

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. 8, No. 1 1997

"Clean Energy For A Better World"

CIVILIZATION MUST HAVE A GRAND PURPOSE

By: Roy E. McAlister, President of American Hydrogen Association

The course of civilization will be determined by what we decide to do with remaining fossil reserves, what people are taught, what they experience, what they see, hear, think and believe.

Does civilization need a grand purpose?

A worthy Grand Purpose for Civilization is achievement of prosperity without pollution. This can be achieved by devoting remaining fossil reserves to evolution of the Industrial Revolution into a Renewable Resources Revolution. We can develop world-wide sustainable prosperity. This can only be done by using renewable energy to make the energy-intensive transportation and durable goods that are needed for prosperity. We must make it possible for those who want to improve their standard of living to do so in a sustainable economy that improves the environment.

Comic books and cartoons must speak of our Grand Purpose. Girl Scouts, Boy Scouts, and 4-H youth need projects that give insight and confidence for overcoming the economic trap of remaining dependent upon diminishing supplies of fossil fuel. At the other end of the educational spectrum, we must find a way for leading universities to establish Renewable-Energy and Wealth-Addition Chairs.

The development of Renewable Energy Parks to provide electricity and hydrogen as economical replacements for fossil fuels is urgently needed. We must establish a Grand Purpose to convert the fossil fuel economic trap into appropriate renewable-energy solutions. We need to adopt food production technologies that protect potable water supplies and rebuild top soil rather than deplete and erode it into the oceans.

All over the world, citizens of every country are looking for a meaningful purpose for life. Throughout history, civilization has flourished when a Grand Purpose

was established and faltered in the absence of serving a purpose that could continue beyond the lifetime of individual participants. The Egyptians had pyramids, the Greeks had democracy, Romans had conquest, and the Industrial Revolution has the quest for increased productivity. But our sense of purpose has been diminished by distractions of pollution and an emerging awareness that the Industrial Revolution cannot be sustained on fossil fuels.

The future of civilization depends upon finding a lasting solution that can provide the dignity and standard of living that fossil fuels have temporarily given 30% of the world's population. At risk is the progress that has been made under the pseudo-economic boom developed by stealing resources from the Earth. Stealing resources without restoring them insults the opportunity to achieve a sustainable economy. And, like any other kind of stealing it degrades the character of the community of thieves and breeds contempt for honest accounting of the true cost of essentials such as food and energy.

We must plan, embrace and accomplish the peaceful, enjoyable, healthful evolution of the Industrial Revolution into a new and better revolution. Most of the technology that has been developed during the past century can be used to create a sustainable economy that is based on renewable energy. With dedication we can utilize existing technology and renewable energy to produce peaceful prosperity without pollution.

The earth has abundant supplies of renewable solar, wind, falling-water, and ocean energy. These supplies are clean, renewable, and widely distributed. There is enough sunlight falling on a fraction of America's deserts to produce renewable electricity and hydrogen for replacing all the oil, natural gas, and

ISSN 1081-1273

continued from page 1.

and coal used in North America. This is because the proven efficiency of Solar Dish Gensets in North America's desert locations for converting solar energy into grid-quality electricity is about 30% on the best daylight conditions and about 23% on an annual average of all daylight conditions. This is an enormous improvement over an efficiency of 0.1% for electricity produced by burning fossil fuels in power plants. Improving the efficiency from 0.1% to 23% allows a much smaller land area to supply our energy needs compared to trying to recreate fossil fuels from biomass. (And, whom among us can wait another 50 million years for the fossilization to coal, oil, and natural gas to occur!)

Fossil fuels, or any other fuel such as ethanol or methanol from biomass, start with an efficiency of less than one percent. Chronic food shortages prohibit the use of top soil for growing biomass feedstocks to make hydrocarbons to replace fossil fuels. Most green crops convert far less than 0.6% of the energy in sunlight to chemical fuel energy. Using coal, oil, or natural gas to make electricity results in an overall efficiency of about 0.1% (one tenth of one percent) and produces more carbon dioxide pollution than the transportation system.

Present food production requires up to 10 calories of fossil fuel to plant, fertilize, herbicide, insecticide, harvest, package, deliver, cook and serve 1 calorie of edible food. In this process up to six pounds of top soil are transported into the oceans by wind and water erosion for each pound of food that is grown. At present depletion rates only 50 years of top soil remains to sustain a growing population that has reached 5.8 billion persons.

Every day, the world's farmers, manufacturers and all of us burn the fossil equivalent of 180 million barrels of oil to support our search for the good life. The fossil reserve, fresh water supplies, top soil, productive oceans, and an oxygen rich atmosphere are priceless gifts that have taken billions of years to develop.

We have learned that true wealth is measured in matters of well being, the natural environment, and the environment that we make for ourselves. We buy cars and homes with comforting interior decorations and music systems to control and improve our immediate environment. We take vacations to be in better environments. Ask prosperous persons how they are spending their wealth, and in most cases, they will get around to telling you of their fine cars, land-scaped yards, travel plans, and so forth to improve their personal environment.

It is time to ponder the purpose of your life by finding the answer in how essential this Earth is to Life and Civilization. Then you must dedicate some thought to the development of a sustainable relationship with the Earth. But what materials can we use to satisfy the enormous energy requirements of Earth's 5.8 billion humans? Can we find clean energy to replace present dependence upon burning the fossil equivalent of 180 million barrels of oil per day? The answer is YES...there are answers.

AHA has advocated a plan for continental integration of Renewable Energy Parks through the North American electricity and gas-pipeline grids. These grids will unite Wind Energy Parks in Canada and the Dakotas; Solar Energy Parks in California, Nevada, Arizona, New Mexico, Texas, and Mexico; Wave Energy Parks along ocean coasts; and Biomass Energy Parks near communities throughout North America. Electric power that is generated in excess of immediate demand will be converted and stored as electrolyzed hydrogen and flywheel kinetic energy for transportation energy and to meet peak electricity energy requirements. To safely reach this destiny, we must develop the awareness, dedication, and investment in the development of appropriate renewable energy supplies to replace fossil fuels. AHA has a grand purpose. We need to make sure that civilization has a grand purpose. too.

For more information on the American Hydrogen Association (AHA) - Arizona State University (ASU) collaboration contact: Roy McAlister at AHA (see address below) or Dale Palmgren\ Don Kelley at:

ASU College of Engineering and Applied Sciences Department of
Manufacturing Engineering Technology
PO Box 876706 Tempe, AZ 85287-6706
Phone (602) 965-2917 Fax: (602) 727-1129

Hydrogen Today

Official Publication of the
AMERICAN HYDROGEN ASSOCIATION (AHA)

216 South Clark Drive, Suite 103
Tempe, AZ 85281

(602) 921-0433 ☉ Fax: (602) 967-6601

E-mail aha@getnet.com

www.clean-air.org

Printed in the USA Copyright © AHA Please request permission to reprint.
Printed on Recycled Paper

"Hydrogen Burner" TECHNOLOGY TO FUEL FUEL CELLS

By Tom Dickerman

Perhaps the problem of providing fuel cells with hydrogen has been solved. According to Greg Hummel of Phoenix Gas Systems, a subsidiary of Hydrogen Burner Technology, their patented reforming unit can easily strip pure hydrogen from any hydrocarbon fuel. This breakthrough technology also appears to be used by Chrysler's new prototype fuel cell car. At this time, Mr. Hummel does not know if patent infringement has occurred.

A simplified description of the fuel-cell system being developed by Chrysler Corporation, is that gasoline is converted to hydrogen, carbon dioxide and water with an on-board fuel processor. The hydrogen is used in a fuel cell to create electricity to power the vehicle. The hydrogen production process of chemical reactions begins with a fuel vaporizer that heats the gasoline to convert it from a liquid to a gas, ensuring cleaner combustion that is free of soot. The vaporized gasoline is then processed in a partial oxidation reactor, essentially a metal canister with a spark plug. By limiting the amount of air in this low-pressure environment, hydrogen and carbon monoxide are produced. Sulfur in the gasoline is converted into hydrogen sulfide gas and filtered from the vapor.

Carbon monoxide poisons proton exchange membrane (PEM) fuel cells, so it must be eliminated or reduced to minute levels. Water is introduced as steam and, acting with copper oxide and zinc oxide catalysts, converts nearly all of the carbon monoxide to carbon dioxide and additional hydrogen is produced. Air is injected into the hydrogen-rich gas, which reacts with the remaining carbon monoxide over a platinum catalyst to produce carbon dioxide, leaving only a trace of carbon monoxide.

The LA Times says, "The Chrysler's processor consists of a number of units that break down the gasoline into hydrogen for the fuel cell. First, a vaporizer — 6 inches in diameter and 20-inches long — converts the gasoline to gaseous form."

"Next, the gas moves to a partial oxidizer, a 14 by 22-inch canister equipped with a spark plug to initiate partial burning. The vaporized fuel is then combined with air to produce hydrogen and carbon monoxide."

"The gases move to another unit, where steam acts with a catalyst to turn the harmful carbon monoxide into carbon dioxide. Additional hydrogen is also produced from this process."

"Finally, the fuel undergoes oxidation in which injected air reacts with a catalyst to remove

remaining carbon monoxide, leaving hydrogen rich gases that are fed into the fuel cell."

The description of Hydrogen Burner Technology's (HBT's) Underoxidizer Burner is similar. HBT is in the process of manufacturing and shipping the units to industrial producers of hydrogen including BOC in the U.S. and Mercant Gas in Japan. These units produce about 500 cu ft. of hydrogen per hour. The first units sold for about \$150,000, according to Mr. Hummel. By mid-1997, HBT expects to begin shipping 3500 scfph units.

The potential impact of such units is enormous for the fuel cell industry. For stationary fuel cells, HBT claims lower first cost, lower product costs and lower maintenance costs than conventional H₂ reformers. If these claims are borne out in practice, it will give fuel cells an important boost for electric power applications.

The potential for vehicles, however, is even greater. The units can be carried on-board; as with Chrysler's prototype. This will allow the gasoline and diesel fueling infrastructure now in place to be used with fuel cell cars.

Fuel cell cars are not as far off as many suspect. Mercedes-Benz and Toyota both unveiled prototype fuel cell cars late in 1996. GM and Ford are both working on prototypes under DOE funding. Other companies around the world may also be working on fuel cell cars, but keeping it secret in an attempt to get the edge on competitors.

If Chrysler and/or HBT have truly solved the on-board reforming puzzle, and if the price is right, mass produced fuel cell cars will be able to fill-up with gasoline or diesel at gas stations all around the world, rather than waiting for a multi-billion dollar renewable hydrogen manufacturing, transportation and fueling infrastructure to be built.

The air pollution benefits may be significant, although not nearly as good as with renewable hydrogen fuel. Chrysler claims a ninety percent reduction in emissions and a fifty percent increase in fuel efficiency, according to the LA Times. Emissions primarily include carbon dioxide, carbon monoxide, nitrous oxides, unburned hydrocarbons, sulphur oxides and particulate matter.

A fifty percent increase in fuel mileage could mean an increase from (say) 30 MPG to 45 MPG. To do so the fuel cell would have to overcome losses of significant energy that is expended in converting gasoline to hydrogen.

