



Hydrogen Today

"Clean Energy For A Better World"

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We Can Change The Weather

by Roy McAlister

The Industrial Revolution has progressed by the exploitation of fossil fuels. Nearly all of the fuels used for transportation are fossil fuels. Most of the fuel used for the generation of electricity are fossil fuels. Every day the fossil fuel equivalent of 180 million barrels of oil are burned to support earth's population of 5.6 billion humans.

During Earth's history, great amounts of vegetable matter was deposited and covered with sufficient alluvium to seal it from air and prevent oxidation. Petrocarbon deposits of coal, oil, and natural gas developed in the places where the alluvium was sufficiently thick and strong to retain the pressures developed by anaerobic decomposition of the vegetable matter. Our fossil bank account diminishes each day as we burn enormous amounts of these ancient solar energy petrocarbon treasures.

Radiation of light from stars provides the primary energy for building green plant tissues, therefore, solar energy accounts for nearly all of the energy available for the human economy on Earth. Solar energy produced all of the coal, oil, and natural gas that we have on Earth. Resources such as limestone, diatomaceous earth, and coral reefs are products of solar energy conversions by nature.

WHAT MAKES THE WEATHER?

Solar energy drives all of the weather on Earth. Every event of the weather including: evaporation of the oceans, winds, rains, hurricanes, tornadoes, snow storms, cold waves, heat waves, etc. is driven by solar energy. The Earth's atmosphere is a giant heat engine in which the heat source is the sun and cooling results from radiation to the black of space.

The addition of greenhouse gases to Earth's atmosphere results in reduced radiation to space and solar energy becomes trapped. Trapping more solar energy in the atmosphere results in more weather. The trapped energy is expressed as more work by the atmosphere. 1995 was the hottest global year on record and it follows a string of record breaking years that built to a worrisome crescendo just before the dust of the Mt. Pinatubo volcanic eruptions blocked accumulation of solar energy for several years.

HOW CAN THERE BE GLOBAL WARMING? - ITS COLD OUTSIDE!

Even the record breaking cold weather is a result of more solar energy being trapped in Earth's atmosphere by greenhouse gases. When cold arctic air goes further south than normal to produce record cold temperatures, it does so to replace air that is abnormally heated over

areas of the continents and oceans that are closer to the equator. The heated air produces a low pressure area and colder air flows towards the low pressure bringing record breaking cold temperatures further south.

Most of the world's 500 million vehicles are in cities. Cars produce about 80% of airborne pollution in cities. Living standards are compromised by carbon monoxide, unburned hydrocarbons, peroxyacetyl nitrate, and poisonous particles from diesel engines and tire wear. The commonality of all of these components to smog is airborne carbon compounds.

Elimination of fuels that contain carbon and controlling the combustion temperature will prevent smog in cities and it will allow the green plants to start keeping up with the rate that carbon dioxide is added to the atmosphere. Cars that operate in cities can be served by existing electric power grids. One way to fuel cars with hydrogen is to add storage tanks and fuel controls for using hydrogen produced by electrolyzing water, grid-delivered electricity or renewable electricity

The equipment needed is a high-pressure electrolyzer and a system for metering the hydrogen into the existing engine. Cars using hydrogen produce no

(Continued on page 2)

Hydrogen Technology

ASU Students Test Thermochemical Regeneration

By Staff Writer

Exhaust gases from a Hercules industrial engine are being used in a study aimed at eliminating particulates and achieving large reductions in CO, CO₂, NO_x, and hydrocarbon exhaust emissions. According to ASU Professor Don Kelley, "Reforming of hydrocarbon fuels by endothermic reactions using waste heat from the exhaust gases can produce hydrogen that is fed back into the internal combustion engine." ASU students built a catalytic heat exchanger which is capable of converting ordinary hydrocarbon fuels into hydrogen and either carbon dioxide or carbon monoxide depending upon how the process reactions are controlled. Goals of the experiment include improved engine performance, higher fuel efficiency, and reduction of harmful emissions.

Roy McAlister, who suggested the hands-on educational project and first served as the technical advisor and then the customer for the "product" that the engineering class produced said, "hydrogen provides superior

combustion properties and allows an engine to operate efficiently through a wide range of leaner air/fuel ratios. If it is done in the

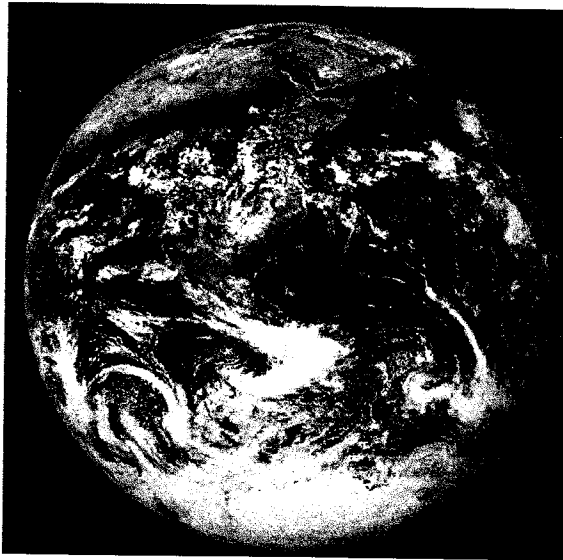
most optimum way thermochemical regeneration allows the engine to operate with unthrottled air entry. Hydrogen provides wide flammability limits, lower net ignition energy, and high flame speeds all of which translate to higher fuel efficiency and very low emissions."

The class was pleased with the project and amazed that they could convert hydrocarbons fuels to hydrogen and increase the energy available for power production by using waste heat from an engine.

Next semester, McAlister has invited another class to advance the technology by studying the reaction rates as a function of catalyst selection, temperature, agitation, and pressure conditions. It is anticipated that reforming methane will produce 20% to 40% improvements in fuel .

economy while greatly reducing emission levels.

ASU Engineering Technology



American Hydrogen Technology

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(Continued from page 1)

carbon dioxide, and no particulates. In instances that the peak combustion temperature is controlled, N-O is not formed.

Producing the predominant quantity of heat by hydrogen combustion allows air-born contaminants such as hydrocarbons to be forced to chemical destruction in the hydrogen flame. The result is cleaner air.

Renewable hydrogen and carbon can be derived from biomass by anaerobic extraction techniques. Using hydrogen extracted from biomass wastes that would ordinarily be allowed to decay into the atmosphere extends minus-emissions benefits by preventing formation of greenhouse gases.

To restore the atmosphere to carbon levels that existed before the Industrial Revolution we must thoughtfully remove carbon dioxide and methane from the atmosphere by encouraging natural processes such as photosynthesis. The plant tissue must not be allowed to decay the carbon back into the atmosphere. We must process the biomass into recycleable carbon products and use the hydrogen as a carbon-free fuel. We need to restore the

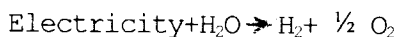
An Introduction to Electrolysis

Part two of a Three Part Series

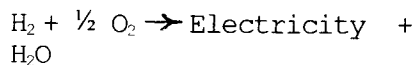
By Roy McAlister

In our last news letter we suggested some experiments for converting water into hydrogen and oxygen. Thanks for so many inquiries and requests for advance releases of Parts Two and Three.

Electrolysis is the process of passing of an electric current through water and soluble additives that make the water more conductive. One molecular weight of water yields one formula weight of hydrogen and one-half formula weight of oxygen.



Electrolysis of water may be reversible depending upon how it is done. By 1839, William Grove's experiments in reversible electrolysis had shown how water could be dissociated into certain volumes of hydrogen and oxygen that could be used to produce water without any of these gases left over and that the recombination reaction produced exactly as much water as was present at the start of electrolysis. Equally important was the discovery that the recombination reaction of these certain volumes of hydrogen and oxygen produced exactly the same electric current as the electrolysis reaction required. Voltage losses in the reaction were shown to be due to resistive losses in the wires and acid electrolyte of Grove's experiment.



William Grove logically concluded that he had found the ultimately clean and efficient chemistry for making the young Industrial Revolution run cleanly. He was knighted for his discoveries and it seemed that the world would soon be rid of air

pollution in cities like London where killer fogs followed the increasing dependence upon fossil fuels. Grove had discovered that an electrolyzer operated backwards is a fuel cell and visa versa. However, what remained an unsolved mystery in Grove's time was how to produce the electricity required for electrolysis without pollution. Subsequent discoveries of coal, oil, and natural gas and the quick profits that could be made by using these fossil reserves would delay realization of Grove's expectation of a clean Industrial Revolution for more than a century.

Grove would have been thrilled to

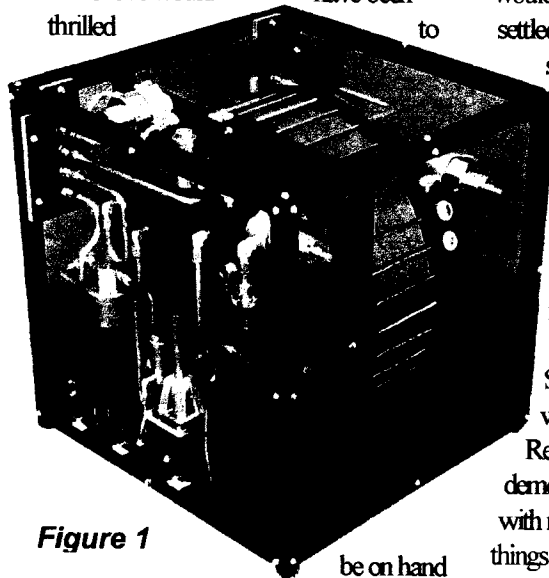


Figure 1

be on hand 150 years after his discoveries to see the work of Hamilton Standard and others regarding a reversible electrolysis process that could make it possible to launch an airplane that would fly continuously without the need to return to earth for refueling. The airplane would have thin layers of photovoltaics on the wings for converting solar energy into electricity which would be used for electrolysis and in electric motors to turn propellers for powering the ultralight airplane. Hydrogen and oxygen stored from the electrolysis process would be used to produce electricity at night for

producing power to turn the propellers.

Modern discoveries of wonderful materials make it possible to design and build such an airplane including polymer electrolytes that facilitate the reversible electrolysis process in weight-saving layers that are only 0.001" (one thousandth of an inch) thick, carbon-fiber composites for making the airplane very strong and very light, and very thin deposits of conductive circuits to facilitate the operation of thin layers of semiconductor materials. William Grove would have known what to do with these marvelous materials if they would have been available in 1839. Grove settled on asbestos as the best material for

separating the hydrogen from the oxygen as these gases formed on the electrodes in his electrolysis experiments. He saturated the asbestos with various acids and bases and found sulfuric acid to provide the best medium for his reversible electrolysis experiments.

Figure 1 shows Hamilton Standard's reversible electrolyzer which is called a "Unitized Regenerative Fuel Cell" and demonstrates how a light-weight package with no moving parts can do wondrous things when combined with renewable electricity. Imagine having one in your home silently making Solar Hydrogen when your wind generator, photovoltaic roof, hydro-alternator, or dish genset is producing surplus electricity. You may also make a deal to buy inexpensive off-peak electricity from the utility grid or from a wind farm. You can use the hydrogen in your lawnmower, barbecue, or in the fuel-cell mode of your electrolyzer to provide electricity at night and at other times that the renewable electricity source does not meet the electrical load requirements. The oxygen can be used for industrial or

(Continued on page 4)'

Photobioreactor



"...water decomposed into its primitive elements,...and decomposed doubtless by electricity, which will then have become a powerful and manageable force...I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable. Some day the coalrooms of steamers and the tenders of locomotives will, instead of coal, be stored with these two condensed gases, which will burn in the furnaces with enormous calorific power...I believe, then, that when the deposits of coal are exhausted, we shall heat and warm ourselves with water. Water will be the coal of the future."

