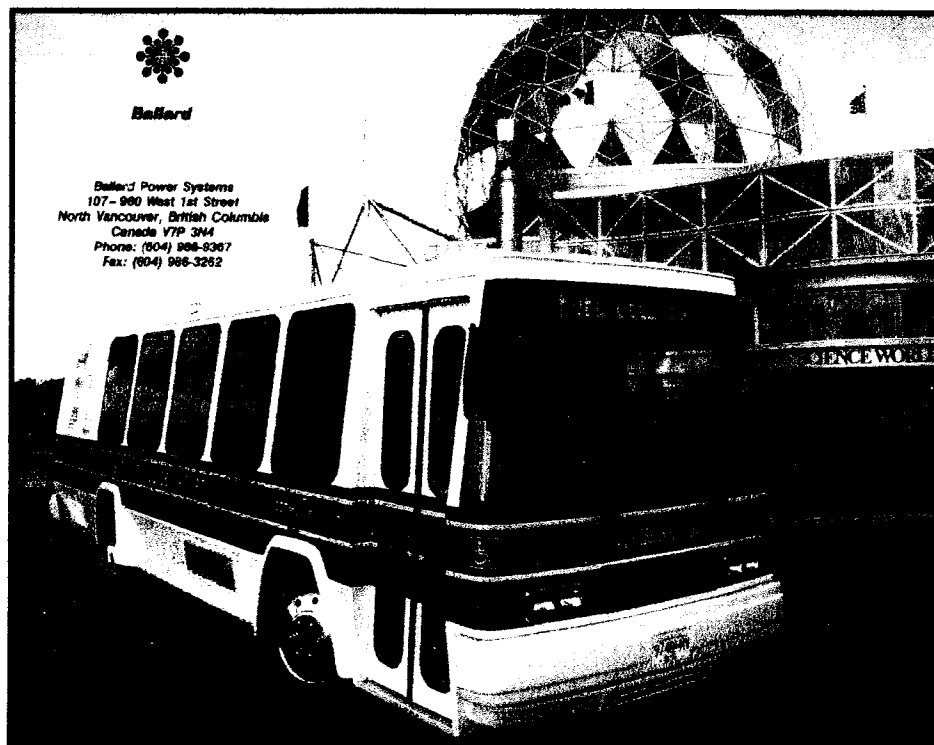




Hydrogen Today

"Clean Energy For A Better World"

Official Publication of the American Hydrogen Association - 216 S. Clark Drive, Suite 103 - Tempe, AZ 85281 Vol 6, No. 2 1995



Ballard Power Systems
107-980 West 1st Street
North Vancouver, British Columbia
Canada V7P 3M4
Phone: (604) 988-8267
Fax: (604) 988-3262

The Ballard "hydrogen powered" Bus. See story on page 3.

What's Inside?

<u>Wind Energy</u>	2
<u>Fuel From Wastes</u>	4&5
<u>Intro to Electrolysis</u>	6
<u>Stirling Engines</u>	7
<u>Energy Parks</u>	11
<u>The Straw House</u>	16
<u>China's Future</u>	18
<u>Texas Bioenergy</u>	22
<u>Conversion Class</u>	23

Solar Hydrogen Pavilion at Clean Cities Events

- By AHA Staff Writers

In the last quarter of 1995 and the first quarter of 1996, the American Hydrogen Association will demonstrate some of the best technology for supporting the achievement of prosperity without pollution. We will have a Solar Hydrogen Pavilion at the Clean Cities Activities, Fiesta Bowl, Phoenix Open Golf Tournament, and Super Bowl XXX.

We will feature clean technologies such as the Ballard Hydrogen Fuel Cell Engine and demonstrations of the Ballard

ZEV bus; the Blue Bird Natural Gas, Methane, and Hythane Bus that uses the new John Deere 6081 HFN Engine; barbecuing and flameless cooking with hydrogen; cogeneration systems; production of renewable hydrogen and methane from city and farm wastes; advanced equipment for renewable energy parks; home-size electrolyzers; and many more advances that provide economic development from renewable resources.

The following schedule of events summarizes these

Continued on page 7.