This would be more consistent with the potential of fuel cells, and more consistent with a ninety percent decrease in some emissions, as claimed. The carbon

dioxide emission would represent essentially all of the carbon in the gasoline. If the overall efficiency is improved by 50% then carbon dioxide emissions can be reduced by 50%. Most emissions would come from the reformer, as a hydrogen fuel cell's emissions are pure water vapor and air.

Editorial comment:

Tom Dickerman's elaboration upon the technology of Chrysler's fuel cell car is most helpful in understanding the hydrogen dynamics of new marketplace forces that will be emerging as the prototype car becomes a production reality. The editorial on page 9 discusses other good and bad points of this development, with particular concern expressed regarding the use of fossil fuel reserves to achieve Chrysler's goal (and those of other auto manufacturers).

The point made by Mr. Dickerman that "mass produced fuel cell cars will be able to fill-up with gasoline or diesel at gas stations all around the world, rather than waiting for a multibillion dollar hydrogen manufacturing, transportation and fueling infrastructure to be built" leaves this editor with the uneasy feeling that this development will not only promote complacent reliance on nonrenewable, finite fossil petroleum, but may also act as a deterrent to the building of the hydrogen infrastructure so desperately needed for long term improvement of our serious, debilitating energy difficulties.

We often speak of building a hydrogen infrastructure as reinventing the wheel. My concern is that with the advent of this new push to sell the gasoline fuel cell electric car with its accompanying infrastructure, we might have to reinvent the wheel a second time. This would be tragic and much more costly at a later time. It is obvious that this Chrysler technology is welcome, but it is not a solution to the long term problems from continued dependence upon fossil energy.

In reality, building a hydrogen production and delivery system may not be as costly or long in coming as many people believe (see article on page 17). With the numerous avenues available for clean methods for producing hydrogen, we need to champion renewable energy education, American inventiveness, and entrepreneurial opportunities to accelerate the processes for incorporating hydrogen into more environmentally friendly and user friendly products.

Our most provocative challenge is one of

public relations outreach programs geared to generating citizen preference and dedication to renewable resources, with an emphasis on hydrogen, the only "No carbon" fuel. Psychologically, the use of fossil oil (low octane gasoline) to produce hydrogen aboard a car is counterproductive as the public receives a mixed and contradictory message from this approach; there are many more essential and valuable applications for oil utilization. The advocates of hydrogen fuel would surely applaud the refueling of vehicles with mass produced hydrogen.

New Membrane: Better Efficiency!

Chemical Engineering/January 1997:

Ref: article by Gerald Parkinson

Hydrogen has been separated from mixtures with other gases by membranes for nearly 20 years. Now a new membrane has reversed the process. Developed by Air Products and Chemicals, Inc. (Allentown, Pa.), to separate hydrogen from hydrocarbons in refinery waste gas, it differs from its predecessors by passing the hydrocarbons while rejecting hydrogen.

The selective surface flow (SSF) membrane consists of a thin carbon layer, with pore diameters of 5 to 7 Å, on a macroporous alumina tube. A mixture of gaseous hydrocarbons and hydrogen, at typical refinery pressures of 50-300 psig, is passed over the high-pressure side of the carbon coated membrane. The larger hydrocarbon molecules are selectively adsorbed and migrate to the lower-pressure side, leaving behind hydrogen. The pressure side becomes richer in hydrogen content.

In field tests with feed gas containing 20-50% H₂, the process has recovered 60% of the H₂, while passing over 90% of the heavier hydrocarbons to the low pressure side of the tube separator says Madhukar Rao, the lead research engineer at Air Products. Since the hydrogen-enriched stream is at a higher pressure, this avoids the need for expending additional compression energy to further purify the H₂ by pressure-swing adsorption (PSA). Rao says, it can recover H₂ from refinery waste streams at about 33% savings compared to the cost of steam methane reforming and separation with PSA.

New York State Sued by AAMA Over 1998 EV Rule

Green Car Journal, Feb. 1997

The American Automobile Manufacturers Association has filed suit against the Acting Commissioner of the NY Department of Environmental Conservation and the State Attorney General in U.S. District Court in NY. The suit seeks to prevent automakers from being required to offer electric vehicles for sale in NY beginning in the 1998 model year. Under the Federal Clean Air Act, NY may continue to pg 22.

AHA News

An exciting development! By: Norman Davis

AHA has received an important and generous donation for our model shop; a beautiful Swiss made Tarex turret lathe. It was donated by a machinist who wishes to remain anonymous. This donor states that it is enough to know the lathe will be used by AHA volunteers for a truly worthy purpose.

This fine gift provides us with a capability of machining critical components for models and prototypes which will then be used to demonstrate some of the techniques indispensable to a technologically advanced society for achieving prosperity without pollution while preserving precious natural resources. Despite this fine addition to our model shop, other equipment and supplies like drill presses, milling machines, lathes, precision measuring instruments and barstock are required to enhance our abilities.

Pledges are crucial for planning the purchases of materials and equipment. Please help us with donations of raw materials, tools, equipment or money. Call Norm Davis for details on how to set up pledges for equipment and related supplies. (602) 921-0433.

INTERESTING CONTRIBUTIONS:

Symbols and numbers often provide traditional markers of the important steps in life. For instance, AHA's suggested donation for membership is \$30.00. Do you know why \$30.00 was selected? Eight people met in late December 1989 to start AHA. They were David Belskis, Sherwin Berger, Harry Braun, Jerry Dellwo, David and Dan Zavaleta, Roy and Kathy McAlister. After their brunch meeting, they contributed all their remaining cash to start an AHA bank account. Yes, you guessed right...the amount collected was \$30.00. AHA was started on \$30.00.

AHA's goal in the next three years is to raise \$10 million to demonstrate and build cost-effective production of renewable electricity and hydrogen. The AHA Foundation bank account was opened in March of 1997 with \$100 from Tom Wilson. It is interesting that Tom builds airships.

Thomas R. Wilson, an air quality specialist in Anchorage Alaska, has invented a self-contained landing system for lighter-than-air airships, and he is developing a new airship that converts solar energy into electricity for electrolyzing water into hydrogen and oxygen. His new airships do not require heavy diesel

engines or the large petrol fuel tanks of yesteryear. They will be lighter than air and will use the hydrogen lifting gas as fuel to operate the airship around the clock at cruising speeds. Wilson's innovations result in quiet, clean, comfortable, and safer airships that are less than one-third the size of the Zeppelins of the 1930's.

Mr. Wilson brings up the all important point that the only mission of the American Hydrogen Association is to develop and demonstrate technologies that provide civilization with options for achieving prosperity without pollution. That takes money. Contributions to AHA allows advancement of our programs to provide civilization with options for achieving a more healthful, peaceful, and prosperous future.

You have a choice. Contributions to the American Hydrogen Association Foundation are also tax deductible. Please give generously, like Mr. Wilson, to the advancement of options for civilization to achieve sustainable prosperity without pollution. Make checks out to the American Hydrogen Association Foundation. However, don't forget to continue being a member of AHA ... membership income is the major source of our general operating fund. Checks to the general fund should be written to ... American Hydrogen Association. Mail checks to: American Hydrogen Association, 216 S. Clark Dr. #103, Tempe, AZ 85281

"PLEASE" - A new campaign to rid the cities of dreaded Brown Clouds

Another goal of AHA for 1997-1999 is to provide remedial action programs for the world's most polluted cities by developing publicity for the Pollution Free Planet program. Publicity, Leadership, Education, & Action for a Sustainable Economy. Every dollar for the effort to eradicate the brown cloud smog advances what Ray Smucker of Rotary International calls the programs for a Pollution Free Planet. Mr. Smucker is a member of AHA and Rotary International and has contemplated the use of hydrogen in motor vehicles since the early 1940's. Watch for developments concerning Rotary International and the Pollution Free Planet programs.

AHA formed the Brown Cloud Busters (BCB) Auxiliary which is chaired by Marcia Imber. The purpose is to increase awareness of the brown cloud and how to reverse the trend in polluting and depleting Earth's air over the major cities of the world.

Ann Hoffmann has written a children's book for AHA about "Hydrogen Hannah" who busts the brown cloud. This book will be available in September. Stonehedge, Inc., the sponsor of this book, will offer it on a pre-published basis for \$9.95. This has been a big investment for Ann and Stonehedge, Inc. Order a copy to launch the Brown Cloud Busters in your area. See order-form on page 24.

CAN THE HYDROGEN STORY BE SURGICALLY ALTERED TO MAKE IT POLITICALLY CORRECT?

By: Sherwin Berger

As I read through a delightful little book entitled "Politically Correct Bedtime Stories," I was intrigued with the adroit manipulation of well known children's stories to convert them to very funny spoofs of the schizophrenic scene that prevails in American society. Between laughter and admiration for James Finn Garner's inventive adaptations, I also gave some thought to how a similar presentation could apply to the American Hydrogen Association, our crucially important story and how we could present it to the private, political and public sectors. By using politically correct language, could we make our message powerful, memorable, or inspiring? But most critically, could we make it something folks would take to heart while we simultaneously indulged in transparent, humorous verbal appeasement? I think not!

The difficulty with achieving an equally appealing, entertaining narrative as did Mr. Garner is this: there is no fictitious framework on which to weave the warp and woof of the hydrogen message. Ours is simply too serious a message. Making the hydrogen narrative politically correct would be like rewriting the history of the Civil War as a comedy.

A profoundly appealing environmental message;

optimism for revitalizing our economy; a solution for global climate change and a wake-up call for ameliorating resource depletion are topics that are inherently confrontational with entrenched financial and power dynasties. Energy consortium giants who are yet to be convinced that inexhaustible hydrogen energy systems will generate far higher profit margins than finite fossil fuels or nuclear energy —automotive and aerospace manufacturers who are yet to grasp the full significance of hydrogen as a superior, lighter, non-polluting fuel — politicians uneducated or callous to the needs for a reversal of current industry agendas and a public cheated of factual information by a media establishment dominated by major corporations are not likely to submit easily to our rational and healing advice. It will take repeated presentations by all hydrogen advocates - presentations that are forcefully given, truthful and demonstrably accurate.

While humor is always in order and will be used by this writer and others to make a point, be assured that our presentations will not be neutered to make them politically correct, altered to make them gender neutral, sanitized to mask their thrust or purged of enlightened self-interest to make them more palatable.

Power & Propulsion Systems Analysis

By: *Gordan Feric;*

Engineering Software Company has developed new software for engineers, thermodynamic analysts, and others that want to know about power and propulsion systems. The Power & Propulsion Systems is a Windows based software package for such work. It is quick and reliable for calculating thermodynamic and transport properties of gaseous, liquid, and solid species, analyzes power cycles, power cycle components - processes and compressible flow. We have tried this software package and found it to be a good tool for designing power and propulsion systems.

Some features are: temperature and pressure (270 K < T < 5,000 K); enthalpy and pressure, entropy and pressure tables. It will help you with power cycles of Stirling, Ericsson, Carnot, Brayton (power and propulsion), Rankine, Otto and Diesel. Power cycles include components and processes of compression, combustion and expansion. It will help with your calculation of compressible flow, sound velocity, mach number, properties of stagnation, static nozzle, normal shock, diffusers, and thruster performance. Editor's note: Thank you Mr. Feric for creating this compilation in the effort to achieve sustainable prosperity. For those interested in purchasing a copy of this excellent software please write to AHA or call Mr. Feric at 301-540-3605 or <http://members.gnn.com/analysis>

AWECO
**Arizona Welding
Equipment Co.**

WAS PURCHASED BY:
PRAXAIR

Hydrogen & Other Industrial Gases
Main Warehouse &
Office Location
4030 W. Lincoln St.
Phoenix, AZ 85009
(602) 269-2151
FAX: (602) 269-0538

MAN YOUR BATTLE STATIONS: STATUS QUO OR NOT TO GO?