Jules Verne, ca. 1870 *The Mysterious Island*

German scientists are working in the Sahara Desert where they have started developing their first heliomite a coneshaped wooden construction with transparent plastic pipe for the movement of thiorhodaceae.

Thiorhodaceae is a strain of bacteria used to produce hydrogen

The results showed that the rate of hydrogen production almost doubled when the reactor was irradiated from the side, since thiorhodaceae favored the long-wave light reflected by the Sahara sand. The scientist have combined bacteria and plant photosynthesis to provide nutrients for the bacteria. They constructed two reaction chambers in which green algae and thiorhodaceae are positioned adjacent to each other. Their metabolic products intact.

The green algae reacted with the bacterial carbon dioxide and water to form both oxygen and carbohydrates. The oxygen can escape and the carbohydrates served to feed the solution of thiorhodaceae. The bacteria then produces carbon dioxide and hydrogen.

One photobioreactor unit produced 285 liters of hydrogen an hour.

The goal would be to construct a photobioreactor at a landfill site or city sewage plant. What now is an artificial symbiosis natural resources experiment could produce two new cash crops...hydrogen and carbon.

(Continued from page 3)

medicinal purposes.

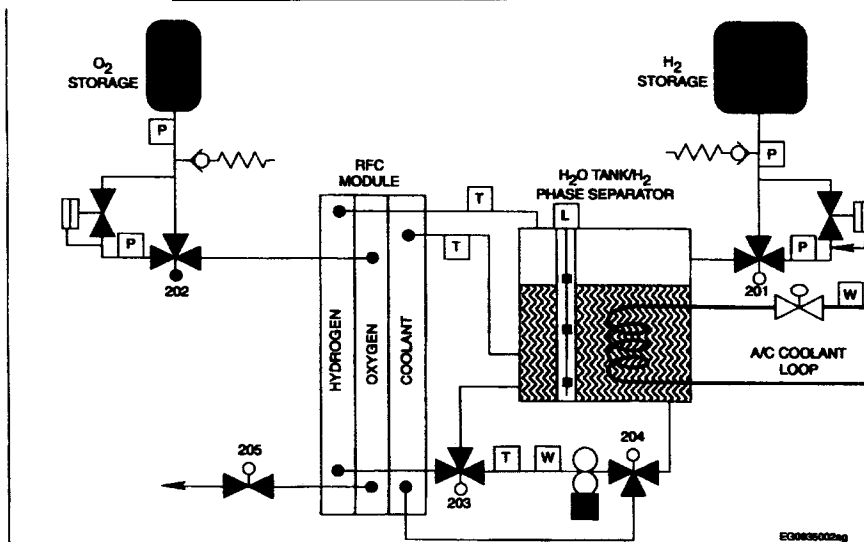
The Hamilton Standard Unitized Regenerative Fuel Cell can provide high pressure supplies of hydrogen and oxygen without a compressor. As shown in Figure 2, hydrogen and oxygen pressurize the electrolyzer and the storage containers because these gases occupy much greater volume than the water.

Please advise AHA of your interest in

adding your name to the growing list of persons that would seriously consider buying a Unitized Regenerative Fuel Cell.

The specifications shown below are adequate to provide electricity for most homes. A larger Hamilton Standard unit could fit in about the same space as a 80 gallon water heater, and supply up to 12 lbs of hydrogen per day. This is enough hydrogen to provide 180 miles travel each day with a 30 mpg vehicle.

Figure 2 Unitized Regenerative Fuel Cell



URFC SYSTEM CHARACTERISTICS

Parameter	Value
Power Output	5 kW
Peak Power Input	26 kW
System Weight w/o Reactants	68 kg
H ₂ Tankage ΔSpar Weight	50 kg
H ₂ Storage Weight	3 kg
O ₂ Storage ΔSpar Weight	25 kg

continued from page 2

concentration that was maintained before the Industrial Revolution. Replacing fossil fuels with solar hydrogen will accomplish this goal while greatly improving the economy and it will allow civilization to be a sustainable experiment instead of a terminal search for the good life.

FuelMaker-Fuel your car at Home

By Marcia DeFalco

The FuelMaker System's design for natural gas has the flexibility to fuel vehicles quickly or over a period of time, as required. There is a huge market need for fleet and in-plant refueling systems that are low-cost, reliable and compact. It is the world's only vehicle refueling appliance which requires no special permitting to install. Thus creating a great potential for the FuelMaker system in the residential market – allowing you to fill your car at home without going to a fueling station.

Natural gas is distributed by an extensive underground piping network. At a residential or commercial site, the gas is usually reduced in pressure before being measured and sold to the customer. The FuelMaker is designed to accept gas

downstream of the utility gas meter and to increase its pressure for use as vehicle fuel by means of a miniature air-cooled reciprocating compressor. An electric motor drives the compressor and a sophisticated control system is used to ensure safe and reliable operation.

A number of unique features are incorporated into the design. To avoid releasing even a small amount of natural gas into the atmosphere, FuelMaker has a system which blows down the refueling hose at the end of the refueling cycle. A valve opens to a small receiver built into the appliance which automatically drops the fill line pressure down to about 0.1-0.3 MPa (15-45psig) for uncoupling.

FuelMaker has an electronic temperature/pressure compensation system with backup mechanical relief protection. Because the FuelMaker system is designed for long-term unattended operation, it has been equipped with a method of detecting whether gas is escaping from a severed refueling hose or a failed refueling problem. Its sensors constantly monitor the rate of pressure rise over time. If the rate is too low or if the outlet pressure drops, the system is automatically shut down.

FuelMaker is equipped with a microprocessor that monitors faults, stores them in memory and displays them for the user and for the service person. An operating manual lists fault indicators (lights on the user panel) and a listing of probable causes and suggested corrective actions.

An added safety feature eliminates the risk of a user forgetting

to unplug before driving away. If this should happen the hose disconnects from the appliance and the unit shuts down immediately.

The FuelMaker is designed to be located outdoors, fastened to a precast or poured concrete base. Protection from vehicle impact may be required. A low pressure gas inlet line and a 220 volt electrical supply are required.

It is easy to use; remove the refueling hose from the FuelMaker and plug it into the receptacle on the vehicle. Push the "start" button and close the lid. After several hours when refueling is complete the appliance stops automatically. Unplug the refueling hose from the vehicle and store it back in the appliance.

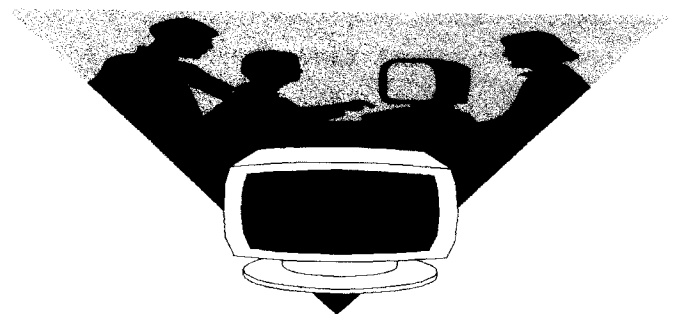
If you wish to interrupt the refueling cycle, simply press the "stop" button, then disconnect the hose.

"It is the world's only vehicle refueling appliance which requires no special permitting to install. Thus creating a great potential for the FuelMaker system in the residential market—allowing you to fill your car at home without going to a fueling station."

NIPSCO

Development Company, Inc., a non-utility subsidiary of NIPSCO Industries, Inc. and FuelMaker Corporation will be co-owner of FuelMaker. The companies say, "They have immediate plans to accelerate the technology research and development efforts in product modifications that will make the FuelMaker system more readily available to the untapped, worldwide residential marketplace."

Marcia DeFalco can be reached at (219) 647-6203



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Hydrogen Politics

Senate Votes to Allow Drilling in Alaskan Arctic A billion dollar Christmas present to the oil companies



by: Staff writer

The U.S. Senate voted by a narrow margin in October to allow the Arctic National Wildlife Refuge to be leased for oil exploration. The provision is called the Arctic Coastal Plain Leasing and Revenue Act - it's Subtitle C of the 1995 Balanced Budget Reconciliation Act (HR 2491). It would specifically allow oil-and-gas drilling in a 1.5 million acre coastal plain which is an important habitat for Alaskan caribou herds. Lobbyists tell how oil production from this previously protected wilderness will raise billions of dollars.

At current oil prices, there is under a 50% chance that ANWR would provide any economically recoverable oil, and should a significant amount of oil be recoverable, it is expected to provide only 300,000 barrels of oil a day for 30 years - providing less than 2% of U.S. oil needs. If the pumping rate were faster, and the consumption rate of the U.S. would remain constant, ANWR oil reserves would provide the U.S. with 6 months worth of oil for transportation fuel. President Clinton has vowed to veto the bill.

In a similar development, Elk Hills Naval Petroleum Reserve in San Joaquin Valley, CA is also up for sale. The government proposes to bring in \$1.5 billion dollars for balancing the budget. Provisions to dispose of the field is included in the budget talks. It is estimated that

some 360 million barrels to more than 1 billion barrels of oil reserves are yet to be recovered from this working reserve. An estimated 1.2 billion cubic feet of natural gas is available. Retired Navy Captain Alan Meeks ran the Elk Hills operation until he left the Navy 18 months ago. Mr. Meeks said, "The Elk Hills reserve has sold about \$16.1 billion worth of oil since 1976 while having expenses of about \$3.2 billion." He calls the proposed sale of Elk Hills a "taxpayer ripoff" which is part of a policy by senior Energy Department officials to give the oil companies a sweetheart deal.

Why? This oil property is the best money maker the government has on its books.

Assistant Energy Secretary Patricia Godley's office proposed the Elk Hills sales strategy to Congress and said, "That the government is ill-suited to run a commercial oil field. There is no government purpose for running a commercial oil field."

The Department of Energy in December sold unneeded gold, silver and other precious metals. "This is an important step in our privatization program to improve performance and reduce costs in the core missions of the department," said Secretary Hazel O'Leary. DeGussa Precious Metals of Ridgefield M.J. was the big winner of the bid for about \$3 million. The precious metals were used in DOE's nuclear weapons program but the need for them has been reduced since the end of the Cold War.

It goes to show that in our fossil economy, taxpayers end-up having to sell

off their National resources to pay for the political spending habits of Congress and the President. So can anyone think of a reason why the government should not give sweetheart deals or big give aways at Christmas to pay off the National debt? Oh, you don't say...the money never ended up balancing the budget, or paying the principle...or interest on our debt!!!

Even worse, we will just burn that fuel up in a wasteful manner as we drive - not thinking of the value of oil, the cost of war, or what we are going to do when we can no longer buy fossil fuels at the pump.

MUCHAS GRACIAS

The editing and layout for this publication were done by Mary Ann Sweikart and Pete O'Biso. Mucho hours were donated by these two and AHA sincerely extends their appreciation and recognition.

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Arizona Welding Equipment Co.

Hydrogen & Other Industrial Gases

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MTBE (Methanol) In Ground Water: How Serious is the Problem ?

Ref: U.S. Geological Survey (FS-114-05)
Staff Reporter

MTBE is an oxygenated hydrocarbon called "ether" that is added to gasoline in the clean fuel program. It is volatile, flammable, colorless liquid at room temperature, with a distinctive odor. MTBE is soluble in gasoline, water, alcohol, and other ethers. Because of its chemical characteristics, MTBE would be expected to be found primarily in the atmosphere and in water.