WORLD-WIDE WEB

Home Page For AHA

GETNET has offered AHA a 20% discount on a business account, which is needed to update our Web page. This will provide AHA with the ability to browse the Web. Marc Rubin has worked diligently, often until the wee hours of the morning setting-up our computer.

<http://www.getnet.com/charity/aha/>

Our e-mail address is:
AHA@GN2.Getnet.com

Marc, Rod Gallagher and Marie Davis will be maintaining the Web Page. Howard Smith was the California operative of the BBS. Much good has come from information exchange through the BBS. It is our hope that the Web will become a greater positive avenue of influence for all of us.

The BBS cost was about \$100.00 per

Continued on page 7.

Hydrogen Technology

Wind Energy

A resource not to be overlooked.

- By Roy E. McAlister

It is likely that one of the first applications of wind power was to sail a ship. No doubt, some of the sailors or boat builders started to think about how to get the wind to do work in tiresome farming and mining applications. By about 500 B.C., enterprising Chinese farmers had replaced human and animal labor with windmills for pumping water. In the Middle East records dating back to about 200 B.C. show the use of vertical-axis machines to grind grain.

Following invention of the windmill in the Middle East, merchants and crusaders that visited the area brought back strange tales about the windmills of the North Africans. These vertical axis machines were indeed ingenious developments that extended the concept of the wheel and axle into machines that would harness wind energy. Eventually the wind swept coasts and plains of Europe came to know the windmill. By the 18th century, some 10,000 windmills pumped water, sawed wood, and powered flour mills.

In the New World, farmers adopted windmills for similar mechanical-power applications. With the advancement of electric lights and appliances, the U.S. market boomed in rural areas. What would dim the windmill market for rural applications was competition from engine-driven generators and a federally subsidized development called the Rural Electrification Association (REA) to extend grid power to U.S. farms and ranches.

Throughout the history of wind machines, there has been the problem of intermittent availability of the wind. In Europe and the U.S., steam engines fired by wood and/or fossil fuels were advertised as the source of power that would supply "round-the-clock" dependability for continuous productivity from breweries, grain mills, metal works and mining operations.

Intermittent winds require energy storage or other provisions for doing without the wind when it is not at work. For watering cattle this was accomplished by filling a tank that would sustain the livestock for days without depending upon the wind. Batteries were developed to keep from missing any of the wonderful radio programs and to provide lights for reading the increasing supplies of reading material that motorized printing presses were turning out.

Two types of wind machines dominate the industry today. A propeller with one to seventeen (or more) blades that rotate about a horizontal axis characterizes the family of horizontal wind turbines. Two or more bowed air foils that rotate about a vertical

axis characterize the vertical axis types that have evolved from the vertical axis machines invented in the Middle East during the third century B.C. Through the years *Horizontal Axis Wind Turbines* (HAWT) have become more popular than the *Vertical Axis Wind Turbines* (VAWT). Major advantages of the HAWT types include better use of high wind velocities, self-starting capabilities, and reduced mass of rotating parts. The VAWTs advantages include ground-level gear boxes and generators for easy maintenance. The main disadvantage of VAWTs is its lower efficiency in higher-velocity winds.

Air velocity is the key to wind power. Wind power is a function of the cube of the wind velocity. Energy conversion results from slowing the air down with a rotating blade that produces torque on an output shaft. The energy conversion potential increases with the swept area or the square of the rotor diameter.

Theoretically it is possible to convert up to 59.2% of the kinetic energy in wind into shaft work. With 75% aerodynamic efficiency and 90% gearing efficiency, a modern windmill might deliver about 40% of the wind energy to a generator, pump, grain mill, or some other load. The older American multiblade types convert up to about 30% of the kinetic energy of the wind. They were designed for self-starting. It's seventeen blades slow a lot of air and provide good starting torque at low wind speeds which is needed to self-start and directly drive reciprocating water pumps. The Dutch four-arm type converts about 16% of the wind's energy. Modern high speed propeller types with direct drive to an alternator utilize up to about 42% of the wind's kinetic energy.