By: Sherwin Berger

The new EPA rules for cleaner air standards bodes ill for any spirit of bipartisanship or accommodation in the 105th Congress. The battle lines are drawn and each side has already angrily voiced their opinions. There is no way that any of the combatants are going to modify a position (that represents a belief) that is at the core of the philosophical divide between the sanctity of health and environmental preservation and the sanctity of money. This is an imbroglio into which the public will be drawn with a vengeance.

Radio and TV talk shows, editorials and letters to the editors have already expressed a variety of knee-jerk responses, many of which reflect the same divisiveness and anger that Congress will wrestle with. I suspect that this EPA proposal will exceed any other public policy issue in scope, vituperation, anti-government, anti-industry and anti-EPA rhetoric.

While the laudable intent of the new clean-air standards is aimed at combating known health and environmental consequences of air pollution, the EPA cannot have its cake and eat it too. The agency is pushing a reformulated-fuels program that showcases more expensive, "cleaner burning" oxygenated gasoline. One type of reformulated fuel is supposed to reduce ozone emissions during summer months, but it doesn't address the problems of carbon monoxide, hydrocarbons, CO₂ or particulates. Another blend of oxygenated fuel will be sold during the winter to allegedly reduce carbon monoxide pollution but again the other pollutants will still be with us, essentially unabated. And these fuels certainly don't stop the national epidemic of urban sprawl serviced by ever more congested freeways that open up more remote areas for thousands of new inhabitants and their ubiquitous vehicles.

The tighter standards are aimed primarily at ozone and particulates. Voluminous studies show that reducing these pollutants would substantially reduce health care costs associated with lung and heart disease. But even if the results prove to be as salutary as anticipated, it will be years before the suffering public gets any relief. After a public comment period

scheduled to run to June 1997 the new rules become permanent — providing the anti-environmental Congress doesn't do something drastic to scuttle the plan as they execute a scheduled rewriting of the Clean Air Act. If things are still status quo next June, without too much tampering, meeting final standards for particulates is scheduled for 2002 and year 2010 for ozone. The deadlines for full compliance for ozone and particulates combined cannot be anticipated for a few years beyond these dates. Even with a best case scenario a lot of people will suffer and die between now and the cut off

"LEARNING MORE ABOUT THE MERTIS OF HYDROGEN IS LIKE TAKING A COURSE IN SURVIVAL"

dates for full compliance. It seems we have been down this road many times before on this and

other health-environment issues. What do those who suffer from air pollution health disorders do in the meantime?

The EPA estimates the nationwide cost of changes to achieve compliance with the new standards will run from 6.5 to 8.5 billion dollars per year. Those who oppose the imposition of new standards claim the figures are much too low. The agency also estimates that \$120 billion would be saved in health costs. Again, those who oppose new standards say the health cost savings are much too high. It is estimated that the new standards will prevent 250,000 cases of asthma; 250,000 cases of acute bronchitis and 20,000 premature deaths. During the protracted process of getting from here to compliance, what will happen to those who are sensitive to pollutants and who are the raw pollution fodder that these figures represent? Wouldn't it make more economic, environmental and medical sense to implement procedures that eliminate all pollutants simultaneously?

Whatever the final numbers there is a huge amount of money and lives at stake. *It would be an act of prudence, kindness and economic logic to take a small portion of the sums being discussed to invest in converting a test fleet of vehicles to run on hydrogen and to build a prototype hydrogen production facility to fuel the fleet.* The American people are primed for a positive, innovative, forceful example of a true problem solving approach that leads to provable results that indicate essentially no pollutants from vehicles fueled by hydrogen. If implemented with a sense of urgency, in the spirit that we exhibit in times

continue on page 8.

continue from page 7.
Man Your Battle Stations: Status Quo or Not to Go?

of national crisis, this could be accomplished swiftly - perhaps in 1-2 years.

Make no mistake - this is a national crisis. However, given the suffering and death due to pollution, health care costs, the political climate, the time frame and projected costs for achieving full compliance the process as presently promulgated by the EPA is unacceptable and unwise. This is not the way to react to a crisis! A true crisis response would recognize that for too many precious years we have been attacking pollution problems piecemeal. Automotive air pollution from cars, trucks, buses, etc. is blamed on the internal combustion engine. It is not the engine that is at fault, it the fossil fuels that power the engine. Fossil fuels produce a large complex of pollutants, yet current and projected new standards target 1 or 2 pollutants at a time. This is a prescription for continued internecine warfare between Congress, the EPA, the public and industry. What is desperately needed is a fuel that delivers the necessary propulsion power but does so without creating pollution of any kind. Readers of "Hydrogen Today" already know that there is only one fuel with these requisite characteristics. It is our duty and responsibility to bring this information to decision makers who are not aware of the unsailable virtues of hydrogen. Learning more about the merits of hydrogen is like taking a course in survival.

Writing this essay has been a painful experience. Since its inception, I have usually been a defender of the EPA. Today, I do not fault the basic thrust of their intentions; they are decent, fitting and humane, but ill timed and focused on a partial target. If and when these proposed limits are met, many destructive pollutants, whose role in destroying life and property is well known, will remain unaddressed and will be relegated to yet another round of debate and fractious partisanship. As long as vehicles use fuels that pollute, as long as power plants and industry burn oil, coal, natural gas, propane or wood there will be air pollution. It can be reduced but not eliminated unless hydrogen energy systems replace fossil fuels and nuclear energy systems.

Arrayed against the EPA and its defenders is a consortium of industrial giants, state governors, utilities, small businesses, motorists, uninformed

politicians and anti-environmental organizations. Their arguments are driven by pocketbook and bottom line balderdash. Until those who are aware that hydrogen can defuse our air pollution crisis and who are motivated to bring the message of prosperity without pollution to industry leaders, politicians and the public, the outcry against rational, humane and cost-effective solutions will become more vicious, more meaningless and more-corrosive of the democratic process. Once again corporate control will dictate the direction the country takes and the public will be cheated of a rare opportunity for radically improving personal and environmental health: Human Needs vs. Corporate Greed. The EPA must also be made aware that the collision course they have embarked upon with Congress and industry has too small a target and ignores the one element that could indeed achieve their environmental and humanitarian objectives.

Nuclear Power Costs - a nightmare:

By: Staff Writer

The owners of the Connecticut Yankee Haddam Neck nuclear power plant voted to permanently retire the 582 - MW reactor for a combination of safety and economic reasons. This continues the pattern of early and permanent reactor shutdowns that has characterized the industry for the past decade and underscores the fact that most nuclear reactors never reach their projected operating life of 30 years, much less 40 years. This should be a factor on how to value "stranded nuclear costs in deregulation talks..." stranded assets are presumably substantially reduced in economic value. Nuclear decommissioning costs should be collected on an accelerated schedule, because of the reactor's short operating life.

As an example, the Haddam Neck will cost about \$425 million to decommission but only \$200 million has been collected to date for this purpose.

In the 1980's the Congress voted to accept the price of the clean-up of nuclear waste...instead of industry paying the price. By the time tax-payers found out that they were paying the cost of clean-up, it was already to late to show Congress that this was terribly unfair. Now in the 90's the only thing to do to get rid of this obligation is to repeal laws, revamp the Department of Energy, and restructure the EPA. *In the rush to deregulate the utilities, it is unfair that we are taxed by pro-nuclear Congress edict for the "nuclear energy age". Now we are going to have to pay more in our utility bills. In deregulation, the utilities are dumping the ongoing cost of nuclear shut-downs.* The environmental damage to the air, soil, and water is going to come out of our pockets. Storage of nuclear waste will continue. Onto this and future generations, the nightmare is simply "*robbing our families of their money.*"

Unless congress acts swiftly to reverse this blatant fleecing of the public, this and future generations will continue to be tramitized by unfair costs and increasing environmental degradation.

WHEN A SOLUTION IS NOT A SOLUTION: Editorial

The January 7, 1997 announcement by Chrysler Corporation of a practical, long range electric car that uses low octane gasoline to make hydrogen for an on-board fuel cell was treated in the press as a totally new technology that suddenly emerged full blown and was an invention of Chrysler engineers. This is obviously not the case. Fuel cell technology has been around since 1837 (remember William Grove's the inventor) and became serious technology in the early 60's for the space programs. Over the years fuel cells have matured into a most promising prospect for pollution-free automotive propulsion. Fuel cell developments are not news to readers of *Hydrogen Today*. Our previous issue (Vol 7, No. 2, 1996) featured a front page article on Energy Partners' fuel cell experimental vehicles; Roy McAlister's Part Three of a Three Part Series on electrolyzers was about fuel cells; and references to Ballard Power Systems hydrogen fuel cells. Other back issues of *Hydrogen Today* have frequently mentioned fuel cells.

The real news in the Chrysler announcement, and one that should thrill every hydrogen proponent, is the recognition by a major automotive manufacturer of the ultimate superiority of hydrogen in the quest for a propulsion technology that is non-polluting. Chrysler will get a good grade on pollution abatement if press reports that the new car will allegedly be 90% cleaner than current gasoline powered vehicles prove to be accurate. Where Chrysler fails is in their reliance upon gasoline instead of water as a feed stock for the hydrogen. One suspects that this is a major concession to the petroleum industry. In fact, statements made by Francois Castaing, Chrysler's Vice President of Vehicle Engineering supports the suspicion that the symbiotic relationship between auto manufacturers and oil companies is still operative. Mr. Castaing said, "We believe that hydrogen needs to be processed from gasoline on board vehicles, because hydrogen isn't a practical fuel choice today." No mention of water as a source for hydrogen and his assertion about hydrogen not being a practical fuel choice today is disingenuous and misleading. Of course hydrogen is not only practical, it is superior in every sense and could be cost competitive with any other fuel if produced to take advantage of economies of scale. If a commitment was forthcoming to demonstrate hydrogen effectiveness (as suggested on p. of this newsletter) we would come much closer to Mr. Castaing's next statement which was

apparently meant to clarify his previous assertion. He said, "Simply put, there are not any filling stations supplying it to a mass market." That is really the nub of the issue. The fact that there are relatively few diesel pumps at gasoline stations never prompted a similar complaint about diesel fuel as a practical choice. But the obvious reason is that diesel is a companion product to gasoline whereas hydrogen is still, unhappily, viewed as an upstart competitor. Hydrogen will be welcomed into the market place only when oil producers recognize that the flow of revenues will increase, at higher profit margins than can be achieved with hydrogen while preserving oil reserves for the thousands of essential oil-based products on which modern societies rely.

Chrysler expects a prototype of their vehicle "as soon as 2005." That's eight years plus another few before production cars would be available at dealerships. This is unacceptable; by that time we will have consumed 1/3 of our in-ground oil reserves. Our often stated warning that the planet has, at best, a 40 year supply of crude oil is still ignored and continues to jeopardize our energy future, products made from petroleum AND our national security interests as OPEC assumes a more commanding position by virtue of our increasing need to import oil.