A computer model showed that 56% of MTBE in the environment should be found in the air, 43% in surface water and only about 0.5% in soil or streambed sediments. Although MTBE will volatilize from soils, it is also highly mobile in soil and can move

into ground water. Once in ground water, MTBE resists decay when compared to other gasoline components like benzene. In surface water, MTBE is not

expected to bio-accumulated in aquatic organisms.

MTBE is released to the air from sources such as industry (makers of MTBE) and vehicles. Once in the air, MTBE can be mixed with precipitation that carry MTBE to the ground water or to streams. Snow in the Denver area supports these findings. Also gasoline spills may directly contribute to MTBE contamination of ground water and surface water.

Water-quality data from urban and agricultural areas show that MTBE occurs predominantly in shallow ground water underlying urban areas. MTBE was detected in 27% of urban wells and 1.3% of agricultural wells distributed across the US. The most frequently detected area

was Denver, CO and urban areas in New England. In Denver, 79% of the shallow urban wells (23 of 29 wells) had detectable concentrations of MTBE. Other urban areas where MTBE was detected included: Reno, Albany, Dallas/Fort Worth, Las Vegas, Atlanta and Albuquerque. In agricultural land-use areas, MTBE was detected in Southern Colorado, New England, and Eastern Pennsylvania.

Other chemical components of gasoline found in well water were: chloroform (identified in automobile exhaust), tetrachloroethane, trichloroethene, cis-1,2 dichloroethene, 1,1-dichloroethane and benzene. Gasoline using MTBE is clearly a serious problem and cause of ground water pollution. Leaking underground storage tanks and spills at the land surface are also

sources of MTBE and other gasoline chemicals in the environment.

So Americans, why do we use dirty fuels that makes us sick (the worst being cancer) and

So Americans, why do we use dirty fuels that make us sick and pollute the air and water ?

pollutes the air and water? Unlike any other energy carrier, hydrogen is nontoxic and can be stored and used safely in our vehicles, factories, farms, and homes without pollution. When we use hydrogen, it recombines with oxygen from the air to make pure water. When produced by modern technologies from renewable resources hydrogen becomes a safe, pollution-free, limitless, and healthful energy carrier for sustainable wealth development.



Thy who have put out

the peoples eye
reproach them
of their blindness.

John Milton, 1642



The HIDDEN COST of plummeting oil prices

by Kathleen McAlister

The OPEC (Organization of Petroleum Exporting Countries) has a production ceiling of 24 million barrels a day. The average price of OPEC oil has recently traded at around \$16 per barrel and it may be forced to fall in 1996 to \$12 per barrel. Yes, we can have cheap oil when we don't have to replace it ... just take it from the earth without a care for health, environmental degradation, or the future. It is close to paying \$20 for the short-term purpose of taking a joy ride in a stolen car. The \$20 does not begin to cover the price of replacing the car or having your lawyer or clergy explain the quick-thrill rationale to a higher authority, but to the thief it seems to be a tidy profit of \$20.

Various energy experts believe Non-OPEC producers will market an

additional 1 to 1.7 million barrels of crude per day next year, while world demand is expected to increase between 1 to 1.3 million barrels a day. A gas war driven by greed to gain the quickest profits by selling oil at a price ridiculously below the true cost of replacement has developed between OPEC and Non-OPEC producers. At present, in terms of adjusted purchasing power, the dollar buys more gallons of gasoline than at any time since World War II. Industrial analysts say oil prices could fall next year unless world oil production levels are lowered. This will probably not happen because Russia is vying to regain the production levels that once lead the world. Russian leaders are under pressure to produce improved living standards and oil has been identified as the most exploitable resource for job development and for balancing the trade deficit that is

developing as Russia imports consumer goods. Iraq will probably enter the world market after the U.S. election.

The real issue is a more-complex matter of economics: the abundance of oil in the Middle East has resulted in a massive shift of the world's economic wealth, particularly since the OPEC oil embargo of 1973 to a relatively few individuals or families in the oil-rich countries of Saudi Arabia, Kuwait, the Arab Emirates, Iraq and Iran.

Iraq and Iran both spent much of their wealth for weapons in their eight-year war, including billions to amass powerful war machines with chemical, biological, and growing nuclear-military capabilities.

"...the abundance of oil in the Middle East has resulted in a massive shift of the world's economic wealth since the OPEC oil embargo of 1973 to a relatively few individuals or families in the oil-rich countries..."

Saudi Arabia and Kuwait, on the other hand, invested heavily in land and businesses in the West, particularly in North America and Europe. In addition, the controlling powers of Saudi Arabia and Kuwait have provided massive financial backing (primarily loans) to the major banks of the world. Since the Gulf War, Saudi Arabia has felt the need to stockpile weapons of war to defend their oil-rich kingdom.

Both Saudi Arabia and Kuwait have been strong supporters of the U.S. economy in yet another way: they have, by using their enormous oil production capability and clout among had the favorable effect of keeping the cost of oil-based energy low, which has helped hold down inflation by keeping the prices of gasoline and diesel fuels relatively inexpensive.

The actions of Saudi Arabia and Kuwait have had, however, the very unfavorable effect of strongly discouraging U.S. development of alternative energy sources, such as renewable electricity and hydrogen. However while America sleeps with the false security of cheap oil prices, Saudi Arabia is shrewdly following a path towards replacing oil with hydrogen and plans to become a leading producer of solar hydrogen. Congratulations to the strategic planners of Saudi Arabia! I'm glad you are looking out for your country's future, and I wish U. S. leaders could have been so thoughtful of the future when we were our world's largest oil producer.

For nations like Iraq, these actions by Saudi Arabia and Kuwait have been extremely costly. Not only have Saudi Arabia and Kuwait supplied

disproportionately greater amounts of the total oil demand to Japan, the U.S. and other Western nations, but they have depressed prices (and therefore net income) for all other oil producers.

Instead of paying billions of dollars every five days to foreign oil barons, the U.S. could be receiving billions of dollars from sales of solar hydrogen along with the products to make and use renewable energy. Instead of staring at a huge and rapidly mounting debt, our nation could be creating wealth. Instead of sending a half million men and women to create hatred and fight for oil security, we could be creating far greater numbers of new jobs in the sustainable, peaceful, healthful, Hydrogen Economy.

And we would not be choking in smog-laden cities and suffering the

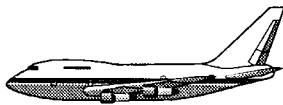
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consequences of greater evaporation of the oceans and more frequent floods, hurricanes, tornadoes, and lightening damage, due to dumping massive amounts of "Greenhouse Gases" (primarily CO₂ and methane) into our atmosphere.

The cost is enormous for avoiding development of clean renewable energy supplies for the world's growing population. We need to print the special purpose paper called money to develop renewable energy with the same glee that we printed money to buy computers, airplanes, bombs and missiles to win the cold war. This time it will curb inflation forever and win the survival war. Without sustainable energy supplies civilization cannot maintain the search for the good life that now requires burning the fossil equivalent of some 180 million barrels of stolen oil each day.

Will cheap gasoline make us forget to make it possible for the 5 billion persons that are dependent upon fossil energy to survive? It is our decision.



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California Rewrites Their Energy Policy: An example for the U.S. to follow???

by Kathy McAlister

Did you know: Between 1990 and 2011, California's population is projected to increase by approximately 44% - twice the growth rate of the US. With 23 million passenger vehicles on the road, using over 13 billion gallons of fuel annually, California is promoting the commercialization of more fuel efficient and clean, alternative-fuel vehicles. Their newly released Energy Policy emphasizes sticking with fossil fuels while working closely with the petroleum industry to ensure an adequate and reliable supply of transportation fuels in concert with air quality goals.

This means that for every gallon of fossil fuel that is burned about 20 pounds of carbon dioxide will be emitted into the atmosphere. Thirteen billion gallons sources 260 billion pounds of carbon dioxide each year. Earth's atmosphere now contains about 30% more carbon dioxide than at any time in the last 160,000 years. With more carbon dioxide, more energy is trapped in the atmosphere and more evaporation of the oceans results.

At the end of June 1995, California had its worse smog alert in many years and was repairing flood damages. Do you suppose California residents are beginning to wonder about their good health and the cost of repairing flood and wind damages from record setting weather? Pollution of the atmosphere, fresh water, and California's ocean seriously threatens their standard of living. Depletion of fossil fuels will ultimately cause economic inflation followed by hardships, increased sickness and starvation, along with strife and social disruption. Will California's newly written

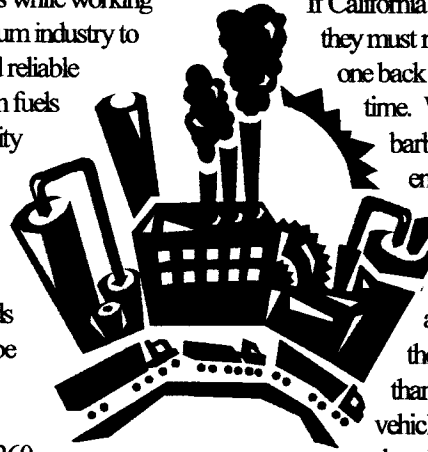
energy policy prevent these harmful trends?

In too many ways, being hooked on oil is like being dependent on some mind-altering drug. We rationalize our actions and pay virtually any price to keep the oil supply coming our way. We are willing to oblige our children to great debt and a compromised environment to pay for our excesses. The U.S. stands armed and ready to go to war to assure delivery of foreign oil to fuel our search for the good life.

If California wants a better world they must make it so...one car, one back yard, one farm at a time. We can equip our cars, barbecues, homes and engine generator sets to operate on hydrogen. Cars using hydrogen operate more safely and clean the air as they are driven. Better than being zero emissions vehicles, our cars can produce less than zero

emissions and operate as public service devices that leave cleaner air behind than the air entering their engines. An average car using hydrogen can clean enough air to fill two to five houses each day with clean air. How good it feels to know that you are cleaning the air for friends in the neighborhood!

Where can this hydrogen come from? It can come from fossil gasoline and natural gas by saving the carbon for more valuable uses, from biomass resources, from electrolysis of water using solar thermal energy, wind generators, and photovoltaics. Not only can the neighborhood be clean it can have better jobs making the clean hydrogen and electricity that are needed for prosperity without pollution.



Hydrogen Politics

THE RENEWABLE RESOURCES REVOLUTION

By: Roy E. McAlister

We live in a period of history that is marked by remarkable advancements of the Industrial Revolution. Millions of families have better homes and more convenient travel conveyances than kings and queens in times prior to the Industrial Revolution. We have sanitary plumbing, air conditioning, hot and cold running water, electric appliances, radio, television, computers, refrigerated foods, microwave cooking and motorized travel through the air, on land, and across water. Much of what we take for granted was beyond the imagination of Leonardo de Vinci, Sir Isaac Newton, and Galileo.

Most of our good fortune has been provided by mass manufacturing processes that were developed during the last century. During this period we built great factories, provided fine products for the masses, and produced agricultural surpluses by harnessing fossil energy from 100 million years ago.

Humans have dominion over other life forms and we have changed the surface of the earth by building cities, dams, highways and canals with fossil-fuel engines. We have changed the surface of earth so much that climate has become more energetic and more capable of mass destruction.

We have stolen enough fossil energy from the earth to make a cruel trap ... the fossil-dependence trap ... and the entire surface of the world ... all civilization ... all remaining wilderness ... all species of life ... are in this trap. We highly value "the fossil energy good life" and this value is placed ahead of sustainability of civilization.