Typical rural electric generating systems with 120 to 200 watts are directly driven and supply 6 VDC power from a 6 to 7.5 foot diameter two-blade propeller. Medium sized units often use 8 to 10 foot diameter two-blade propellers with a 600 watt generator that provides 32 VDC. Larger units have three or four blades at 10 to 16 foot diameter and supply 1,500 to 3,000 watts. Hundreds of thousands of these units were built before the REA came into force.

Utility-scale operations typified as a large central power station with grid delivery to surrounding cities favor larger designs. Large units with 100 to 180 ft diameter and 200 kw or larger generators were of interest to utilities. In Vermont, the Smith-Putnam unit had a 175 ft two-blade propeller and turned a 1,250 kw generator. It cost about \$1.25 million in the 1940s.

The cost of wind-generated electricity has fallen steadily with
Continued on page 15.

Ballard Hydrogen Fuel Cell Buses

- By Roy McAlister

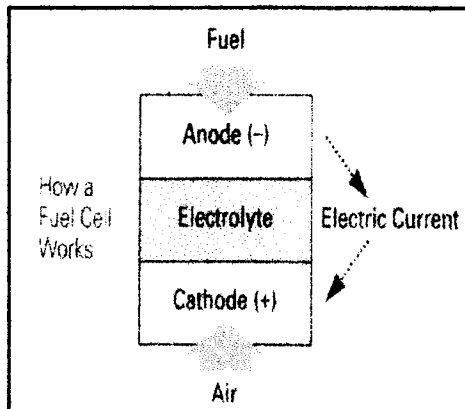
Fuel cell engines are devices that convert a fuel such as hydrogen or methane into shaft power. One type of fuel cell engine uses a special polymer membrane between two porous electrodes to produce electricity. Hydrogen flows through the pores of one electrode and supplies electrons which are taken through the windings of an electric motor. After doing work to turn the motor, these electrons are delivered to the other electrode where oxygen from the air accepts them and reacts with hydrogen ions that pass through the polymer membrane. The result is clean power and water as the exhaust from this fuel cell engine.

A recent General Motors study under a U.S. Department of Energy contract concluded that fuel cell engines for transportation applications could be made for about the same costs as comparable internal combustion engines. One way to help reduce the cost and improve the efficiency of a fuel cell engine is to operate it on hydrogen.

Ballard Power Systems of North Vancouver, British Columbia, Canada has entered into an agreement with New Flyer Industries (a leading manufacturer of heavy-duty transit buses) to develop and market a new generation of urban transit buses. These buses will use hydrogen fuel cell engines for pollution-free operation.

Soon your city will be able to order buses with Ballard fuel cell engines. Passengers can combine the satisfactions of: greatly reducing the congestion of too many automobiles on the streets and parking lots; traveling without pollution; and making better use of farm wastes, landfill methane, and off-peak electricity and natural gas.

Ballard has achieved over 11,000 hours of accelerated testing on their fuel cell engines. Early testing of a demonstration



bus using the Ballard Power Systems fuel cell engine indicates that the cost of operating and maintaining the Ballard Fuel Cell bus will be about the same as the equivalent Diesel engine bus. The fuel cell engine requires a less expensive transmission because of the higher torque produced at low speeds.

The Ballard Hydrogen Fuel Cell Engine provides 275 HP for a new transit bus with 75 seats and a range of about 400 kms (250 miles). Commercial options include regenerative braking which will improve the range to about 560 kms (350 miles). It has good acceleration and a top speed of over 100 km/hr (65 mph) if needed. Service requirements are quick and easy. The time to refuel is about the same as with Diesel buses and there is little maintenance because the Ballard fuel cell engine greatly reduces the parts count and complexity compared to Diesel engines.

On test rides of a smaller 107 HP demonstrator, I have noticed that passengers enjoy the Ballard hydrogen fuel cell bus. Drivers like the bus because it is powerful, quiet, and well mannered. Mechanics' wives should like the bus because their husbands will come home cleaner and happier than when they work on grimy, smelly, knuckle-busting Diesel engines. Others that travel on the same roads really appreciate this clean bus which is completely pollution free ... without any smoke, fumes, or the typical Diesel-engine knocks and rattles.