On balance the Chrysler Corp. announcement is a good news, bad news story. It is good news in the sense that hydrogen is slowly being acknowledged; bad news in the continued use of a nonrenewable fossil fuel in a time frame that disregards the economic, social, political, environmental and national security consequences of myopic, short range planning. Our energy policy must include a broad landscape of energy options that promote rising expectations for rational solutions based on hydrogen and other renewable resources. This is the only true way of achieving authentic solutions rather than facile pronouncements of dubious merit.

A LONG HABIT OF NOT THINKING SOMETHING IS WRONG, GIVES IT THE SUPERFICIAL APPEARANCE OF BEING RIGHT; AND RAISES AT FIRST A FORMIDABLE OUTCRY IN DEFENSE OF CUSTOM.

Thomas Paine

"If our Earth was a child, it would have a big bruise with everything we do to it. I'm surprised we haven't died. Without our Earth we would Die. God gave us this world so we could take care of it and so we could live happy not unhappy. So do what is in your heart and do not pollute.

Guamita Rascon; a child's response to AHA's Peace Article in Vol 7.

California Deregulation of Utilities: NOT A model for the Nation

By: Tom Dickerman

I have spent a great deal of time on the deregulation issue. I have read the California legislation, cover-to-cover. It seems to me that there are serious causes for public concern, especially since the CA law is likely to be a model for the nation.

The passage of the CA law was slickly managed by Public Relations types, much like NAFTA and GATT. It is strongly supported by the utilities and large corporations of all types. Why? This alone should be a cause for our concern.

Under the CA law, the utility companies will be entirely relieved of all responsibility for research and development related to power generation, as well as all responsibility for fostering sustainable energy. These responsibilities are being transferred to the California Energy Commission (CEC). Sustainables are vital to our very survival, because we are running out of oil, and we will run out of economically produced natural gas and coal, sooner than we think.

The CEC is a part of State government. The State of CA has major debt problems, and is under pressure to downsize. The CA legislature will decide how much is spent on the CEC's mandates. This is the second worst place to make technical policy decisions, second only to Congress. I expect R&D and sustainable energy to be steadily downsized, at a time when they should be massively increased. It would be much easier for the Public Utilities Corporation (PUC) to manage such expenditures of regulated, integrated utility companies.

The utility companies are also relieved of responsibility for holding down electric rates and for helping the poor. Power rates for residential and small business consumers will be artificially held down to 90 percent of current rates by the sale of bonds. After five years, these bonds, with interest will be repaid by the same consumers!

According to PR spokespersons, competition in the free electric market will drive down retail power rates. If this were so, why are power producers gleeful about deregulation? It is because unregulated power generation will take the lid off electric rates and profits can be maximized. Most well-established industries make a high percentage profit on their investment. We should not expect deregulated power generation to be different. Rates will rise, and there will be no protection at all for small consumers.

Large consumers (such as mining companies and heavy industries - yes, the same companies that lobbied to

get Palo Verde nuclear power plant into Arizona) will be allowed to get first crack at buying power from the power marketers. They will skim off the lowest cost producers. Later, the little people will get the left-overs: the high cost producers. The new wholesale prices at the retail level will depend on the stranded-cost recovery policies crafted by regulators. The high retail prices currently prevalent in the Northeast indicate that this is a region where stranded costs will be high. Economic efficiency dictates that if stranded costs are to be recovered from customers, the costs should be recovered through charges at the retail level. The more stranded costs regulators allow utilities to recover, the more future retail pricing will continue at today's higher prices.

Under the new competitive scenario, when a large industrial customer switches to a new electric provider, the old provider's costs will now have to be spread among the remaining customers. This is called **stranded investment** and is a very contentious issue in deregulation. No one wants to pay for it. Further, no one really knows how much it is. Utilities and industrial customers (such as mining) want to jump ship without any responsibility for their share of the costs. If the Commission allows this to happen, you and I will be paying higher bills, so that a large consumer can enjoy the benefits of lower bills.

Power generation can be out of state or out of the nation, where environmental protections and labor protections are negligible. Power generation will be by companies that are no longer regulated companies.

Also under CA deregulation, the utility companies get full payment for uneconomical generation plants! These costs are estimated at \$28 BILLION. These plants have been previously paid for by the electric customers over past years, including operating costs and fair overhead and profit. Now, PG&E et al will recoup these costs a second time.

The situation is different for nuclear facilities, such as the Diablo Canyon nuclear power plant. The PUC had steadfastly not allowed PG&E to pass on to consumers the cost of Diablo Canyon. PG&E's poor management decisions, and cost overruns in the billions were held in limbo. Now the deregulation law undoes the good work of the Commission, and PG&E gets everything. If you or I or any other business made bad investment decisions or allowed excessive cost overruns, we would have to eat them. Not PG&E — the electric customer will pay for their mistakes!

'Talk It Up' By: Sherwin Berger

Bringing our good news message to schools, churches, civic groups, and service organizations as well as to economic, social, environmental and political discussion groups will become the premier function of an AHA Speakers Bureau. Renewable energy has recently been selected as the 1997-98 national high school debate topic. There will be a national teleconference in Sept 1997 and a "showcase debate" to be held in Washington DC in May 1998. **The debate topic reads: "How can the U.S. best reduce its fossil fuel consumption? Resolved: That the federal government should establish a policy to substantially increase renewable energy use in the United States."** This is a worthy topic for a national high school debate.

A committee has already convened to discuss the structure and most effective means of communicating with those who are anxious to broaden their knowledge of hydrogen and to help students with their debate presentation.

An informed speaker fills a unique educational niche in bringing a powerful message to the audience. The special rapport that can bond a speaker and audience is easily lost when the audience senses a person is unprepared, unable to develop a theme, does not project confidence or cannot adequately answer questions. Speakers must be thoroughly prepared to articulate a structured message that is also factually accurate.

Volunteer speakers are needed for this project. If you have time available to commit to a thorough training regimen and believe you could be an impassioned, effective communicator, we would be pleased to hear from you. Dave Stempien is the team leader of this program. Dave can be contacted at: email ahaspeaker@aol.com

Initiation of a Glossary of Hydrogen Related Terms:

By: Sherwin Berger

Articles in *Hydrogen Today* frequently make reference to terms needed for accurate descriptions of physical, chemical, electrical and biological processes as well as for atmospheric sciences or automotive - aerospace mechanics. Our readers include scientifically sophisticated persons as well as those with limited background in technical matters. One of the many purposes of AHA is to close the information gap between Universities, researchers, industry and the public, by drawing on world-wide developments concerning hydrogen, solar power, new materials, energy conversion, economics, and the environment.

A glossary and table of comparative equivalents data will help to avoid any misinterpretation of articles already presented and those that will appear in future issues. The glossary will begin in the next issue; it will be an ongoing feature that will appear in the Hydrogen Technology section of this newsletter.

Meanwhile, if any reader is in doubt about any terminology previously used or wishes to have clarification on a term that is unclear please write and state your question.

American Hydrogen Association:

A technical and non-technical research and educational group, that bonds many different scientific, economic, and social disciplines ..., encounters the term "fuel cell" in two distinctly different references: To race car and aircraft builders, a **fuel cell is a fuel storage tank**; to energy conversion engineers it is **a device for converting fuel into electricity**. Thus our AHA glossary will define "fuel-storage cell" and "fuel cell" to eliminate confusion.

Saddam Hussein wins the Gulf War ??

By: Staff writer

The oil fires in Kuwait riveted the world's attention in 1991, and as each day passed the relentless flames devoured about five million barrels of oil. Remember the hellish landscape, the fine mist of oil particles that hung in the air and the deafening roar of the wildly burning wells?

Just a few miles to the south, where the Persian Gulf washes the Arabian Peninsula, another environmental atrocity assaulted the region. Blasting pipelines and storage facilities and emptying loaded tankers, the Iraqis deliberately spilled as much as six million barrels of crude. Soon after came the end of the Gulf War.

Then in August of 1996, the world learned that Iraq was pipelining oil to Turkey. Then we learned that Prime Minister Necmettin of Erbakan signed a 23-yr, \$20 billion deal with Iran for natural gas.

Our attention was on the Kurds being killed...or so we were being told. The nightly news showed women crying and dead bodies. We wondered what was the story. The stories were well orchestrated to keep our attention away from the oil situation; the real reason for the war in the first place.

So the oil embargo has failed. We ask ourselves why did this happen? The answer is simple, the world was facing a short supply of winter fuel reserves. For the last two years the U.S. had to dip into strategic oil reserves. The world can not support an extended oil embargo without everyone being affected; particularly in this fossil fueled U.S. economy.

There are no winners in war. From this day forward, all wars over oil will have a devastating effect on the world's economy and the environment.

Recently at a Senate hearing, former CIA Director James Woolsey and General Lee Butler (a field commander during the Persian Gulf War) delivered powerful warnings about U.S. dependency on low-cost imported oil and its threat to the nation's security. "The U.S. is sleep walking into a disaster," said Former DOE Sec. Donald Hodel.

Power Engineering's Opinion: *Hydrogen is no energy lightweight:*

By: John C. Zink, Managing Editor of Power Engineering...December 1996

Several months ago I listed distributed generation devices and energy storage as strategic technologies for the electric power industry. I contended that these technologies have the potential to contribute to a revolutionary change in the electric business, I think hydrogen should be added to that list. Of course, everybody knows hydrogen is the ultimate clean-burning fuel, but it takes more energy to produce it by electrolysis than you get back when you burn it.

That doesn't sound like much of a bargain. If we think of hydrogen as something other than just an in-kind replacement for natural gas, however, the picture begins to change.

First, hydrogen is a medium for concentrating dilute energy sources. One of the big drawbacks to renewable energy sources such as solar and wind power is that they are so dilute. Solar energy reaches the Earth at a rate of not more than 1 kW per square meter, and it takes about 20 acres of wind machines to generate 1 MW. If photocells and windmills were devoted to producing tanks of hydrogen instead of dribbles of electricity, their output could pack more of a punch.

Second, hydrogen is a storage medium. Right now, producing hydrogen by electrolysis then using it in a fuel cell is only about 50 percent efficient, vs. about 65 percent for compressed air storage. So more work is needed. But the right circumstances could make hydrogen energy storage pay — shifting low-value energy to high-value energy, providing enhanced system reliability and making use of otherwise idle investment in generating equipment. Hydrogen might even replace a battery as the storage medium for electricity in an electric car.

Third, hydrogen is an energy transportation medium. The concentrated energy packed in hydrogen, where it is produced, can be transported much like the energy in oil or natural gas is transported from the well to the point of use. Whether it is produced by a remote nuclear plant in its off-peak hours, by solar collectors isolated in a desert or windmills offshore, hydrogen can power fuel cells in the center of the city.

I think the day is past when just the “tree huggers” and other (ed. allegedly) anti-business elements embrace the use of hydrogen fuel. I think it is time for people in the power industry to consider hydrogen a serious contender for future use as a clean fuel/energy storage/energy transportation medium.

Dear Mr. Zink:

Thank you for including *hydrogen* in your list of strategic technologies as mentioned in your “Opinion” in the 2 December 1996 issue of *Power Engineering*.

One technical note that should be mentioned regarding the efficiency of electrolysis. Hydrogen has been produced by electrolysis at efficiencies exceeding 90% and it is possible to increase the efficiency by reducing the voltage of electrolysis through addition of heat. High temperature endothermic electrolysis can actually produce hydrogen in an amount that yields more energy than the amount of electrical energy consumed in the process. This is not a perpetual motion scheme. The trick in this endothermic process is to add heat to replace the requirement for electricity. At a sufficiently high temperature the voltage approaches zero.