Politics is dedicated to wealth redistribution and this is a widely endorsed pursuit. But let's look at some big-time wealth redistribution. The U.S. economy hemorrhages at

the rate of a billion dollars every six days to pay for foreign oil. This tremendous cost of imported oil adversely tilts the balance of trade. The U.S. suffers a balance of trade deficit that is closely correlated to our growing dependence upon foreign oil. We are redistributing our wealth to other countries.

OPEC controls about 75% of the planet's oil reserves. OPEC provides about 36% of the oil consumed. By 2010, OPEC will have about 90% of the planet's oil reserves. If we remain dependent upon oil how will we survive the wealth redistribution program in 2010?

We must end our preoccupation with wealth redistribution and replace it with wealth addition. We must add wealth to this planet in order to achieve a sustainable economy. Nature provides an example as green plants convert solar energy, water, carbon dioxide, and various trace elements into plant tissue by photosynthesis. In order to achieve sustainability, much more solar energy must be added to the planet's wealth by incorporating it into energy-intensive products.

We must invigorate the Renewable Resources Revolution. Fifty years from now, we are going to look back and realize that we did not act fast enough. We need to accelerate investment in the renewable infrastructure. This is an enormous project and we must make much progress while we have the economic base, political security, educational capabilities, the workforce and the fossil resources needed to achieve sustainability.

The US has tremendous advantages that have resulted from enormous investments in highways, canals, pipelines, and electricity grids. We know how to invest for the public good. We must diligently build Renewable Energy Parks to achieve sustainable prosperity.

BALLARD AND NEW FLYER FORM ALLIANCE FOR FUEL CELL ZERO EMISSIONS BUSES

VANCOUVER, Nov. 1994—Ballard Power Systems Inc. announced today an agreement with New Flyer Industries Limited to develop and market a new generation of urban transit buses to be powered by the Ballard Zero Emission Fuel Cell Engine. Under the agreement, a 275 horsepower (205 kW) proprietary fuel cell engine designed by Ballard will power a New Flyer 40LF Low Floor Bus. This commercial prototype bus is scheduled to be completed by mid-1995. In June 1993, Ballard, together with B.C. transit, developed the world's first fuel-cell powered electric vehicle based on a 125 horsepower Ballard Fuel Cell Engine. Since then, this zero-emission vehicle has been tested for thousands of kilometers,

demonstrating the value and feasibility of using Ballard Fuel Cell engines for mass transit across North America. Among its many design advantages, the New Flyer low-floor bus will provide more convenient and safer access for seniors and the physically challenged. "Using the Ballard's pollution-free engine, these advanced low-floor buses will be the transportation mode of the future," says Jan den Ouden, President of New Flyer Industries Limited. "We are very excited about working with

continued page 11

By: Kathy McAlister

It isn't news that States are refusing to live under the early EPA's 1990's clean zero emission laws. There are no penalties or fines for refusing to conform to the EPA Clean Air Act. State laws are being passed to roll back the alternative fuels mandates for transit authorities, local governments and private fleets to operate as zero emission vehicles. Now, the states are talking about Low Emission Vehicle (LEV) exhaust standards using reformulated gasoline and low-sulfur diesel fuels.

Some of these rules will be voluntary...if you want to convert or not convert. The National EPA believes that this will offer greater environmental and economic benefits. By February 15, 1996 the States must have filled an implementation plan that include LEV. The only way that this can be implemented is by an agreement between the states and all auto manufacturers with sales in the US. The auto manufacturers are not agreeing to any National LEV until they know that zero emission vehicles (ZEVs) are dead. And if future administrations decide to proceed with the ZEV mandates, the auto manufactures can opt-out of the entire National LEV program.

For example Texas is creating an Alternative Fuel Council with grants in the millions to provide assistance to public and private fleet owners for the costs of converting vehicles to use alternative fuels. They will oversee the projects and make funds available to school

districts, state agencies, counties, cities and mass transit authorities to cover the capital costs of installing refueling systems, modifying engines or purchasing new vehicles that run on alternative fuels. These funds are supported by federal oil overcharge funds and will provide capital for matching grants. Using dollars to buy fossil fuel equipment to operate on fossil fuel.

Clean air, reducing consumption on fossil fuels or poisoning our water supplies are not primary considerations. So why change the laws? simple...corporate welfare for the oil and auto industry. "By undermining the Clean Air Act we're writing a check for ourselves that's going to bounce for future generations." This famous quote is from Jim Wallace, for the kids at Ben Franklin Elementary School in Ridgewood, NJ.

Jim Wallace has taught his students how to write letters to editors, organize a campaign and stage a protest. They developed public educational materials such as pamphlets, a video which was broadcast to the rest of the school, and a school newspaper, complete with updates on New Jersey's air quality, along with comic strips and word search games related to air and water pollution.

The big question is: Will the States that are working to overturn Zero Emissions laws be able to look California and the North East States in the eye after undermining their Zero Emission laws and be proud of their fossil-dependant economy and pollution in 30 years?

CONTINUED FROM PAGE 10

Ballard to develop this new generation of efficient and environmentally-clean transit vehicles."

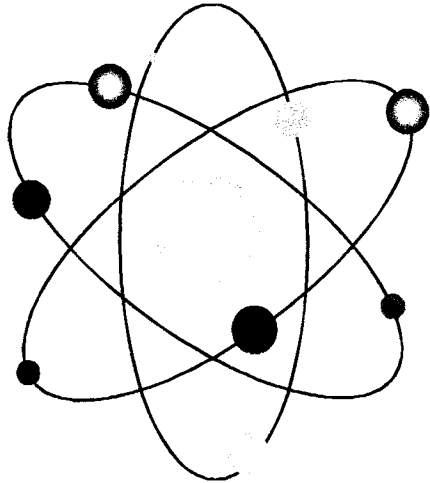
Ballard and New Flyer are expected to begin jointly marketing the commercial version of the zero emission bus to transit authorities and transportation companies in North American cities. "The New Flyer low-floor bus is an ideal platform for the commercial introduction of the Ballard Fuel Cell to the mass transportation market," says Paul Howard, Vice-President of Ballard. Existing diesel engine compartment of the bus and New Flyer's experience with electric drive technology in fleet transit vehicles will help maximize operating performance.

New Flyer Industries Limited is a leading manufacturer of heavy-duty urban transit buses. New Flyer buses are used by transit authorities in major North American cities such as Atlanta, Boston, Chicago, Toronto and Vancouver. New Flyer is also the only North American manufacturer and supplier of electric trolley buses used in San Francisco and other cities.

Ballard Power Systems Inc. is a world leader in the development of fuel cell power systems. At the heart of its products is the Ballard Fuel Cell, a proprietary zero-emission engine that converts natural gas, methanol or hydrogen fuel into electricity without combustion. Ballard Fuel Cells are currently being used by several leading international companies including Daimler-Benz, General Motors, and the Dow Chemical Company to develop zero-emission vehicles and clean stationary power plants.

For further information:
Paul Lancaster (604) 986-9367

Former weapons designer now believes in abolition of nuclear weapons



Reprint from Los Alamos Monitor

By: Stephen T. Shankland
Assistant Managing Editor

Ted Taylor, a former nuclear weapons designer who now believes nuclear weapons should be abolished, knows there have been "twists and turns" in his life.

Taylor, who spoke at a Los Alamos Fe-based Study Group-sponsored talk, said he began his career opposing nuclear weapons and finished his career opposing nuclear weapons. But in the middle, he was captured by the excitement of designing the weapons and the addiction of big - very big- explosions.

The early 1950s really were the golden age of nuclear weapons. The excitement, the financial support, the helpfulness of colleagues, "the wonderful people who really knew what they were doing" all combined to make for an atmosphere that he hasn't seen since. "I don't remember anyone having to write a proposal for anything," he said.

And the feeling of watching a nuclear explosion to which he contributed was incomparable.

If Taylor had key involvement in the bomb. "It became my bomb. And when it exploded in this awesome way, it was like a high."

"It's something that is sort of you extended, going POW! and releasing energy that is clearly off the human scale." Taylor said.

It was an immense sense of power, of "being an important part of doing things that had global effects," he said.

In those early years, the lab suggested to the Pentagon what nuclear weapons work to do, not vice-versa. And the Pentagon agreed.

The Pentagon's goal could be summed up in the equation "Y = infinite; m = 0," meaning that the Pentagon wanted a bomb with an infinitely large explosive yield and no mass.

But later on, Taylor's graduate school opposition to nuclear weapons resurfaced. While a graduate student at the University of California Berkeley, Taylor had co-authored a paper that suggested all nuclear scientists go on strike until nuclear weapons knowledge faded away.

But after "flunking out" of Berkeley while supporting a young family, Taylor decided to accept a position at Los Alamos National Laboratory set-up by his Berkeley mentor, physicist Robert Serber, and his future LANL boss, Carson Mark of the Theoretical Division.

His work at the lab, including such tasks as calculating the biggest and smallest possible fission bombs, was intellectually stimulating. He grew too attached to the work. He became disappointed one night when a calculated blast radius, inscribed as a circle, centered on the Kremlin, that didn't include all of Moscow.

But there was a tension in his life. His mother asked him. "Why are you working on those things, the purpose of which is to kill as many people as possible?"

Taylor felt his response was a rationalization. "We are making war impossible by having reduced it to the absurd. The bigger and more numerous the bombs, the less likely the war."

Later career changes brought him to the Pentagon.

It was there that Taylor changed his mind. "I bottomed out in the middle

(Continued on page 13)

Far better it is to dare mighty things, to win glorious triumphs, even though checkered by failure, than to take rank with those poor spirits who neither enjoy much nor suffer much, because they live in the gray twilight that knows not victory or defeat."
—Theodore Roosevelt

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(Continued from page 12)

of the bowels of the Pentagon." Taylor said. "I realized I had this addictive disease. The only treatment is abstinence. Total abstinence."

Within a few months, he had uprooted and moved to Vienna, where he worked with the International Atomic Energy Agency, a United Nations organization.

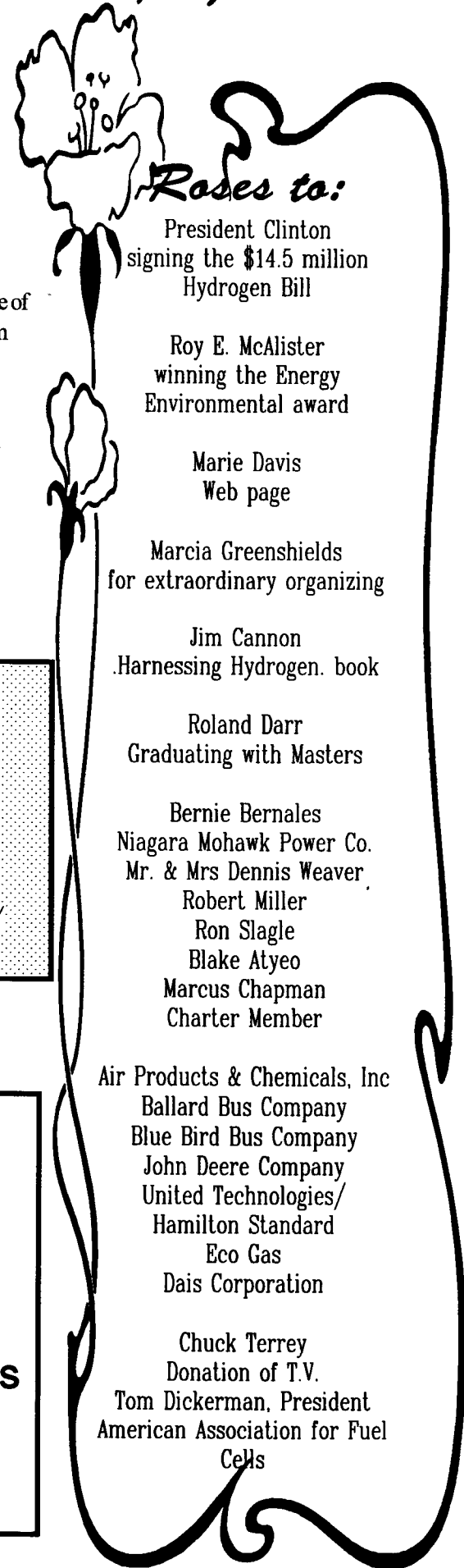
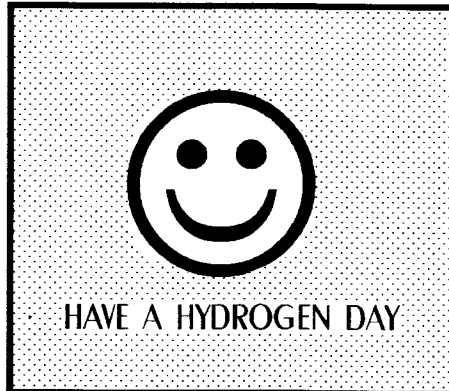
This work brought Taylor to his current belief: All nuclear weapons and nuclear power plants should be abolished.