JOHN DEERE'S ALTERNATIVE FUELS ENGINE and the BLUE BIRD BUS

- by Roy McAlister

John Deere and Blue Bird have combined efforts to develop a bus that uses landfill methane or natural gas instead of gasoline or diesel fuel. John Deere's new 6081 HFN Engine is a turbocharged, six-cylinder engine with 8.1 liters (496 cubic inches) displacement. It is an in-line, four-stroke type with a compression ratio of 10:1 and has spark ignition with an adaptive learn fuel control and spark advance system which enables it to interchangeably utilize fuels such as landfill methane, hythane, and natural gas. It is rated at 250 HP and drivers report that it provides quick response and excellent acceleration.

Blue Bird has installed this engine in buses designed to facilitate adoption of alternative fuels. Compressed methane storage on the Blue Bird is sufficient for a range of up to 350 miles with the new John Deere engine. Eight buses are presently in tests and service in California, four buses are in accelerated tests in Texas, and high altitude testing is proceeding in Colorado with another bus.

Reports to date show excellent fuel efficiency and low maintenance. Operating data show the John Deere powered Blue Bird bus using methane provides a refreshing option for school and commercial bus fleets that will provide considerable savings in comparisons with other possibilities such as the lead-acid battery, propane, advanced-tech diesels, and methanol buses.

(See related article on renewable fuels from wastes on the next two pages.)

AIR PRODUCTS
Air Products and Chemicals, Inc.

Package Gas Services

4625 South 36th St. Phone (602) 437-0144
Phoenix, AZ 85040 FAX (602) 437-3130

High Solids Anaerobic Digestion

Anaerobic digestion is a biological conversion process. Microorganisms that live in the absence of air and digest biomass have several distinct advantages over thermochemical conversion processes. Anaerobic digestion can effectively derive fuel values from wet materials that would have to be dried to burn. These digestion processes produce many organic derivatives such as vitamins, soil conditioners, and carbon dioxide in addition to fuel values. After extracting higher value products, materials that remain can be added back to the soil to provide trace nutrients, improve soil structure, support soil life forms, and enhance water-retention capability. High solids anaerobic digestion produces fuel energy with relatively minimal environmental impact.

Anaerobic digestion processes resemble aerobic composting processes in many ways. Both processes depend upon development of a uniform mixture of feedstock material with the proper nutrients and water which is essential for solvating certain process reactions. The digestion process is more rapid if the biomass is chopped into particles about 1/4-inch to 1-inch in major dimension but fines produce slimes and cause the problem of slowing the reaction. The main difference between these processes is that aerobic processes depend on microorganisms that require oxygen and anaerobic processes are ruined by oxygen.

Aerobic processes require stirring or forced air flow to assure adequate availability of oxygen. Aerobic microorganisms decompose and oxidize biodegradable organic material to form carbon dioxide and water and the fuel potential is released as heat. Anaerobic digestion decomposes biodegradable material to form methane which can be collected and used as a fuel. Anaerobic digestion occurs naturally in high concentrations of wet organic matter that accumulate in the absence of dissolved oxygen. Swamp gas is noted to be

combustible because of the methane content.

Anaerobic digestion is common in the bottom sediments of lakes and ponds, in swamps, peat bogs, intestines of animals and in the anaerobic interiors of landfill sites. According to the International Energy Agency an important advantage of anaerobic digestion is that it produces a net 341,200 to 512,000 BTU of fuel energy per dry ton of waste. In comparison, composting requires about 100,000 to 200,000 BTU of energy per ton of dry waste. Anaerobic processes can reduce wastes while producing a revenue stream from the energy produced.

An operating temperature of about 140°F encourages certain thermophilic microorganisms that support anaerobic digestion. At this temperature the metabolism is quite high and digestion is rapid requiring about 10 days to release most of the methane potential from a ton of waste. About 85°F is favorable for another group of microorganisms called mesophilic(s) that cause digestion to occur in about 25 days. Psychrophilic microorganisms grow at lower temperatures and require much longer for complete digestion which may take 60 days or more.