Another reason for including hydrogen as a strategic technology is to improve the efficiency of energy conversion to the point of providing sustainability. The best that we engineers have managed to achieve in supplying electricity for the Industrial Revolution is about 0.1%, with the serious handicap of being dependent on supplies that were produced millions of years ago. This embarrassingly low efficiency starts with ancient photosynthesis 500 million to 60 million years ago which was about the same as it is today. This first step efficiency averages less than 1%. Suppose that the extremely generous efficiency of 50% is used for conversion of the biomass to fossil fuel and that the generous estimate of 50% efficiency is used to estimate the discovery, production or mining, clean-up, and delivery of the fossil fuels to a power plant. Continue the generous estimates and give 40% for the average power plant conversion of delivered fuel to electricity and transform and transmit the electricity to customers at 95% efficiency. Multiplying the factors together provides an overall efficiency of less than 0.1% which severely limits future possibilities for sustaining the prosperity that we have produced with energy-intensive products.

Solar-thermal electricity conversion and delivery through the grid, using gensets, has been demonstrated at an overall solar to electricity efficiency of more than 23%. This means that it will require hundreds of times less land area to provide sustainable supplies of energy by solar-thermal conversion processes than by attempts to reproduce fossil fuels.

But energy storage and convenient delivery are required to meet the needs of transportation and industry. Hydrogen can be transported through existing natural gas pipelines and it can be stored in depleted natural gas and oil fields. Humans have traveled faster and greater distances using hydrogen than with any other fuel. Hydrogen fuel has taken mankind to the moon and back.

Sincerely,
Roy McAlister,
President of American Hydrogen Association

Dear Mr. McAlister,

Thank you for your interest in reprinting the "Opinion" piece from the December 1996 issue of *Power Engineering*. Permission is granted subject to the normal condition that proper credit is given.

Thank you for the additional information you furnished in your letter. It looks like my 50% efficiency from electricity to electricity was a little low. Assuming a 70 - 75% efficient fuel cell, the hydrogen option would appear to match the CAES efficiency of 65% or so. That's encouraging.

I have been interested in the potential for widespread use of hydrogen for some time and, as vice president for research at Central and South West Corporation, I partially funded some photo-electrolysis work by John O'M Bockris at Texas A&M University in the mid-80's. I am pleased to hear that progress is continuing.

Sincerely,
John C. Zink, Managing Editor, Power Engineering

Stranded Power: A new report puts the nations' stranded cost total at \$202 billion including federally funded plants at \$147 billion, municipal utilities for \$33 billion, and rural electric cooperatives for \$22 billion. Of the total, nuclear plants account for \$86 billion while above-market power purchase contracts (e.g., PURPA contracts) account for \$54 billion and utilities' regulatory assets (i.e., previously incurred costs carried on utilities' balance sheets with the assumption that they will be recovered later) totaling \$49 billion.

Shaw's Welding

Arc -- Acetylene -- Heliarc

In Shop Welding
Quality Work at Reasonable Prices

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

Roses to:

Rotary International
Ray Smucker
Craig Wilson
Tom Strong
Larry & Judy Trimmell

Members called home in Death

L.A. Britton
Sandra Adler Lent
Charles Sutherland
Roger Hinds

Foundation Board contributions

Tom Wilson & Norm Davis

Car Donations

Ted Tash
Tim McKinna

Marie Davis, Ben Ferguson,
Cameron Way
for the AHA Web page

Mission Meetings

D.K. Harrison, George O'Connor,
Paul Greenshields, & Ewu Kueter

Metro Tech

Hosting an AHA Conversion Class

Sponsors

Shaw's Welding
Air Products & Chemicals, Inc
Nigeria Mohawk Power
United Technologies/
Hamilton Standard
Eco Gas
Dais Corporation
Praxair

AN INTERVIEW WITH ROY McALISTER, P.E.,
President of American Hydrogen Association
By: Marcia J. Greenshields

Few people work as hard as Roy McAlister to solve the world's problems. Many people, because of habit, ignorance, lack of foresight, and/or greed consider the problems to be insoluble. Roy McAlister works fourteen to eighteen hours a day to bring hope to all of us.

In December 1989, when Sherwin Berger, David Belskis, Harry Braun, Jerry Dellwo, Dan and David Zavaleta, Kathy and Roy McAlister met and decided to form the American Hydrogen Association, a new way to express what he had been doing throughout his career came into existence for Roy McAlister. Roy understood the task ahead and that it would require extraordinary dedication. Since making the decision to provide education and scientific demonstrations through the auspices of the American Hydrogen Association, about the worthy road to renewables, Kathy and Roy McAlister have spent their income and time in this public service effort to advance the solar-hydrogen economy. Roy has spent most of his waking hours writing letters, writing articles, making speeches, giving interviews, teaching students, and personally conducting visitors around AHA facilities to acquaint them with this noble cause.

Roy is that rare person who is 100% dedicated to what he knows to be true. If you ask him, however, his is a labor of love. Right, Roy?

Roy: I do this in the great company of many others that volunteer time to make a better world. Many AHA volunteers work on the tasks of scientific demonstration and education. Harry Braun, Dr. Zweig, Dick Williams, Dan Morton, Paul Warsitz, John Gotthold, Chuck Terrey, Tom Dickerman, Claude Culbertson, the Zavaleta brothers, and Dr. Nejat Veziroglu come to mind as outstanding examples of dedication. These and many other unpaid heroes are an inspiration. I believe in the efforts of those people who work on renewables in companies that recognize the limitations of fossil resources. To me, a hero is someone like Mel Larsen, building the Radax hydrogen engine, or Demetri Wagner, who formed a corporation called Gas Development Resources.

In all of space, with billions of galaxies, currently we know only of one planet that can support 5.8 billion persons and a wonderful diversity of life. We must protect this precious garden of life. Adoption of

renewable resources provides the opportunity to protect the progress that civilization has made.

Marcia: *Do you foresee a time when you can let up and pursue personal pleasures, the way people enjoy a game of tennis or golf?*

R. Show me how a golf club or tennis racket will do as much as carbon components for cars and renewable hydrogen fuel for cars and I will learn enough about the games to invent better clubs and rackets. I find satisfaction in knowing that there is a growing global population of persons with knowledge and understanding of hydrogen. To exceed the prosperity that the Industrial Revolution has brought, we need to be performing more demonstrations of how to adapt to the "Renewable Resources Revolution." As our first priority, we need to make renewable hydrogen from solar energy and other renewables like garbage and sewage.

M.: *What do you see as the greatest obstacles to the solar-hydrogen economy and, therefore, the reason why you must work such long hours?*

R.: I work long hours because it is the only way I know how to accomplish as much as possible. The reasons are: Education: Our educational system is providing engineers, scientists, economists, artists and other graduates with "pat" answers that are not always accurate or in the best interest of society. Too much of what we teach students assumes dependence on fossil energy. We consume the Earth's resource wealth from processes that pollute the planet and cause have-nots to get poorer while the rich increasingly get richer. We have based the Industrial Revolution on fossil fuels. As they are depleted, we will see very stressful times, possibly leading to anarchy. Even the richest nations cannot have prosperity when we deplete fossil reserves and horribly pollute the planet simultaneously. Our educational system does not put enough emphasis on these looming catastrophes or how to solve them.

The Economy: Another problem is the economy. In the U.S. we take more than a billion dollars each week out of the economy to buy foreign oil. We use the oil to pursue the good life as consumers. Instead, we could be providing jobs for making renewable electricity and hydrogen to replace the \$400 billion dollars per year we now spend on non-renewable fossil energy. We should stimulate the economy and protect the environment by adopting the Renewable Resources Revolution to replace dependence on ancient fossil fuels. We should drive cars made from

MEMBER'S FORUM

carbon materials derived from biomass and sewage.

M.: How would you rate AHA's progress in seven years?

R.: It has been exasperatingly slow compared to what it will be after we reach critical mass (ten percent of the population). Currently, we are spending time in teaching independent studies and Master Thesis students who will enter the labor force and will be properly positioned to promote the concepts of the American Hydrogen Association. However, AHA needs more corporate sponsors who would profit by entering the Renewable Resources Revolution. On the other hand, I am exceptionally pleased with the outpouring of effort and dedication by our volunteers who have made all of our progress possible.

M.: Many people look to government for answers. Other than leadership in passing laws to force the automobile industry to manufacture cars which don't pollute, do you see a need for government in the solar-hydrogen economy?

R.: Government can not solve the people's problems. Consumers need to vote with their dollars and force the auto-makers to sell us cars that clean-up the air. Auto-makers will take notice if we were willing to spend half the price of a new car on our old cars by equipping them to use renewable hydrogen and/or natural gas interchangeably with gasoline. The buy-out of old automobiles to get them off the road defeats the effort to retrofit existing engines to clean burning hydrogen. Corporations can provide a market for renewable hydrogen; it is in their ultimate best interest and will eliminate the need for government regulations. I believe the best role of the government is in converting their fleets of automobiles to run on renewable fuels.

M.: Obviously, if more people joined AHA, your job would be easier. Have you a few words to encourage everyone to join this International organization?

R.: Sometimes people don't join, because they have not been asked to join. Please know that AHA would welcome you to this organization. The opportunity is to create a critical mass of persons that have the desire for answers and the determination to literally change the world through the appropriate utilization of renewable technologies. Join AHA and all of our jobs will be more effective [probably not easier but more effective].

M.: Writing letters to manufacturers, educators, editors, to people in Congress, and to the media, handing out information, and spending approximately \$3 a month doesn't seem too much to ask of anyone to help turn around both the economy and the state of the environment. In fact, that's why I joined. I want to leave the world a better place. AHA provides that opportunity. The enthusiasm is catching, isn't it?

R.: Marcia, you are an inspiration because of your self-giving. You are making a difference in the world by your efforts to advance the goals of the American Hydrogen Association. Yes, the enthusiasm is swelling our numbers.

M.: Hard as you work, it's obvious that you don't consider yourself a workaholic. This really is a labor of love for you. Still, if everyone interested in improving the economy and the environment would spend a little time every week with the same enthusiasm that you exhibit, your dreams for AHA would be closer to fruition.

R.: Yes Marica you are right; this world can be a better place for future generations. Future generations can benefit from our efforts to produce prosperity without pollution and all of us would derive greater satisfaction in knowing that each one of us helped to bring about this outcome.

M.: You're a professional engineer, Roy, with many patents. Undoubtedly, there are more inventions inside your brain begging to be put on paper, but which can't be pursued due to the lack of time. What's the key to keeping everything in perspective?

R.: The purpose of my life, and therefore most inventions that I think about, are to protect this blue planet by improving the efficiency of renewable energy conversion systems. Keeping everything in perspective by choosing the most critical projects to advance this cause of renewable resources and conservation doesn't leave much time for inventing.

Yes, I have many more ideas to develop. Sometimes, I have just enough time to write one paragraph at a time. I do get them on computer — at the current time, they are just unfinished. Time is a factor, but consider how difficult writing patents will be if energy and economic systems collapse.

M.: The goals of AHA are similar to those of many people concerned for life on this planet. Would you please state how AHA differs from other

**McMaster-Carr
Supply Company**

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

Serving Industry Since 1901

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

MEMBER'S FORUM

organizations?