And those who break agreements involving weapons of mass destruction - anything "of the scale in terms of human killing capacity" - must be punished. Breaking such

agreements should be the "most heinous" crime.

Solar energy should replace nuclear and fossil fuels, he said. He also called for a massive, open, international effort to research the use of solar power to extract hydrogen from water.

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Roses to:

President Clinton signing the \$14.5 million Hydrogen Bill

Roy E. McAlister winning the Energy Environmental award

Marie Davis Web page

Marcia Greenshields for extraordinary organizing

Jim Cannon .Harnessing Hydrogen. book

Roland Darr Graduating with Masters

Bernie Bernales Niagara Mohawk Power Co. Mr. & Mrs Dennis Weaver

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Member's Forum

EFFICIENCY IN NATIONAL ENERGY STRATEGY

By: Chuck Terrey

The National Energy Strategy (NES) talks a lot about increasing the efficiency with which we use fossil fuel energy. However, efficiency is only half of the story. Efficiency has no meaning if we have no fuel.

You can't put efficiency into the tank of your automobile and expect it to move you a mile. Efficiency is only important in the context that there is fuel to use.

We now use 84.5 quads (1×10^{15} Btu's) of energy each year in the United States. In spite of our efforts and success in efficiency improvement our total energy consumption continues to rise at about 1.5 percent per year.

We are limited by the laws of physics as to the maximum efficiency we can achieve in a conversion process of fuel energy to work. Conversion of 33 percent of the energy in fossil fuel to electric energy in a steam power plant is considered excellent. In spite of all we can do, we waste two tons of coal energy for every ton that is delivered as electric energy. The rest of energy is lost in cooling because there is no practical way to use it. Because large

power plants are usually located in a remote location, we have no practical way to use the waste heat to heat or cool our homes and provide hot water. When I was a student at Purdue they had a small electric power generating plant on campus. The waste heat was used to heat

not care about the efficiency of the source of its electricity. However, note that the process and the fuel used to generate electricity has a great effect on the amount of work done with a given Btu's of fuel. This shows us that there is a lot of room for improvement in efficiency if we are

willing to change the fuel and processes. Rather than the 84.5 quads of fossil fuel, we now use we could achieve the same result with perhaps

"In other words hydrogen could cost twice as much as gasoline based on it's Btu content but, it could be less expensive based on the work done basis."

buildings and supply hot water. This strategy improved the overall efficiency of the fuel.

On the other hand fuel cells using hydrogen as fuel can be 70 to 80 percent efficient. Because they are silent and non-polluting they can be placed in close proximity to where the electricity is used. This permits much of the 20 to 30 percent "waste" energy to be utilized in local applications. The result is that nearly 100 percent of the energy in the fuel can be utilized. Similar benefits are offered by co-generation engine generator systems.

Electric motors can be better than 95 percent efficient in converting electric energy to work. The electric motor does

30 quads of hydrogen.

The fact that hydrogen can be used in more efficient processes is a significant factor that has been ignored when making cost comparisons to fossil fuel. In other words hydrogen could cost twice as much as gasoline based on it's Btu content and it could be less expensive based on the work done basis. In reality hydrogen can be made less expensive than fossil fuel on a Btu basis if we mass produce the machines that convert solar energy to hydrogen fuel and build the infrastructure to distribute that fuel inexpensively. In reality we can have a decline in the real cost of fuel by making the transition to renewable hydrogen fuel.

'96 Olympics "Look for a Hydrogen Hybrid Bus"

By: W. Summers, Project Leader
DOE Westinghouse Savannah River Company
Aiken, South Carolina

Southeastern Technology Center has received \$480,000 contract to provide public awareness of a prototype bus that would provide twice the fuel efficiency of a diesel bus, with a 150-mile range.

The Olympic/hydrogen hybrid bus project involves the conversion of an internal combustion engine, a Ford V-8, to hydrogen in a series hybrid electric system which incorporates regenerative braking and a set of batteries. Total project cost is expected to be about \$4.5 million.

The 33 foot, 32-passenger bus frame will be built by Blue Bird Corporation. Westinghouse Electric Corporation will provide the electric drivetrain. The metal hydride storage system will be based on lanthanum-nickel based hydride storage technology. The hydride storage system and the hydrogen engine/generator set will be integrated into the bus by the Georgia Tech Research Institute near Smyrna, Georgia.

Metal hydrides are intermetallic compounds in the form of a powder, that absorb and retain hydrogen at given temperature and pressure conditions. They release the hydrogen, or dehydride, when the pressure is lowered or the temperature is raised. Continuous heating is supplied to the metal hydride beds, so that hydrogen gas will be released.

(Continued on page 16)

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W e a r e u n i q u e a m o n g o u r p e e r s

By: Kathy McAlister

A uniquely American tradition that has flourished in this country is voluntary action for the public good known as "philanthropy." We can truly say that AHA people have an outstanding commitment to philanthropy – a commitment based on our personal conviction that the "hydrogen" is essential to our American way of life. And indeed it is.

Museums, parks, hospitals and community organizations supported by philanthropy are the cornerstones of our very quality of life in America. Voluntary associations are helping to address some of the most troubling social, injustice and energy issues of our times. Perhaps most important our deep conviction that philanthropy people share is that non-profit activities are essential to our democratic society.

AHA people share their dedication – who at the close of business or on weekends – join others at AHA to build engines, talk and write. A place where students, scholars and practical people, from all walk of life, come together to develop and promote renewable energies. These people comprehend that the perpetuation of our diverse tradition of giving, caring and

serving, carried out every day is key to the present and future energy vitality of our nation. That through their own work, innovative technologies are being developed.

The exciting news is young people's commitment to AHA! I must admit that it is the technology that they are committed too. It is critical that we educate the World about the importance of renewable

Member's Forum

hydrogen...and these young ones are doing it. However, we need a hundred million volunteers – to help spread the news about all kinds of renewable energies.

As an association, you can join many kindred spirits – people like you who believe that energy practices can be improved by closely linking education, study and research. We are an educational, demonstration and scientific association dedicated to changing the way energy is produced and used. Thinking and feeling about the importance of our car and the way of life that fossil fuel has afford us in the past, but will not be there for us in the future.

Spreading the word is the most important aspect of AHA. Also, AHA wants you to be a true partner. Your donation to AHA is public ownership. Your help today will enable AHA to further strengthen our energy heritage by expanding the crucial educational, leadership and outreach programs. But whatever the size of your donation, or your participation as a partner, the mission of AHA makes a valuable difference. Your inspiration, your generous support and your active leadership are crucial to this goal of energy independence. If you haven't joined AHA, do so today. Yes, you are unique among your peers. For AHA has been blessed by the grassroots...the people who are dedicated to change the energy picture of the world. This picture will have no more smog... And this picture has people in it who care enough to help. Thank you.

THANK YOU

Let's all recognize and thank Chuck Terrey. Chuck was generous enough to donate a video-television.

Blue Streak, Honda Special, Cadillac Cooking Center...and the Bentfender Racer

as reported by: Kathy McAlister

"Blue Streak" came purring into town, pulled-up outside and out stepped Mr. & Mrs. Herb Johnson from Tucson. "Here is AHA's BMW," he said. We are donating it to the American Hydrogen Association. For all of those who know Roy McAlister, cars come in all sizes, ages and physical conditions. Mostly, the cars that Roy drives happens to be the difficult beasts ... requiring daily attention. Roy just doesn't drive cars. He always has a test going on. But the Blue Streak BMW is like a dream ... because it came

with a very good log of maintenance and fuel consumption everyone wants a BMW.

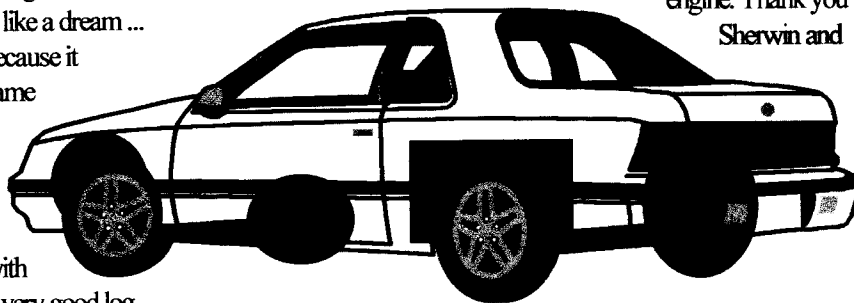
So here is the beautiful blue BMW being donated to AHA. We have considered plans for master mechanic and body man Blake Atyeo to restore it. But if you know Blake, the vehicles he restores are better than new. And, we are not sure Blake would let students get close after he restored it.

Herb said, "That he had heard Roy speak at a Breakfast Club in Tucson about 1993, and he told his wife, that when the car was no longer needed, that he was going to donate it to the American Hydrogen Association." Thank you Mr. & Mrs. Johnson.

Patty Olson donated a high-mileage Honda Civic. Currently, there are special

test sensors on this vehicle. Roy was driving about town in the Honda and I noticed Roy under the hood of the Honda more than usual. We would just go a short distance, then up with the hood. Finally, I said, "Roy what are you doing under that hood." He said, "keeping the student's tests going."

Sherwin Berger is a founding member of AHA. This past summer he donated a car that has been through various tests. Clare teaches the auto classes at AHA and has suggested making a hydrogen drag racing car or a good hydrogen demonstration vehicle with a souped up engine. Thank you Sherwin and



Faye.

Perhaps the most amazing car is the mascot of the Oregon Chapter which is a Hydrogen Cadillac. This car, was donated by Mr. and Mrs A. V. Ottemoeller converts to a hydrogen cooking center. Under the tag plate, on the right side of the gasoline tank cap, is a hydrogen connection for filling the hydrogen tanks on this dual fueled car. On the other side of the gasoline cap is another port for sending hydrogen to the cars portable cooking center. Imagine it, this car can take you in luxury to a beautiful beach as it cleans the air, and then be converted to a hydrogen cooking center. How about that for demonstrating hydrogen prosperity.

All of these cars have served in various educational projects and AHA greatly

appreciates their availability for providing hands on opportunities for students.

Editor's note:

For those wishing to donate a car to the American Hydrogen Association, please call and arrangements will be made. AHA will provide documentation for your tax deduction.