Most man-made anaerobic digestion systems have been based on wet processes with water contents of about 90-95%. This is because the wetter systems are easy to stir and process by pumping.

Recently there has been increased research and interest in high solids anaerobic digestion systems that operate with 25-40% dry matter. These dry processes are often called "*anaerobic composting*."

A typical municipal solid waste anaerobic digestion plant serving a population of 100,000 has a capacity of 500 tons per day for a wet system or 250 tons per day for a dry system. It could be

expected to release 1.5 million cubic feet of methane per day. This typical plant could produce 250 tons per day of compost based on a wet process and 125 tons per day of compost for a dry process and can require about 1,250 acres of sustainable application of the compost.

Swine wastes produced at Martin Farms in South Boston, VA., are digested in a covered anaerobic lagoon which produces methane and then fires a generator to produce electricity. The system can generate up to 26 kilowatts and will save Martin Farms \$10,000 each year on its electric bill.

The processes used for anaerobic digestion all have the same basic steps: (1) separation of organics from inorganics, (2) pretreatment, (3) digestion, and (4) post treatment. Separation may be accomplished by mechanical separation, source separation, or hand sorting. Pretreatment may consist of sorting, chopping and mixing. Digestion involves heating and mixing. Post treatment may include separation, composting, storage and marketing.

The *Dry Continuous System* involves a continuously-fed digestion vessel with a digestate dry matter content of 20-40%. Both are completely-mixed and plug-flow systems, where the mixture moves through the system like a plug in a pipe. Liquid from the previous digestate is recirculated to wet the incoming mixture and inoculate it.

The *Dry Batch System* is similar to a sealed landfill except digestion is performed in a closed vessel. To start, the mixture is placed in the vessel and inoculated with digestate from another digester. Liquid is then recirculated through the mixture to maintain a uniform moisture content and to distribute microorganisms and nutrients.

The *Leach-Bed Processes* are similar to the dry batch processes, except that liquid is exchanged between vessels containing

Continued on page 8.

Renewable Energy From Wastes

- by Roy McAlister

Garbage and sewage have presented disposal problems throughout the history of civilization. Offensive to our senses of sight and smell, garbage and sewage wastes have been discarded in places that are out of sight and far enough from where we live to spare us from the repugnant odors of rot and decay. Eventually, wet sewers were developed for carrying water and sewage to local rivers, lakes, or to the ocean.

Beginning in 1619, water was piped into the homes of London. This "city water" was much easier to use than the more limited supplies that previously had to be carried into the home in buckets. Regular bathing, clothes washing, and floor scrubbing became more practical and expected of self-respecting citizens. Hoping for better sanitation and to eliminate the fear of something bad falling on you, King James I issued a building code prohibiting the use of overhanging commodes and the dumping of chamber pots into the city streets. The invention of the modern flush toilet, which was greatly improved by a man named Crapper and called the "water closet", made it possible to flush unmentionable wastes out of sight and out of mind.

As wet sewers and flush toilets became the standard for population centers, it became apparent that rivers could not sustain the growing load of biomass wastes without becoming dangerous sources of disease. Sewage disposal plants were developed to kill dangerous microbes and remove concentrated sludge which could be stored in landfills or used in other applications. The water produced from sludge removal processes could be added to rivers, lakes, and oceans with less danger.

Landfills became another waste-disposal remedy for garbage. As the industrial revolution created more and more ready-to-eat, ready-to-use, eye appealing packaging, and disposable products, the scope of garbage accumulation and disposal became enormous. Wastes were hauled to remote areas, compacted by

tractors, and covered with soil. But this approach often produced continuing problems including contamination of ground water, the stench of rotting biomass, and a trail of paper shreds and trimmings from trees that littered the roads to the dump and the area around the dump.

Eventually, standards developed to assure public safety by requiring garbage-collection trucks to have provisions for compacting or at least containing garbage being transported to landfills. Landfills are required to seal wastes such as garbage and sewage sludge within an impermeable liner and to provide for venting of gases such as carbon dioxide and methane with provisions for preventing the escape of poisonous hydrogen sulfide fumes.