R.: We differ from other organizations by demonstrating workable cost-effective solutions rather than giving only lip service to the problems.

M.: Thanks, Roy, for the hope you've given me and all of us associated with AHA and to all those who understand that we can have prosperity without pollution. Any last comments?

R.: We live at a critical moment in history when the search for the good life can be found by adopting renewable resources. It is an opportunity for individuals, families and organizations to work for something that will help us and future generations. Take time to consider what is most important to you: it is clean air, pure water, wholesome food, and the opportunity to prosper. Join the American Hydrogen Association and help assure that you and future generations will not have to struggle needlessly with some of our most pressing problems..

M.: My concluding comments to the readers:

People like Roy and his wife, Kathy, who unselfishly give to mankind, are the best and perhaps last defense of this country. Personal suffering has led them to pursue ideals to which most of us have given too little thought. Their leadership has provided a guide for making life easier for everyone and a legacy for which future generations will bless them. How many of you have ever thought of leaving a worthy legacy to your children and grandchildren? Here's your opportunity to learn about and get involved with AHA's aims to educate everyone about renewable resources. Make your presence on this planet count for something about which you can personally feel proud.

*A Healthy Planet is a Gift
We give to Each Other.
Roy E. McAlister*

AHA provides a training ground for the "transition economy executives" and provides leadership necessary for a transition into the next millenium. By participating in discussion groups regarding economics and economic development, AHA encourages product development that ensures environmental quality for all. AHA is a catalyst — a liaison to forge supply and demand partnerships that do not have the concept of "immediate gratification" at someone else's expense. We need to show that we care and are committed to a sustainable future instead of a "what can I get now" attitude.

AHA wants to see renewable fuels and products in the

marketplace as quickly as possible. AHA wants all car companies to stop producing cars that require hydrocarbon fuels. It is for our planet and our own health that we want to ban hydrocarbon fuels for transportation. Besides, it is a waste of a precious commodity. Our national debt cannot continue to support our energy habits. What we have learned is that energy has become as important as food, water, shelter or air. Our civilization, at this high rate of energy consumption, could not function without energy as we know it today. It is important that we all make a transition and profit from an improved way of living. It is exciting to think of the future and how old fashioned the use of fossil fuels have become. When looking at new technology the fossil fueled car is starting to look-like the horse and buggy technology. Americans are very creative and they have the answers. However, while we sit around and talk about it foreign countries are doing it. We can't simply think of "them" verses "us" but rather we must work for "all" to promote benefits for mankind and civilization.

*You must become the change
you wish to see.*

Mahatma Gandhi

Did you Know? by: Roy McAlister

Global combustion of 2,800 million tons of coal each year releases about 10,200 million tons of carbon dioxide, 8,960 tons of thorium and 3,540 tons of uranium into the air, water and food chain. The carbon dioxide causes greenhouse gas warming. Radioactive ash causes cancer.

When coal is burned, trace amounts of mercury in the coal break down into different forms or "species," including elemental mercury and oxidized mercury.

Most of this mercury is removed by the pollution control systems currently in use. However, elemental mercury doesn't dissolve in water and can remain suspended in the atmosphere for up to two years. Therefore, it can be deposited almost anywhere in the world.

Oxidized mercury is soluble in water and much of the portion that escapes from the coal plant travels into near-by ground and river areas of the coal plant.

When elemental mercury naturally transforms to oxidized mercury it can accumulate in fish populations, leading to mercury poisoning in persons that eat fish that have accumulated it.

HYDROGEN: A Cash Crop For American Farmers

By: Sherwin Berger

NO, you did not misread the headline of this article. Historically farmers have been associated with raising animals for market and growing fruits, vegetables and grains. Hydrogen hardly fits the conventional picture of a crop for harvesting, but in our rapidly changing world, it seems suitable to enlarge the definition of crop to include any product in which planning, time, effort and finances are invested for the specific purpose of generating farm income.

Many farms are bountifully endowed with open spaces, wind, sun and organic waste - all of which, properly utilized, can be used in the production of hydrogen. Not only can farmers "harvest" hydrogen but in doing so will play a principal role in providing a bridge between the demand for hydrogen and the interval during which the supply is weak until some of the engineering and construction of large scale production facilities come on line. Filling this gap is crucial to prevent loss of enthusiasm and to give the public ongoing opportunities to experience hydrogen as the fuel of choice.

Farm landscapes are as varied as the multitude of crops grown on them. However one feature found on a large proportion of farms is the windmill. These simple devices have long been in use and operated by the action of wind against adjustable slats or vanes attached to a horizontal axis whose speed of revolution is proportional to the strength of the wind. Through appropriate gearing the windmill can act as a pump for water, a grinding millstone or as a source for converting mechanical energy into electrical energy.

Extensive, sophisticated windmill arrays of modern design are being built in the United States and other countries to generate electricity for domestic and commercial purposes. Electricity utilization is not limited to conventional uses, it can be passed through an electrolyzer to separate water into its component parts of hydrogen and oxygen. Whenever appropriately situated, windmills will meet a need and create a new cash flow from both hydrogen and oxygen gases.

Where windmills would not be suitable because of terrain and wind patterns, sunlight can be directed onto parabolic reflectors equipped with Stirling motors at the focal point. The Stirling motor operates very efficiently and will also generate, as in the case of the windmill, electricity for electrolyzing water. These parabolic concentrators, called solar gensets, hold the world record for converting solar energy into electricity.

Anyone who has been exposed to farms for a period of time is aware that farming activities represent a huge ongoing source of biomass and animal wastes. This hydrogen bearing organic material, when processed with selective micro-organisms, will strip the hydrogen from the molecules of the organic material. The technology has been used for many years in the municipal processing of sewage. Some industrial plants and food processors bioremediate to reduce the quantity of organic pollutants that are dumped into the environment. The application of bioremediation that has attracted the most notice was the use of oil-loving bacteria along the beaches of Prince William Sound during the Exxon Valdez cleanup.

Proliferating industrial and commercial demand for hydrogen will initially be serviced by farmers. Then, as increasing hydrogen utilization by all sectors of the economy continues to expand, farmers will be well positioned to provide hydrogen as a cash crop that will meet these ongoing needs. Hydrogen farming also has the great advantage of not being limited to a single growing season. The entire year offers opportunities for income producing hydrogen farming.

The hydrogen farmer will literally become the cornerstone for an orderly maturation of hydrogen energy systems to replace fossil fuels. The technology available to the farming community is indeed good news for farmers and for the entire transitional process to hydrogen energy systems.

The Problem With Stealing Oil:

By: Staff Writers

Nothing worth doing is completed
in one lifetime.
Therefore we must be saved by hope.
Nothing true or beautiful makes
complete sense
in any context of history.
Therefore we must be saved by faith.
Reinhold Niebuhr

There is a deep conflict between the processes of material progress and depletion of our natural resources...air, minerals, soil and water. The ideals of 'progressive' government and culture — and the values of advanced civilization — are inconsistent with our practice of expending resources without replacing them. Stealing resources is bad business and it is immoral. Government and corporations pretend to promote economic growth and technology development, but practice obstruction by short-term goals for power and profit.

Material depletion of fossil minerals is elitist: it makes the rich richer, exalting the few who can control the most stolen resource. Material depletion is facilitated by the expansion of opportunity. Although democratically demanded, it means the expensive support of activities through subsidies to their leaders. Management and control can only prevail by making materials scarce. A world without competition and innovation succumbs to the sure laws of deterioration and decay. As resources predictably dwindle, governments will extend their controls. Distribution becomes paramount. Planning works. Even such a somber certitude seems better to many than the notion of a continuing and incalculable struggle to extend the mastery of mankind over nature and to increase the funds for material depletion. Mother nature has been the supplier of our wealth.

In a depleting economy governments can no longer defer to scientists, technologists, and businessmen as the heroes of the age. It is the state...nation... all that matters are the works of power and bureaucracy; mass behavior and its regulation. Conservation, distribution, and control becomes crucial values.

In a world of material depletion, poverty will increase nearly everywhere. But experts will come forth with new rationales for ignoring the plight of the global poor. It dooms the worker to subsistence wages - a stagnant world economy or let's print more money to buy from Mother nature. However, let's talk simple...everything runs down or runs out. Energy, soil, protein, iron - you name it - it deteriorates or runs out. This means that fuel becomes steadily more costly to steal from Mother Earth. Capitalism, with its imperative of growth, violates the very law of nature if it steals resources. Mother Earth does not care if you pay \$5.00 for oil or \$45.00 per barrel of oil. You are stealing, if you are not replenishing the oil.

In its own simple scientific terms, this theory suffers from a rather extended time frame...we have forty to fifty years of fossil oil; but we had billions of years of sunlight. The rich and

the poor are going to suffer if we don't decide to harness energy from solar. This would be renewable energy. Just think...we wouldn't have to steal, we could create energy forever...yes forever fuel is solar-hydrogen.

We are about to listen to the music, for we did not listen to the words in time. Harnessing renewable energy will take time, discipline, a new kind of informed labor force, and long-term investment.

Thinking creatively to solve problems:

President Clinton suggested that we are in a new age - the information age. However, the concept of information that he is advocating misses the economic surprise in all radical innovation. The idea that we can buy a computer to gain knowledge that safely and systematically assembles facts, misses the radical difference between knowledge and inventing new products. It is the leap of abstract thinking...not the look...the leap through time and space beyond the swarm of observable fact, that makes discovery. This is not easy...it is a life time of preparing by focusing totally on an idea. Yes, the leap of imagination precedes knowledge. Creative thought is not a process of accumulating evidence on a computer.

When you fall in love, a mortal must trust his intuition, and act before he can really know. The idea will not fully reveal itself and its possibilities until he builds trust, and commits himself and engages in all the emotions of love. Creative thought requires that same act of faith. The type of person needed for the renewable infrastructure is the same type of person who trusts his intuitive, spontaneous creative mind, enough to pursue laboriously the experiments that will lead to the knowledge that it is going to take to build Renewable Energy Parks. Creative thought must be open to change and surprise...the flexible person.

Like all new industries wrong ideas have to be abandoned or progress will be halted. This is where we are with oil - we know the end of this experiment...pollution and depletion. When we reject the idea of the fossil fuel infrastructure, change and creativity will occur. Are we so frozen with fear of "what are we going to do without oil," that we can't make a detailed plan for business and government?

The problem is not even fear - it is our teaching. We have elaborate concepts, ideas that are rigid and complex, covering even a wider expanse of knowledge to make one believe that he/she doesn't really know much about anything. How can this person change the world? So we immobilize ourselves, as we gather more and more knowledge and facts. Let someone else do this, I can't possibly understand how to create a new paradigm!!

Our saving hope will be our first impasse with a problem. Problems, hardships and obstacles to get what we want on demand will make us all creative. One day we will not have energy at the usual costs, the lines are back and we can't get gas. Then we will solve our problems—a better mouse trap. By that time, it will be too

late. You see, harnessing renewable energy is a task that will take time. When a nation gives birth to a man or woman who is able to produce a great thoughts that changes the nation, it takes another who is born to understand, admire and build that dream. Those people are AHA members. It is all of us building renewables together. And we must build it now.

