast Sustainable Energy Association, (413) 774-6051, Nancy H.

October 24-28 – Gatlinburg, Tennessee – Eighth Symposium on Separation Science and Technology. (615) 574-4934

October 25-26 – Cathedral City, California – TRANS CON 2000. Contact: CVAG - Lester Cleveland or Michael Cohen, (619) 346-1127.

October 27-28 – Washington, D.C. – Global Change: A New Direction for Decision Making. (313) 994-1200 ext. 3234.

October 28 – Tucson, AZ – Chapter meeting of AHA. Contact Mike Baker (602) 469-5554. (4th Thursday of each month.)

November 1-4 – Detroit, Michigan – 1993 SAE International Truck and Bus Meeting. (412) 772-7148.

November 7-10 – Colorado Springs, Colorado – 10th international Symposium on Alcohol Fuels.

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 _____

- | | |
|--|---|
| <input type="checkbox"/> Regular Membership (\$30/Year) | <input type="checkbox"/> Sustaining Membership (\$100/Year) |
| <input type="checkbox"/> Student/Senior Membership (\$20/Year) | <input type="checkbox"/> Life Membership (\$1,000) |
| <input type="checkbox"/> Family Membership (\$40/Year) | <input type="checkbox"/> Corporate Sponsor (\$1,000/Year) |
| <input type="checkbox"/> Monthly Pledge _____ | <input type="checkbox"/> Newsletter Sponsor _____ |

All donations to the **American Hydrogen Association** are
Tax-DEDUCTIBLE under IRS 501-(C)-3 as a Non-Profit Organization

Enclose check or money order and mail to:

American Hydrogen Association, 216 S. Clark Drive, Ste. 103, Tempe, AZ 85281

American Hydrogen Association Headquarters Gets New Address

216 South Clark Drive, Suite 103 Tempe, Arizona 85281

— Kathy McAlister

What's behind the Move? ...Looking ahead

The minute I heard the landlord sold the building, I said, "What an opportunity." Herb Hayden began the search and came up with a little more room for about the same rent. We sent out renewal notices, sponsors were sought, and loyal members provided extra funds needed money for deposits, clean-up, paint, equipment rentals, and the actual move. Members packed, cleaned, moved, unpacked, and we only lost two hours of being off-line...A job well done...and a BIG THANKS to the great crew that worked tirelessly in the June heat. Here are six major topics as we look back at what we have done and what we need to do:

1. **Previous Success:** AHA's first years were foundation years. AHA wanted to make renewables such as solar hydrogen, dish gensets, wind machines, and renewable energy parks household words. AHA started "Hydrogen Today" and started building membership. AHA wanted schools to start teaching renewables, and we gave vision to the business community about what products were needed.


2. **Future Expectations:** By 1995, AHA wants renewable solar-hydrogen, wind, fuel cell/electric and other renewable energy products to enter the marketplace as replacements for nuclear and fossil fuels.

3. **The Ability to be Funded:** The current membership (along with emergency contributions and much appreciated volunteer time) can just about sustain AHA, "Hydrogen Today", and business as usual. Volunteerism by dedicated members is the backbone of AHA.

4. **Competition:** The National Energy Act of 1992 mandates fleet conversion to alternative fuels and gives a great tax break for conversion and fueling stations. AHA is going one step further. We want each environmental organization to convert one car for their group. Each 75 new members to AHA can pay for a conversion system...installed. You supply the car, and we will get membership to help finance and provide the work. You then can help by showing others. The theory is: grassroots will convert from fossil fuels to home-grown prosperity.

5. **How well Hidden?** We are all learning the hidden cost of oil and nuclear energy: health threats, toxicity in the air and ground water, wars for

access to nonrenewable resources, waste disposal problems, inflation, balance of trade deficits, and depleted resources. But AHA is well hidden too. We need media coverage, advertisement, books written, conference participants, editorials answered, talk on talk shows, etc. Do what you do best. Keep up at the tasks of advancing technology, demonstrating renewable resources, teaching, and writing about conversion to renewables. Be a part of history and ride into the future with a winner ... make it happen.

6. **The Ability to Increase Efficiency:** In order for our children and grandchildren to have opportunities for prosperity, AHA wants to build a laboratory, a renewable energy park, convert the transportation sector to clean fuels, and help accomplish this transition to the Renewable Resources Revolution in 50 years. On our Golden Anniversary of AHA, we can all celebrate that move in the 1990's as another step towards prosperity without pollution. It brought out team spirit that motivated us all into action. Just like moving we will be proud to be able to say, "I knew it could be done" - "We did it" - "Thanks be to all". Let us celebrate with a glad heart. 

THE HYDROGEN ASSOCIATION
216 South Clark Drive, Ste. 103
Tempe, AZ 85281
USA

Non-Profit Org.
U.S. Postage
PAID
Phoenix, AZ
Permit No. 2295



Printed on Recycled Paper in the U.S.A.