(Continued from page 15)

In the bus, the metal hydride powder is contained in a series of storage tubes which permit the introduction and removal of hydrogen gas. During refueling, hydrogen gas is absorbed by the metal hydride powder and heat is removed. During bus operation, hydrogen fuel for the engine is released from the metal hydride by passing warm engine coolant through tubes in the storage beds.

Definition of Renewable Energy

Texas Renewable Energy Industries Association

"Renewable Energy, or equivalently, Renewables, shall mean any energy resource that is naturally regenerated over a short time scale and derived directly from the sun (such as thermal, photochemical, and photo-electric), indirectly from the sun (such as wind, hydropower, and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment (such as geo-thermal and tidal energy).

Renewable energy does not include energy resources derived from fossil fuels, waste products from fossil sources, or waste products from inorganic sources."

Enegenics Advances

Phillip A Burghart
Energetics Senior Vice President

Ergenics was awarded a key contract by ARPA (U.S. Department of Defense Advanced Research Projects Agency) to work on Ergenics' highly innovative rechargeable battery technology directed at producing a 20 KWHr unit for an electric vehicle (EV). Ergenics' battery will extend an EV's driving range by a factor of three over today's lead acid batteries. Batteries are a major impediment to mass marketing of EVs. Unlike existing lead acid batteries, the Ergenics' battery will also last the entire life of the vehicle.

The initial phase of the project calls for design, fabrication and demonstration of a "High Capacity Hydrogen Storage Unit". This marks the first time a hydrogen storage density of 200W-hr/L will be demonstrated using the Ergenics' patented storage technology. The storage technique will allow hydrogen to be stored safely in solid hydride form at low temperature and pressures.

The Ergenics Segmented Battery™ combines the high energy

storage density of metal hydrides with the space proven chemistry of nickel/hydrogen batteries. The resulting battery outperforms other battery technologies in all significant characteristics including extraordinary cycle life and high discharge rate capability. This makes for faster acceleration of a vehicle. In addition to EVs, it is especially well suited for use in powering Hybrid Electric Vehicles. The Hybrid EV uses a small internal combustion engine in combination with a battery. David DaCosta, President notes, "We are succeeding in resolving the previous limitations of electric vehicles by developing this high performance battery technology. The Segmented Battery removes major barriers to satisfying the mass markets for high performance, safe, and economic electric vehicles." Ergenics' goal is to develop its own battery manufacturing capability, as well as, form joint ventures and license to others where appropriate.

The program is part of the Mid Atlantic Regional Consortium for Advanced Vehicles (MARCAV), which is administered by Concurrent Technologies Corporation. For more information contact Ergenics, Inc. (201) 962-4480 or fax: (201) 962-4325.

Dr Moon Shine Speaks

REPRINT PERMISSION: IOWA RENEWABLE ENERGY ASSOCIATION
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Today's lecture concerns people from Venus and guys from Mars, imposters who both think they own the Earth. The Mars guys have always believed everything important comes from something called "Mars fuel," made from decaying Marsbeasts. On Mars there was an infinite supply of these Marsbeasts, but as the Mars guys took over other planets this "Mars fuel" became expensive to mine and transport to other planets. The price went up, as supply and demand will do to prices. The Mars guys left the deserts of Mars and moved to the "third rock from the sun."

Enter Venus people from a very warm planet heated by the sun. These peaceful people tried to coexist with Mars guys when they moved to Earth, which wasn't hard to do at first. Over many years the Mars guys noticed their profits decline and an increase in the number of solar panels and windmills. At first the Mars guys tried to discredit the Venus movement by blaming the drought of '88 was caused by windmills blowing all the hot moisture away to another state; or the reflection of sunlight off solar panels caused airline pilots to be blinded so they should be covered on sunny days. When these failed, the Mars guys were left with three choices:

1. buy all the sunlight to resell to the customers,
2. convince the Earthlings that solar panels would use up the sunlight and cause a "nuclear winter", or
3. the most unbelievable-show how to sell electricity made from Marsbeasts at below production costs and still make a profit. (Of course, more subsidies and tax credits were always seen as part of this process to keep things "equal.")

This third idea was actually accepted by the Mars guys' overseer, the IUP (Iowans Up against Progress).

The Venus people were mostly right brain and saw the need for saving Marsbeasts for future Earthlings, while the left-brain Mars guys could only see \$\$ and control of all energy sources. The Venus people tried to communicate with these Mars guys, but the language barrier (lots of take and little give), thought process (\$\$\$), and plenty of a drink called Marsguy Stonewall, made coexistence very iffy.

Dr Sun N. Shine and I know the Marsguys will not understand, but the last chapter might go as follows: The Venus people were last seen with tears in their eyes as the Mars guys were trying to convince God that the price of sunlight was not negotiable. "If you don't sell to us, then no one gets it!" Dr Sun N. Shine and I have yet to figure out how Mars guys and Venus people will finally solve an even bigger problem: where to go after we have used all the Marsbeasts and this "rock" we have borrowed is stamped "Non-Returnable" by God.

Hi Dee Ho, good neighbors, Dr. Moon Shine/TES

Carbon Membranes for Hydrogen Separation

Air Products: S.Sircar

Air Products has donated hydrogen fuel at many of AHA's educated demonstrations. AHA wishes again to say "Thank you". While at the 2nd World Hydrogen Summit in Montreal, Quebec, McAlister learned that Air Products has a new nanoporous carbon membrane for separation of gas mixtures. The carbon membrane is called a Selective Surface Flow Membrane. It separates the components of a gas mixture by selectively adsorbing components of the mixture on the pore walls at the high pressure side followed by selective surface diffusion on the adsorbed molecules to the low pressure side.

This membrane is suitable for enriching hydrogen from a hydrogen-hydrocarbon gas mixture such as refinery waste gases. Hydrogen enriched gas is produced at the feed pressure while a hydrocarbon enriched steam is produced at the low pressure side of the membrane. The membrane pores are 5 to 6 Angstrom in size and thickness is 2 to 5 microns.

Translation...

AHA would like to thank Jin Nishimura for his efforts in translating AHA materials to Japanese for distribution overseas.

PRIZES NEEDED TO ENCOURAGE IMPORTANT DEVELOPMENTS

by: Roy McAlister

The tremendous productivity of the Industrial Revolution has provided leisure time and remarkable opportunities for entertainers. Consider the athletes that receive enormous incomes from specialization as a baseball hitter, or football quarterback, basketball center, or boxer. Or if you are not extra athletic note the millions paid to people that look good in the movies. Big money is available for organized entertainment to fill leisure time even though it has no productive result. Promoters have learned how to make society reward entertainers.

But where are the prizes for important developments that make it possible to achieve better living standards and advancement of civilization? Establishment of the Nobel Prizes for this purpose has an interesting history.

A Swedish inventor named Immanuel Nobel failed in business and moved to St. Petersburg Russia where he experimented with nitroglycerine, manufactured rifles, and built water mines. In the middle 1800's his son Alfred Nobel traveled to America and served as an apprentice to the famous Swedish immigrant, John Ericsson, the ship builder and inventor of the Solar Dish Stirling Engine.

Alfred Nobel returned to Europe and specialized as his father had in explosives for military applications. He became immensely wealthy by inventing blasting caps made of fulminate of mercury, dynamite, and manufacturing smokeless powder for military guns, explosives, and as he described them other "tools of Hell." In 1876 Alfred Nobel advertised in the Vienna newspaper for an assistant:

"Elderly, cultured, wealthy gentleman requires equally mature lady, linguist, as secretary and supervisor of household in Paris."

Soon after winning the job as Nobel's

secretary, Bertha Kinsky disappeared by eloping to Vienna to marry von Suttner of Bohemia. Bertha von Suttner probably became a larger influence on Alfred Nobel as a Baroness than she might have had as his secretary. As a Baroness with some wealth of her own she embraced pacifism in the 1880s and found time to write and publish a novel "Lay Down Arms." Nobel, the Dynamite King, found the novel and propaganda supported by Baroness Bertha von Suttner interesting and invited the von Suttners to vacation with him in Switzerland.

During this vacation in 1892, four years before his death the munitions maker challenged the

Baroness to "Inform me, convince me; then I will do something great for the movement." After days of debate and hardheaded skepticism in which the Dynamite King maintained that peace would come if someone invented something so terrible that war would be impossible to win, the vacation ended with the von Suttners reporting that they had failed in their efforts to convert Alfred Nobel to pacifism.

Three months later on March 14, 1893, Alfred Nobel drafted a will in which he left his residuary estate to the Royal Academy of Science at Stockholm with directions for an annual disposal of income "as a reward for the most important discoveries of achievements in the wide field of knowledge and progress, excluding physiology and medicine."

As his health deteriorated, Nobel decided to write a new will modifying the first will in which he designated prizes for advances in Physics, Chemistry, Physiology or Medicine, Literature, and promotion of the Fraternity of Nations and Abolition of Standing Armies and the Formation and Increase of Peace

(Continued on page 19)

Carbon Membranes for Hydrogen Separation

Air Products: S.Sircar

Air Products has donated hydrogen fuel at many of AHA's educated demonstrations. AHA wishes again to say "Thank you". While at the 2nd World Hydrogen Summit in Montreal, Quebec, McAlister learned that Air Products has a new nanoporous carbon membrane for separation of gas mixtures. The carbon membrane is called a Selective Surface Flow Membrane. It separates the components of a gas mixture by selectively adsorbing components of the mixture on the pore walls at the high pressure side followed by selective surface diffusion on the adsorbed molecules to the low pressure side.

This membrane is suitable for enriching hydrogen from a hydrogen-hydrocarbon gas mixture such as refinery waste gases. Hydrogen enriched gas is produced at the feed pressure while a hydrocarbon enriched steam is produced at the low pressure side of the membrane. The membrane pores are 5 to 6 Angstrom in size and thickness is 2 to 5 microns.

Translation...

AHA would like to thank Jin Nishimura for his efforts in translating AHA materials to Japanese for distribution overseas.

PRIZES NEEDED TO ENCOURAGE IMPORTANT DEVELOPMENTS

by: Roy McAlister

The tremendous productivity of the Industrial Revolution has provided leisure time and remarkable opportunities for entertainers. Consider the athletes that receive enormous incomes from specialization as a baseball hitter, or football quarterback, basketball center, or boxer. Or if you are not extra athletic note the millions paid to people that look good in the movies. Big money is available for organized entertainment to fill leisure time even though it has no productive result. Promoters have learned how to make society reward entertainers.

But where are the prizes for important developments that make it possible to achieve better living standards and advancement of civilization? Establishment of the Nobel Prizes for this purpose has an interesting history.

A Swedish inventor named Immanuel Nobel failed in business and moved to St. Petersburg Russia where he experimented with nitroglycerine, manufactured rifles, and built water mines. In the middle 1800's his son Alfred Nobel traveled to America and served as an apprentice to the famous Swedish immigrant, John Ericsson, the ship builder and inventor of the Solar Dish Stirling Engine.

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(Continued on page 19)

SCIENCE & ENGINEERING

(Continued from page 18)
Congress.

Alfred Nobel left 27,716,243 kroner or about \$7,427,953 at his death in 1896 to fund these prizes for encouraging unusual brilliance and achievement. Soon after his death, considerable contention arose regarding the appropriate approach for awarding the Nobel prizes and various writings and quotations of Alfred Nobel were reviewed to determine his wishes.

For instance, Nobel once said not to "leave anything to a man of action since he would be tempted to abandon work. On the other hand, I would like to help dreamers, for they find it hard to get on in life." And he wrote to the von Suttner following the vacation they shared in Switzerland: "I should like to allot part of my fortune to ... the man or woman who had done most to advance the idea of general peace in Europe."