It takes altruism, investment, competition and yes, even bankruptcy to make renewable energy viable. Competition will drive production. Individuals will divide the work and specialize labor. We can get rid of poverty for we will not have to have scarcity as the center of our thinking. We can produce all the energy that we like - because we learned how to harness renewable energy. We will not have self-interest that leads to an ever-enlarging welfare state ...or greed by the wealthy. Only in freedom of renewables will we have new challenges to master.

In the U.S. today, we are facing the oil master plan. We must abandon economic freedom, because our frontier of individualism is closing, because our biosphere is strained; because our resources are depleting; because our technology is perverse, junk science; because of over population...yes, we are walking in the shadow of the death of oil. We cannot afford the luxuries of waste. In the pursuit of happiness, we are over consuming.

To overcome this we will have to become Godfearing men and women who recover their belief in hope, faith charity, chance, providence, ingenuity and freedom. Yes, it is divine intervention by the miracle of human creativity... searching the realm of God's enlightenment.

Who is going to open the door of renewables? I'm too poor, I'm not a gifted individual, I have no leadership abilities, my imagination is beat out of me, oh God we can't all be like this!

It is going to take faith (like the poem by Reinhold Niebuhr at the beginning of this article) that as we commit to renewables that all the doors of opportunity will open.

Civilization must have a grand purpose. The renewable infrastructure is worthy of our best efforts.

Our future depends on it.

Impact of Fixed Nitrogen and Carbon

By: Roy E. McAlister

Throughout agricultural history, atmospheric nitrogen has been converted into biologically usable forms ("fixed") by specialized bacteria and lightning. Today most nitrogenous fertilizers are made from fossil fuels, which has made fixed nitrogen so widely used, that it is associated with changes in the way soil, microorganisms, and plants operate. We have doubled the nitrogen in the nitrogen cycle by adding it to the soil, water, and atmosphere.

The nitrogen glut is evident throughout the bio-geo-chemical cycle. For instance nitrous oxide is a potent greenhouse gas. It accumulates in the atmosphere and can

deplete stratospheric ozone. Other nitrogen compounds contribute to smog and acid rain. They alter the pH and nutrient balance of soils and water. Researchers now think that the excess nitrogen may be diminishing biological diversity of plants.

A special type of symbiotic diversity is found in the root nodules of leguminous plants such as soybeans, peanuts, alfalfa, and clover. Anaerobic bacteria that live in these root nodules fix atmospheric nitrogen and produce millions of tons of natural fertilizer each year. Lichens are a symbiosis between a fungus and an alga or cyanobacterium. Rice paddies can accumulate abundant growths of such nitrogen fixing organisms. Cyanobacteria also form a symbiosis with a small floating fern (Azolla) which thrives in rice paddies. This type of symbiosis has sustained many heavily populated rural areas that depend upon rice without artificial fertilizers. It is much better to encourage natural symbiosis to fix nitrogen.

In cities we see oxides of nitrogen and photoactive hydrocarbons in the form of photosynthetic smog. Smog can be eliminated by using hydrogen in place of gasoline in motor vehicles. When combusting hydrogen in the automobile, the engine will intake nitrogen as the major constituent of the air. *The trick to avoiding oxides of nitrogen in the exhaust is to burn the hydrogen below the temperature of 4,000° F.* This avoids production of one of the two required ingredients for smog synthesis. The other required chemical ingredient that is photoactive in smog, is hydrocarbons. Using hydrogen also avoids the presence of photoactive hydrocarbons in the exhaust. The only by-product of hydrogen combustion is water vapor...no oxides of nitrogen or carbons...carbon monoxide or carbon dioxide. Hydrogen vacuums and steam-cleans the air.

A related carbon experiment involved seeding the oceans with iron to stimulate phytoplankton blooms. After observing very low iron concentrations in ocean areas that had little life, John Martin conceived the theory that carbon dioxide could be removed from ocean water and thus the atmosphere by distributing iron-rich nutrients in such ocean waters.

In a trial, which occurred after Mr. Martin's death, iron additions to selected stretches of ocean water stimulated the growth of phytoplankton resulting in photosynthetic conversion of some 2,500 tons of dissolved carbon dioxide into biomass. But then the biomass died, sank, and decayed at the sea bottom. Much of the biomass decay became anaerobic resulting in releases of methane. Methane produces about 70 times greater greenhouse energy-trapping results compared to carbon dioxide.

It is much better to encourage natural symbiosis to fix nitrogen and to leave fossil carbon fixed in the Earth (as illustrated by the ocean experiment) than to continue wasting oil, coal and natural gas to make ammonia fertilizers.

With Daily Supplies of Sunshine
& Wonderful
and
Oceans of Water
& Bountiful

Hydrogen can Power
A World of
Prosperity Without Pollution.
Mel Larsen

President Bill Clinton

Fx: (202) 456-2461

Re: The Success Equation of the Industrial Revolution

$$E \implies M = W$$

Energy => Material = Wealth

You want to lead the United States and the world into the 21st Century?

You want to be a great President?

The above equation expresses the economics lesson of the Industrial Revolution. Getting the meaning of this equation will empower you. **If you want to increase the value of material you must put energy into it.**

We are a rich country, because we applied a lot of energy to provide the things we value and make us wealthy. If we are to remain rich, we must have an unending abundant supply of energy that we can use when and where we want or need it. Fuel is energy stored.

The primary source of fuel is solar in origin. It is solar energy that created the hydrocarbon resources we call "fuel" that gives us energy we benefit from today. Solar energy converts carbon dioxide into a more valuable hydrocarbon product through the photosynthesis process. All life requires a continuous supply of energy for its existence. We as human beings apply energy to increase our productivity.

Energy makes natural resources available to us that would be unattainable without it. *Once you understand that energy is the source of "wealth", you will have the vision of the future.* Energy can solve our economic problems. If we solve our economic problems, social problems will diminish. We will not only balance the budget, we will pay off the national debt. All of the things we want to do depends on energy not money.

Charles H. Terrey

Rethinking Courage By: Joe Dillard

It takes courage to make the world a better place. Courage is a medal of respect we pin on someone else; it is rarely something we give to ourselves. We think courage is bravery, and we set a standard for ourselves that is so high that it is both unattainable and demoralizing. Perhaps the most popular misconception about courage is that it is a confident, defiant reaction to circumstances that would scare another man into inaction or retreat. It is not a reaction to fear. Courage can be far less impressive at first glance, but it provides the seed bed out of which active courage grows.

Courage is calculated risks. It risks ridicule, failure and embarrassment. Courage comes not only in trying, but in picking yourself up when you fail; knowing that to succeed at anything, there are first a certain number of failures before you learn the route. Persistence and perseverance are a consistent course of action. Courage is also having the right of your convictions. Do you live by what you believe is right?

We think of people who sacrifice themselves for others as courageous. Martyrdom, in the form of seeking out opportunities to validate the belief that the world is cruel or unfair, is not courageous. *It is a cynical avoidance of responsibility for making our life better.*

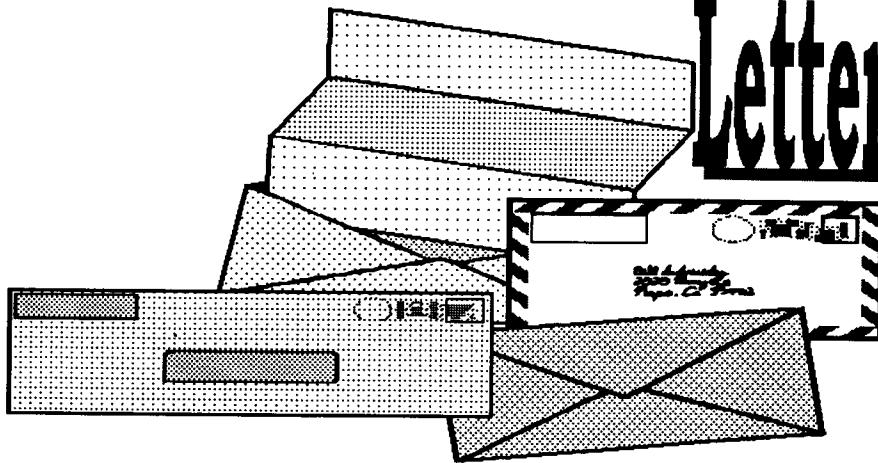
It takes courage to bend, not to react to fear, courage not to be defensive, courage to listen and courage to be patient. When AHA first started, we were timid souls. What looked like courage to you was us just saying the same message over and over. Asking people to join was a scary event. Asking people for money was even a bigger deal. Taking on the oil companies, car companies and the way we have been using our mineral, water, and oil reserves was a calculated risk that their reaction to us could be negative. Fortunately, industry, government and the people heard the story and realized that they are on this same planet. But now, we must go the next step. This is going to require real courage. We are going to have to speak-up about our own energy needs. We are going to have to speak out against energy abuse. It is even harder that we ourselves have abusive habits that are affecting the Earth and ourselves. Still harder is the fact that we are going to have to build much of a new energy infrastructure that must change our current systems. And it has to be built fast...and that takes money. We have become slaves of oil. In America there is money and resources to build sustainable energy systems for the entire planet. We must figure out who has the capability of leading, and then aggressively supporting that leadership with the needed talent and money.

Here at AHA, we are growing that seedbed of courage. Commit yourself to looking for courage in your life. Nourish, foster, support and acknowledge your acts of courage. Visualize the world transformed and with it, your life, and the lives of your grandchildren. Support this hydrogen transformation with your time and money. Hand out information sheets and membership blanks. Educate people by talking to them and showing them a video. Be an early adopter of the technology. But most of all, maintain your personal integrity. You will attract people to what you do first and foremost by who you are.

Perhaps someone would like to sponsor and design a T-shirt or a button that reads:

Life shrinks or expands in proportion to one's courage.

Anais Nin



Letters to the editor

Dear AHA,

I thought that you might like to know that my seven year old son thinks that the promotional video for AHA ("The Solar Hydrogen Economy", Narrated by...Harry Braun) you sent me is really neat. He really wants to watch it. When I asked him why, he said, "Because I want to know everything about hydrogen that you know, Dad". It woke me up. I've always been interested in hydrogen as a fuel and basic chemical feed stock (for at least 20 years). I just haven't kept in touch. I need to join up and start looking for opportunities to promote the concept. I think I'll start with myself and my kids. Look for my check by snail-mail soon

Ken Shumway
Mobile, AL

Editor's note: This father's wake-up call, prompted by his seven year old son's curiosity, should become an example to be emulated by every parent. We thank Mr. Shumway for sharing this personal, pertinent insight with Hydrogen Today readers.

POLLUTEC 96 Lyon, France, a report to the members of AHA

POLLUTEC is an annual European trade show focusing on pollution management (waste management, toxic emissions management, energy management). This year it was held during the fourth week in October in the city of Lyon, France. There was a booth at the show for U.S. companies to display their wares. There was very little displayed at this booth, only a brochure listing four U.S. companies. I inquired if I could display some AHA literature that I had brought along and they carefully placed it in the most prominent position.

The show had an impressively large number of exhibits and a large attendance. 1700 companies participated directly or indirectly. The exhibit areas were divided into: Water; Air-Noise, Waste, Recycling,

Industrial cleaning, Energy, Control-Analysis-Measurements, Multi-sectoral activities, Institutions, and Collective stands.