So, who did Nobel intend to reward, the emerging hopeful or the already recognized contributor? One of the witnesses to Nobel's signing of the last will declared under oath: "His desire was, as he always stated, to place those whose work showed promise in a position of such complete independence that they would be able to devote their whole energies to their work."

Most of the Nobel

prizes have been given for achievements five to ten years after their public announcement which allows for peer review and public comment. The code of statutes that governs the Nobel Foundation's funds provides that one tenth of the annual income must be added to capital which has allowed the fund to grow substantially through the years.

Although Alfred Nobel was a shy, nervous, and decidedly bashful man, his prizes for brilliant contributions by others have made a lasting and inspiring memorial for himself and many others that have received recognition for their work to advance the causes of civilization.

Consider making a lasting and inspiring memorial for yourself or your family by establishing a fund (as Alfred Nobel advocated), to place those whose work shows promise in a position of such complete

independence that they would be able to devote their whole energies to their work.

We would like to assist you in accomplishing what Nobel thought was good for the promising worker



and for civilization by setting up prizes that encourage continuing work with provisions for larger rewards upon completion of the work and acceptance by the public. We believe that your gift should make an inspiring memorial and that it should grow in capital magnitude by royalties or other additions.

Thank You...

Thank You Marie David!

Marie took an extra job to be able to afford a new computer system to create the Web page for AHA. She is 100% dedicated to helping you enjoy the Web and E-Mail capabilities. You have probably noticed the great improvement since the last newsletter. If you can... thank Marie by sending in her a donation. If you can't afford a donation, then please send her a message to let her know that you appreciate her work and effort. AHA has asked for a grant to help off-set some expenses.

This is one volunteer who works extra hours to pay for something she believes in. The world needs more volunteers just like Marie. Is she wonderful... YES!

Staff Reporters

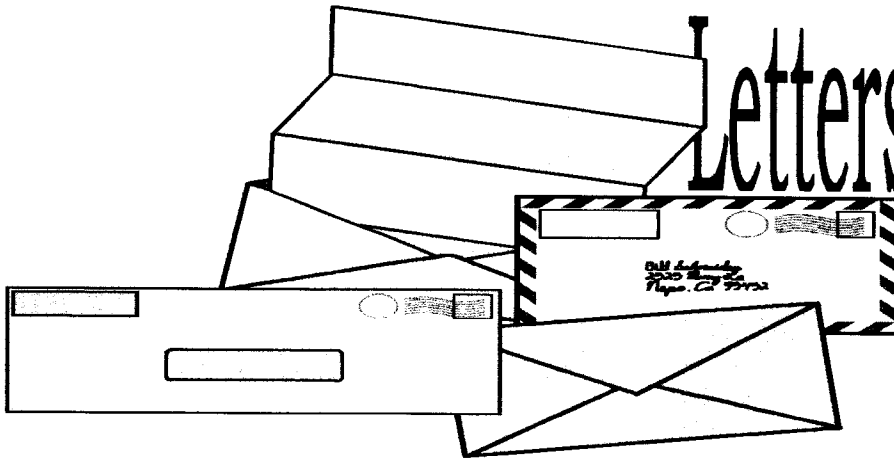
Special thanks to the equipment suppliers for supplying hydrogen. AHA volunteers were outstanding throughout the planning, program development, and presentation stages of the events described below. Starting in Nov. 1995, we showed technologies for achieving prosperity without pollution to some 4,000 visiting mayors and city managers at the National League of Cities Congress which was held in Phoenix. Most of these city planners expressed surprise that it was possible to convert city wastes such as sewage sludge and garbage into solutions for crowded streets, inadequate parking, unemployment, and air pollution.

We showed emerging technologies for using landfill gases such as hydrogen and methane for powering transportation vehicles and making electricity. Two buses were demonstrated along with our Dodge pickup. Blue Bird demonstrated a 300 mile (or more) range bus with a new John Deere engine with advanced electronic fuel metering and ignition that can use landfill gases such as mixtures of hydrogen and methane. Ballard Energy Systems and New Flyer demonstrated hydrogen fuel cell technology that will allow their Phase III bus to achieve 300 miles range with 75

passengers. Both of these buses can be refilled with gaseous fuel from a suitable high pressure reservoir in about 12 minutes. Our message to city managers was that they could start Renewable Resources Parks for converting city wastes (that usually source greenhouse gas insults to the environment) into valuable hydrogen and various forms of carbon such as filter media, diamond plating, and fibers that are stronger than steel. The hydrogen from these Renewable Resources Parks could power cars and buses like those on display to perform as minus emission vehicles (MEVs) as they clean the air. Cities can have more jobs, clean air, and prosperity.

We welcomed Florida and Nebraska foot-

continued on page 22



Letters to the editor

Hello AHA,

I spoke to you over the phone about attending the NGO Forum for Women in China in September. I attended a solar workshop and had the opportunity to speak about solar-hydrogen technology. There was a great response by the participants, requesting more information about the technologies available.

As you can see, by the enclosed list of those requesting information, that many of these women are from other countries with varied situations with which to work. From the discussions, it was evident that they are anxious to encourage renewable energy systems.

They were particularly interested in the dish genset systems and production of hydrogen. Some may benefit from the automobile conversion information. I will be sending them some other basic information.

Thank you for helping them obtain the information that may help them pursue alternatives. All I can say is that it was an incredible experience being with so many motivated women. I want to assist in any way I can to spread the knowledge about solar-hydrogen and the genset systems so that the transformation can take place! Let me know if I can be of assistance to you.

Sincerely,

Malana Kim Love

Editor's note: The information was sent to the list. I will send this newsletter to them, so that they can remember the good work you did in China. Thanks.

Dear AHA,

I have been interested in learning ecologically sound ways to do things since I was able to ride a bike. Four years ago I decided to take a plunge. I quit my job to join the front line of labor in the electrical trade for qualification to install photovoltaics and other Renewable Energy products. IN this process I asked myself: "How can I get involved now in the conversation of Renewable Energy in a manner that is hands on?" So while training in the electrical trade I read, starting with Whole Earth Epilogue, which lead me to the Real Goods :Source Book", Alternative Energy Engineering, etc.,and the game began. I started to accumulate simple technology to begin creating electricity with P.V. But I rent, and living at places like President James Monroe's residence was not the most perfect of places to incorporate the present and future technology with historical authenticity. There is a considerable trend here to create an aesthetic different from solar panels. I took a six-day PV workshop put on by Solar Energy International sponsored by the University of North Carolina Solar Center in April, 1995.

Determination created an opportunity to work with some foreword people in my town of Charlottesville, Virginia. We created the Central Virginia Renewable Energy Group wherein Michael Lucy, creator of Coalition for a Sustainable Downtown Charlottesville (which holds meetings at the Virginia Discovery Museum in Charlottesville every second Wednesday of the month) and Richard Johnston, grad student in Materials

continued on page 22

Dear AHA

A woman who I admire enormously once wrote, "Although the world is very full of suffering, it is also full of the overcoming of it."

Another woman, from a tribe I respect and honor, said, "If you came to help me, then you can go home. But if you consider my struggle as part of your own survival, then perhaps we can work together." There are hundreds of apt quotes from marvelous people who have left words of wisdom and wonderful actions from which we can all learn and which we can all emulate.

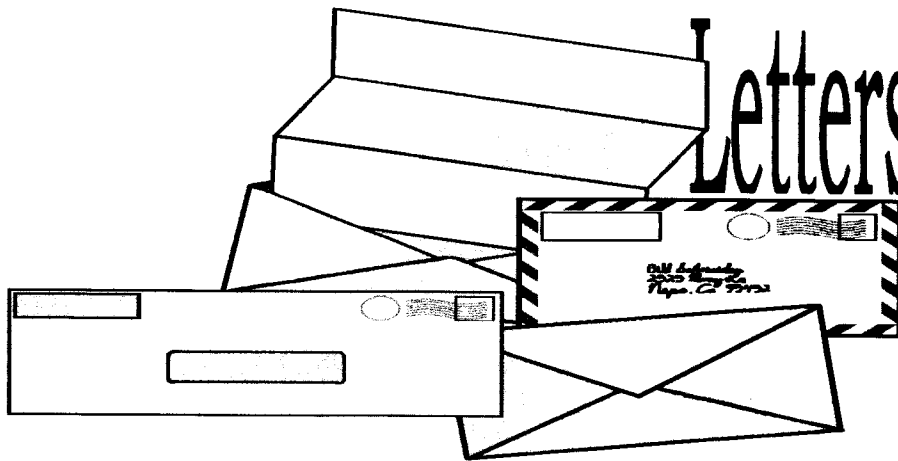
The first quote is from Helen Keller who was certainly familiar with a unique form of suffering and the overcoming of it. The second quote is from an Australian aborigine woman speaking to an aid worker who came to help her "primitive" group.

I chose these quotes because each, in its own fashion, is indicative of the energy, concern and selfless dedication that AHA infuse into the efforts to bring renewable energy into being. AHA's planet-inclusive concepts go to the heart of the aboriginal woman's conviction that we are in this together. It is your words and deeds in striving for this goal that gives impetus to our learning and is surely an on-going source of inspiration for many of us who know AHA. I believe the cause will prevail, not only because it is right, proper and just, but also because of the outstanding people who motivate and lead AHA.

Faye and I join in wishing you joyous times and the happy fulfillment of your fondest hopes for the future.

With respect, administration and love,

Sherwin and Faye Berger
Founding members of AHA



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Founding members of AHA

e: Be Healthy By building Tilth

Dear Kathy,

Thanks, for publishing our response. In answer to your questions, we'll attempt to cover them one by one.

You requested more information on composting. Composting is a biological process of decomposition, for converting organic solid wastes into a stable, humus-like product. Compost is a soil conditioner, and contains valuable nutrients which aid plant growth. Since the process is a biological one, living organisms are the agents for accomplishing it. Aerobic composting involves the activity of aerobic microbes, and oxygen during the composting process. It is characterized by high temperatures, the absence of foul odors, and is more rapid than anaerobic composting (anaerobic - oxygen is excluded, temperatures are low, and presence of odors). The compost material is arranged by alternating the layers of carbon and nitrogen sources. Because part of the carbon is lost as CO₂, carbon is present in greater concentration than is nitrogen.

The optimum range for most compost, is a C/N ratio of 20-25 to 1. The smaller the particle size, the faster the breakdown. Wastes consisting mostly of law clippings, leaves, vegetable wastes, need a moisture content of no less than 50%. If straw is added, the necessary moisture content increases. The temperature the compost reaches affects the biological activity. Each group of organisms has an optimum temperature, and any deviation from the optimum is manifested by a decline in growth and activity of the organism. We compost in the thermophilic range (114 degrees F-16011oF), which kills most pathogens and weed seeds.

There are various methods of composting, depending on your needs, and how much land you have under cultivation. There are windrows, piles, bins, and in-vessel composting methods.

We grow organically/bio-dynamically in a small area where space is a problem, so we chose in-vessel composting to meet our needs. We experience no vector or odor problems.

We purchased a drum composter, suspended on a metal frame, so it can be easily turned. With in-vessel composting, we feel we have more control over the finished product. Our drum holds 82 gallons of dry compost material. It takes only two weeks to turn out quality compost, and the finished product is about half the original quantity by volume.

Composting material can be broken down into two categories: CARBON and NITROGEN. Your carbon sources are basically anything brown and dried. Carbon can include dried shredded leaves, dried grass clippings chipped and shredded tree trimmings, dried spent and shredded garden plants, dried and shredded straw or hay. Your nitrogen sources are basically anything green and fresh. Nitrogen can include fresh cut grass clippings, fresh shredded green leaves, fresh shredded green spent garden plants, manure, your household fruit and produce waste, and coffee grounds and eggshells.

We layer the compost material, to easily keep track of the quantity of various nitrogen and carbon sources we add. We do not follow the typical 25-1 C/N ratio, because most of our material is chipped and shredded to a small particle size beforehand, and because we seldom use material which is more difficult to break down. We prefer a 50/50 (by volume) ratio on C/N. We thoroughly wet down the material, and as the water drips from the drum, it is collected in catch buckets below, and recycled back into the batch. We use Bio-dynamic preparations (made from herbs) as a compost starter, and save some finished compost, which will be added to inoculate the next batch. It's somewhat like a yogurt or sourdough starter - save a little of what you make to start the next batch.

Our goal is to produce a quality compost that contains necessary amounts of nitrogen, phosphorus, potassium, and trace minerals, to feed our produce and fruit trees, without additional nutrient supplementation. Our current area of research is in learning the specific nutrients each plant imparts into the compost. The plant waste indigenous to this desert area, are of particular interest because they are in plentiful supply. We are attempting to learn which plants, provide what nutrients to the compost, so that we can better determine what to compost, to meet the nutrient demands of our plants.

We discussed sludge, and it's potential as a compost material, which could be used in growing food for human consumption. The thermophilic range of temperature used in composting may only reach 160oF. 160o is insufficient to kill many diseases found in our sludge. 212o, over three or more days, is required to kill the hardy Tuberculosis bacterium.

The current sludge regulations don't check for many diseases, and allow 1000 MPM/gm Fecal Coliform and/or Salmonella in class A Biosolids. Using sludge as a compost material, for use in food production is unwise. 15-20 Salmonella cells can produce a typhoid-like fever in humans. As few as 10 organisms of Enteroinvasive Escherichia coli (EEC) can produce dysentery, vomiting, fever and chills. As few as 10 Shigella spp. cells can result in tissue destruction in humans. A toxic dose of less than 1.0 microgram of Staphylococcus aureus can produce illness and death, and exists in sewage.

In addition, maximum allowed levels of Arsenic (75 mg/kg), Cadmium (85 mg/kg), Chromium (3,000 mg/kg), Copper (4,300 mg/kg), Lead (840 mg/kg), Mercury 57 mg/kg), Molybdenum (75 mg/kg), Nickel (420 mg/kg), Selenium (100 mg/kg), and Zinc (7,500 mg/kg), which are current Biosolids limits, are unacceptable for food production. What the net long-term effect on the soil will be, is unknown. You asked how do we recover minerals/nutrients from human waste, so we can use as soil nutrients? We suggest that sludge be used to grow plants not used in food production, for man or beast. A solution might be to utilize our sludge in re-growing our forests.

You requested recipes for herbal immunity enhancing. The list is vast. Eat organic fruits and vegetables, which are rich in God-given nutrients.

Continued from page 20

Science at the University of Virginia and I decided to take the materials I had accumulated and build a PV educational display to reside at the Virginia Discovery Museum. We did this using the original Real Goods "Remote Home Kit #1" design with only 1 recycled solar panel (instead of 2 that were called for in the design) from Alternative Energy Engineering. The charge controller and two 12 volt compact fluorescent lights with ballast were from Real Goods. For our first appliance Richard Johnston converted my portable radio from ac to dc with a voltage controller from Radio Shack. We need to shorten the leads from the panel (that were originally made long to permit visibility of the panel from the window of the museum) to reduce voltage drop and we intend to do this in a workshop including the employees of the museum so that they can have a vocabulary to work with for understanding the basics of PV technology.

We also have plans to start an electronics workshop where we are thinking of building a battery low-level alarm and an inverter. At our first meeting, we will propose an initial project of building a parabolic solar cooker, and create a Matching Funds project for financing materials and installation to Solarize the Virginia Discovery Museum as a Lab/Showcase of 21st Century technology for Central Virginia. Look for more information on our Central Virginia Sustainable Energy Homepage (Esustain). For more information call the Virginia Discovery Museum @ (804) 977-1025. Thanks you AHA.

Tom Phillips

Central Virginia Renewable Energy Group
c/o P.O. Box 512

Charlottesville, Virginia 22902

fax: (804) 977-9681

e-mail CEGY@www.com.CHV.VA.US

Editor's note: A circa 200 B.C. wind mill (and somewhat more modern dynamo), 1800 hydrogen (or town gas) pipeline, 1861 Grove fuel cell and/or electrolyzer, and 1870 Eicsson Dish Genset, might be of interest to the museum and historical setting.

continued from page 19

ball fans to the Fiesta Bowl. Their interests ranged from fuel cells for submarines in Florida to making hydrogen a new cash crop for Nebraska farmers. It was very interesting to note the growing awareness and concerns about weather changes due to greenhouse gas accumulations in the atmosphere. Florida has suffered a series of devastating hurricanes and nearly every visitor thought the weather in the future would cause more losses and casualties. Nebraska fans were anxious to learn about opportunities to operate from engines on hydrogen and how to develop a market for

hydrogen in the cities. Phoenix Open visitors were very interested in hydrogen-powered golf cart (Palm Desert, Ca has a prototype fuel cell golf cart. A project of Schatz Energy Research Center from Humboldt State University in Arcata, Ca) lawn mowers, and the opportunity to use cogeneration engines to double energy conversion efficiency by making electricity and heat for recreational facilities. We showed advanced hydrogen storage technology, fuel cells, and hydrogen

engines for golf carts and lawn mowers. We teamed with the ASU Engineering Technology Center and the ASU Experience for the Super Bowl week. Our pavilion display was at the northeast corner of College & University about a block from Sun Devil Stadium. The night before the Super Bowl we cooked vegetables and chicken shishkabobs for football fans at the Tempe Block Party. John Zeggert, Claude Culbertson and Marie Davis developed the hydrogen cooking technique and shishkabob recipe for the Super Bowl.

THE SYMBOL OF SUSTAINABLE PROSPERITY

by Roy McAlister

Tom Van Nort is the winner of our 1996 AHA T-shirt logo contest. See the logo on the front page of this issue of Hydrogen Today in the upper left hand corner.

Our symbol proclaims that the earth can achieve sustainable prosperity without pollution by using solar hydrogen as the replacement for fossil fuels. From a distance, the symbol is a central proton and an orbiting electron, representing an Atom of Hydrogen. As you come close enough to see finer details, the central sphere resolves into our home planet. The orbiting banner is an infinity sign around the earth which depicts hydrogen the fuel that can virtually last an infinity.

T-shirts with our new logo are available for donations of \$10 or more. Lab coats with our new logo are available for donations of \$25 or more. Add \$1.00 per garment for packing and U.P.S. shipments. Shipments to Arizona residents must include 6.95% tax. The lab coats are especially useful for occasions when you need to be "Dr. Science" and demonstrate how to make hydrogen from water by electrolysis or when you are making hydrogen by solar pyrolysis of biomass.

ASU Engineering Technology



American Hydrogen Association

Events Events Events Events

Important Dates of AHA:

Southern CA Chapter of AHA
Monthly Meeting: Contact: Dick
Williams - 9816 Arlee Ave. Santa
Fe Springs, CA 90670.

AHA - Silicon Valley Chapter:
Phone/fx (408) 738-4014.

American Hydrogen Association:
Contact: Roy McAlister,
President (602) 921-0433 fx:
(602) 967-6601.

April 2-4 - Alexandria, VA
Seventh Annual U.S. Hydrogen
Meeting: Contact: Angela
Barbara (202) 223-5547, Fx:
(202) 223-5537.

April 10-12 - Los Angeles, CA
Alternative Fuel Vehicle
Forum; Contact (800) 427-3976.

April 13-18 - Asheville, NC
Solar 96 National Solar Energy
Conference - "Sundancin' in
the Smokies": (303) 443-3212.

April 14-18, 1996 - Cairo, Egypt
- "Renewable Energy
Conference & Workshop"
NREL Contact: Dr. L.
Kazmeriski (303) 384-6600, fx:
(303) 384-6604; Dr. H El
Agamawy (Egypt) (202) 3610-
806 fx: 202-781-236.

April 20 - Phoenix, AZ - Earth
Day Arizona - Desert Sky
Pavilion, Contact: John Sanford
(602) 266-0902.

April 22-27 - Hannover Fair '96
- Joint presentation of
Hydrogen Technologies,
incl. "A Global Presentation of

Hydrogen-Technology"
June 24-27 Copenhagen,
Denmark Ninth European
Bioenergy Conference: Fx: 45
4492 5050.

April 25-28 - Denver, CO
Symposium on New Energy
Science; Denver Hilton; Contact
(970) 482-3731.

May 5-7 - Austin, TX
Alternative Vehicle Fuels
Symposium; (800) 638-3599

May 6-10 Oslo, Norway -
Second European Solid Oxide
Fuel Cell Forum "Engineering,
Systems, Applications"
Conference & Exhibition: P.O.
Box 124 Blindern N-0314 Oslo,
Norway - 47 22 06 73 00;
Telefax: +47 22 06 73 50.

May 10-17 - New York to
Washington, DC 8th Annual
American Tour de Sol; Contact
Northeast Sustainable Energy
Association (413) 774-6051; Fx:
(413) 774-6053.

June 15-21 - Denver, CO -
World Renewable Energy
Congress IV. Jessica White
(303) 275-4358, Fx: (303) 275-
4320.

June 23-27 - Denver, CO
WINDPOWER '96: 26th
Annual Conference and
Exhibition of the American
Wind Energy Association:
Contact: L. Redmond (202) 383-
2511; Fx: (202) 383-2505.

June 23-28 - Stuttgart, Germany
- 11th World Hydrogen
Energy Conference. 49 69 7564
241.

June 24-27 Copenhagen,
Denmark Ninth European
Bioenergy Conference: Fx: 45
4492 5050.

June 25-27 - Stockholm, Sweden
Efficiency, Costs, Optimization,
Simulation & Environmental
Aspects of Energy Systems;
Contact 46 8 723 0858.

July 8-11 Monterey, CA 26th
International Conference on
Environmental Systems; Fax:
(412) 776-0002.

July 27-Aug 1 - Honolulu, HI
International Conference on
Environmental Systems; Fax
(412) 776-0002.

July 29-31 - Trabzon, Turkey
First Trabzon International
Energy & Environment
Symposium; Fx: (604) 721-6051
Canada.

Aug 11-16 - Washington DC
International Energy
Conversion Engineering
Conference; Fx: (301) 258-0524.

Sept 7-8 - Cedar Rapids, IA 5th
Anniversary I-Renew Expo &
Alternate Fuel Vehicle
Showcase: Contact: (319) 687-
2622.

Sept 15-19 - Nashville, TN -
Bioenergy '96; Fx: (202) 347-6109

Nov 17-20 Kissimmee, FL 1996
Fuel Cell Seminar-The Dawn of
Commercialization. Fx: (202) 347-
6109...Hyatt Orlando Hotel.

MEMBERSHIP APPLICATION / CONVERSION CLASS REGISTRATION

- Yes, I want to join the American Hydrogen Association and help make a transition to clean Hydrogen energy
- Yes, Enroll me in the automotive conversion class. Dates currently being offered: October 19-20, 1996

Name _____

Address _____

City _____ State _____ Zip _____

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

Occupation and /or Areas of Special Intrest _____

- Regular membership (\$30/year) Family Membership (\$40/year) Lifetime Membership (\$1000)
- Student Membership (\$20/year) Sustaining Membership (\$100/year) Auto Conversion Class (\$50 Deposit / \$225 Total)

All donations to The American Hydrogen Association are Tax Deductable 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*

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