I did not attend any of the conferences, because I was there on a marketing mission for Phoenix Control Systems, Inc. I was involved with the booths at the show. My limited French did not stop me from making business contacts since there was at least one person who spoke fairly fluent English at every booth that I approached. The most interesting contact for my purposes, was a software firm that sold a program that could model the dispersion of pollutants in air, water or soil. I can report that I found a major breakthrough here, in the design of garbage trucks. One model on display advertised that it was exceptionally quiet so that it would not awaken sleepers in the wee hours of the morning.

This show was a testimony to the deep concerns of the Europeans for the problems of human impact on the environment. It also demonstrated that capitalism and the profit motive could be brought to bear on problems of the environment. It would be good if AHA participation in this show were stronger in future years.

Frank Kruglinski
Phoenix Control Systems,
(602) 582-4282
e-mail sales@pcsi.az.com

Editor's note: The point about extending AHA participation in this show and others is well taken. We look forward to expanding AHA's outreach to many other countries through trade shows or any other mode of spreading the heartening news that is inherent in the hydrogen story. If readers know of shows that would be appropriate or have other suggestions, we welcome your thoughts.

Letters to the Editor

Dear AHA,

Thank you for sending the classnotes, *Philosopher Mechanic*. Sometimes, just putting a thought or idea on paper seems to galvanize my thoughts with affirmative action to lead the way through the jumble of information and misinformation that seems to exist about the subject of hydrogen.

My background and training and experience is "auto mechanics"; almost 35 years of repairing, servicing, studying, modifying and experimenting with most every make of car and light truck. Fifteen of those years were in my own service station where I enjoyed all the ramifications of a small business owner/operator.

My pet project has always been to get more miles per gallon, particularly on my own vehicles where I could monitor the results of my latest experiment. Some results were good and some made it worse or created an additional problem somewhere else...I'm sure you know the routine...anyway, I've tried or at least looked at and discarded every gimmick, add-on, additive product or do-dad that came along.

The latest thing to catch my attention is an on board hydrogen generator electrolyzer unit for automotive use. I purchased one that is a chamber, cylindrical in shape approx. 6" dia. x 10", made of heavy plastic material. One end is removable: inside are positive and negative electrodes of stainless steel plates submerged in the electrolyte (their so called "patented secret sauce"). It operates on 12-15 V @ 8-10 amps producing H₂ and O₂ via electrolysis. The gases are drawn off by the manifold vacuum line tee-ed into the unit.

A cursory examination, produced a few questions which they could not answer for me and the more I queried about the process, the more I became

dissatisfied, with their answers. The past few months I have been reading as much as I can find at the library on the subject of hydrogen and some of the experiments carried out during the energy crisis of the mid '70s, and so far it seems that this unit is mostly snake oil...they are on to something, that's for sure...but it's not quite right yet. I will keep experimenting with similar devices to see if I can get some results that I can work with.

Norris Nygaard - Canada

Note: On-board electrolyzers can help reduce exhaust emissions by adding hydrogen and oxygen to the gasoline-air mixture that is burned. In order to get the best results, the air-fuel ratio should be increased and the ignition timing changed for the faster combustion characteristics of hydrogen.

The problem with on-board electrolysis is that 100 units of gasoline energy are used in the engine to make about 25 energy units of shaft power which could be entirely consumed by an alternator and electrolyzer to produce about 10 to 15 energy units of hydrogen.

So far this does not help the fuel economy to trade 100 units of energy for 15 units of energy and it reduces the available power for getting down the road.

Therefore, the best way to power the electrolyzer is with "stopping energy" in which the kinetic energy of the vehicle is recovered as hydrogen energy instead of heat on the brakes.

Keep-up the good work of experimenting and inventing. It will be philosopher mechanics just like you who will change the world one car at a time until we have clean air and a sustainable economy. Thanks, Roy McAlister

continued from page 4. only adopt vehicle emissions control requirements that are "identical" to CA's standards. CA's regulations no longer include any requirements for ZEVs for 1998 through 2002. AAMA contends that the DEC regulations include percentage ZEVs requirements beginning in model year 1998, and are, therefore, preempted by Federal law.

Dear AHA,

I am interested in a membership with your organization and am sending \$30.00 - initially to get acquainted and receive some information.

I am a career Master Electrician and am a committed environmentalist. Through the years, I have been catching some occasional bits of information about hydrogen power and would like to get educated about the subject as I sense it is exciting and really starting to "take off." I am specifically interested in application of hydrogen power for residential housing or for isolated uses such as water pumping stations, cabins, look out towers, etc.

Please send me information that might help me with study and items such as regenerative fuel cell applications. Also, a broader outline of the organization's purpose, and a variety of interests would be great.

It looks like a wonderful group doing some great work!

Larry Barnard

Note to Larry:

Hope you enjoyed the Philosopher Mechanic. The theme of this issue of "Hydrogen Today" was developed to answer letters like yours. AHA wants you to know about the organization along with hydrogen and renewable energy technologies.

The real issue is about integrity. Are we an organization that can be trusted to provide options for a prosperous future? Each of us must decide about our mission. However, we can't wait long to decide. Renewable energy parks are needed soon. Oil took over 6 million years to fossilize and 130 years of technology development to get us where we are today. We can not wait the last minute and start the energy park developments. AHA needs a model solar energy park, a model wave energy park, a model biomass park, and a model wind energy park to demonstrate the economic viability of these essential approaches.

If we continue to be a throw-away, don't pg 23.

Events Events Events Events

upcoming upcoming upcoming upcoming

April 19-20th & October 18-19, 1997 — Tempe, AZ — AHA Hydrogen Auto Conversion Class; Contact: Kathy 1-(602) 921-0433. Registration is accomplished by returning a form and a deposit of \$50 or full payment of \$225 (payable to AHA) or \$400 for non-members of AHA. Reference materials will be supplied including: Jay Storer, *Propane fuel conversions* (S.A. Deisng Books, 1986 and Roy McAlister, *The Philosopher Mechanic*, AHA's class notes, 1996. The propane book can be purchased for \$18.00 plus shipping, and the class notes are \$35.00 plus \$3.00 shipping. Class starts at 8:30 a.m. and continues to 4:00 p.m. each day. On the second day, lunch will include a hydrogen BBQ.

Apr 7-10 - Detroit, MI — 5th Annual Environmental Vehicle Conference; fx (810) 355-1492.

Apr 14-19 — Hannover, Germany — 3rd Joint Presentation of Hydrogen Technologies at Hannover Fair ; Contact: Wolfgang Pech +49 89 958 1724 or Fx: +49 89 958 1923.

Apr 25-30 — Washington, D.C. — Solar '97: Energy for a Sustainable Prosperity; (303) 443-3130.

May 27-29 — Amsterdam, The Netherlands —World Sustainable Transport Conference; fx: 44 171-793-8007.

May 25-28 - Estoril, Portugal — 3rd Annual Chemistry, Energy & The Environment; Hotel Palacio; Phone/fx: 351-1-778 3594.

June 20-22 - Amherst, WI - The Midwest Renewable Energy Fair - Portage County Fairgrounds, (715) 824-5166; fx: (715) 824-5399.

June — Toronto, Ontario, Canada — 8th Canadian Hydrogen Workshop; (416) 978-2551

June 23-26 - Kona, HI -BioHydrogen '97 - Ph: (808) 956-2335 fx: (808) 956-2335 mkamiya@hawaii.edu.

July 7-10 — Lisbon, Portugal —4th International Conference on Technologies & Combustion for a Clean Environment; fx: 351-1 847-5545 — Portugal.

July 21-24 - Yogyakarta, Indonesia - International Conference on Fluid & Thermal Energy Conversion '97 - Garuda Hotel - (312) 996-5592 fx: (312) 996-8305; email: mansoori@uic.edu

July 30-Aug 1 - Florence, Italy - FLOWERS '97: Florence World Energy Research Symposium.

1998 - Buenos Aires, Argentina - I.A.H.E. Meeting. Fx: (54) 1 328-8640/-890.

Aug 5-8 - Beijing, China - U.S. - China Conference on the Environment (in conjunction with ASU (AZ State Univ) (602) 943-3922; fx: (602) 943-4458 e-mail global@goodnet.com; www.goodnet.com/~global

Sept 8-13 - Kazan, Russia to Moscow on motor-ship - 3rd International Conference on New Energy Systems& Conversion Email: root@kaiadm.Kazan.SU

Oct 11-12 - Tempe, AZ -Short-course "Gensets" production of electricity and hydrogen - Taught by Roy McAlister. Deposit is \$50.00. Total price is \$495 which includes a working model of a Solar Dish Engine.

WEB SITE: WWW.CLEAN-AIR.ORG

AHA has registered the domain, "clean-air.org" on the World Wide Web, and may maintain a web site or other electronic publication. The webmaster coordinator will be an appointed position by the President of AHA. The webmaster coordinator will have final say as to the substance and integrity of the web-site. Each Chapter may have its own homepage connected to AHA's domain. The purpose of the web-site is:

1. To extend leadership, education, electronic commerce and promotion of renewable resources to AHA members and the world-wide community through electronic media.
2. To maintain an encyclopedia-like library on renewable energy; provide self-study programs, develop curriculum and link information to form a field of renewable energy studies for the Wealth-Addition task force.
3. To organize a technical team of members to work effectively with non-technical persons to develop multimedia capabilities and graphics for each homepage; to attract AHA's target audience and to develop the curriculum for self-study program.
4. To develop a high-quality mission-critical messaging ..infrastructure that is easily accessed.
5. To help provide information about funding opportunities for worthy projects in the field of renewable resources.

continued from page 22.

society and consume beyond sustainability, humans will be relegated to tough times. Thank you Larry for your support of AHA's programs to provide options for achieving sustainable prosperity. P.S. Larrys of the world, I am counting on you. Kathy McAlister

TAX SEASON GREETINGS FROM AHA

As each person prepares tax returns and submits funds to help support U.S. revenue needs, be mindful that monies are often allocated for inappropriate purposes. This is an ideal time to contact your senator and representative and voice your determination to promote Congress' awareness of inexhaustible, non-polluting hydrogen energy systems.

- Yes, I want to join AHA, or give a gift to help make a transition to clean Hydrogen energy.
- Yes, Enroll me in the automotive conversion class. [Dates currently being offered: April, 19-20; Oct. 18-19, 1997]
- Yes, Enroll me in the Genset - Short Course. [Date currently being offered: October 11-12, 1997]
- Yes, I want to buy Hydrogen Hannah, at the pre-published price of \$9.95, plus \$2.00 postage: check enclosed... Shipped Sept/Oct. 1997.

Name _____

Address _____

City _____ State _____ Zip _____

Telephone - Home (____) _____ - _____ Office (____) _____ - _____

- Regular membership (\$39/year) Corporate/ Institutional/Membership (\$2,500) Life Membership (\$1,000)
- Student & Senior (\$25/year) Sustaining Membership (\$100/year) Auto Conversion or Genset Class \$50 Deposit
- American Hydrogen Association Foundation donation: \$ _____

Consider a life income gift. Make a tax advantaged gift to AHA while retaining income on the capital for life.

For details contact George O'Connor, Fund Director

All donations to The American Hydrogen Association are Tax Deductable to the extent allowed under IRS 501 (C) 3 as a non-profit Organization. Enclose Check or Money Order and Mail to:

American Hydrogen Association, 216 S. Clarke Drive, Suite 103, Tempe AZ 85281

Phone: (602) 921-0433 Fax: (602) 967-6601

The Hydrogen Association

216 South Clark Drive, Suite 103

Tempe, AZ 85281

USA

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