Bothersome Fugitive Emissions and Depletion of Soil Nutrients

During the last 100 years, it has been learned that greenhouse gases are accumulating in the atmosphere. Even the most modern sewage-treatment and garbage-disposal facilities eventually release the carbon and hydrogen found in biomass molecules to the atmosphere. If the disposal conditions are provided with an abundance of air (aerobic conditions), the releases of carbon and hydrogen are predominantly as carbon dioxide and water vapor. If the disposal conditions are anaerobic (absent oxygen) the carbon and hydrogen releases shift to methane (CH₄) or possibly hydrogen (H₂) depending upon the kind of garbage, type of microorganisms present, and conditions of disposal, including the temperature, pressure and amount of water that was incorporated in the biomass.

These gases allow most of the solar radiation including ultraviolet, visible, and infrared wavelengths to penetrate to the surface of the earth. Upon reaching the surface, these solar rays are converted to heat. (Note the temperature of asphalt pavement on a sunny day.) Greenhouse gases block heat energy that would have

been radiated back into the black vacuum of space.

As more energy is trapped in the atmosphere and materials of the earth's surface, there is increased evaporation of the oceans; more extremes in the weather including tornados, hurricanes, and severe flood-producing thunderstorms; and there is evidence of warming of the atmosphere.

Sludge and garbage continue to decay after confinement in landfills to produce greenhouse gases such as methane and carbon dioxide. In addition, the present disposal practices deplete farmlands of essential minerals that are taken from productive soils by crops that wind up in sewage and garbage landfills or the oceans. Soil nutrients such as calcium, phosphorous, potassium, iron, cobalt, molybdenum, manganese, chromium, and nitrogen are taken to the cities as food and fibers. After these essential soil nutrients are taken to landfills as ingredients of sewage and garbage, they may remain imprisoned for hundreds of years with no little or no hope of being returned to the farms that sourced them.

Fugitive Emissions Can Be Captured for Profit

Profit-minded entrepreneurs have noted the opportunity to protect the environment and deliver a better energy product at a lower price. Ecogas Corporation, of Austin, Texas, has developed a business for collecting, processing, and distributing renewable energy from biomass landfills. Ecogas places shallow wells in landfills for the low-pressure extraction of methane. Along with the methane are other gases such as carbon dioxide, nitrogen, water vapor, and hydrogen sulfide. These gases are collected in the landfill gas discharge stream.

In order to increase the energy value per cubic measure, Ecogas filters methane through special membranes and liquifies it to facilitate delivery by cryogenic tankers to market. This filtration and liquefaction

Continued on page 8.

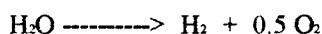
An Introduction to Electrolysis

Part One of a Three Part Series.

- By: Roy McAlister

Through the years we have demonstrated how to make hydrogen and oxygen at nearly every public event that AHA attends. We separate water into hydrogen and oxygen by *electrolysis* to develop an awareness of how simple it could be to become energy independent if we make our own electricity from renewable resources. Hydrogen serves as the clean energy carrier for replacing fossil fuels.

We often show how the process of electrolysis is similar to one step of photosynthesis in which water is split to release oxygen and hydrogen. The overall reaction is the same in each case, one molecular weight of water yields one formula weight of hydrogen and one-half formula weight of oxygen.



This bit of chemistry provides a good chance to introduce the concepts of: zero, minimal, or favorable environmental impact; stoichiometry; and the safety advantages of hydrogen in comparison with other energy carriers. We show the favorable environmental impact of starting with water, using the hydrogen and having water as the end product of the energy conversion processes. Stoichiometry is demonstrated by having just the right amount of reactants in a reaction to form the product(s) without any left-over reactant. (If you start with water, electrolysis produces stoichiometric amounts of hydrogen and oxygen to produce water.)

Safety advantages of hydrogen include the fact that hydrogen is not poisonous nor is its product of combustion which is water. We illustrate how released hydrogen rapidly dissipates into the atmosphere and results in a much shorter time to be ignited than would be equal energy units of gasoline or other petroleum sourced fuels. Considerable effort is made to show the dangers associated with producing, storing, and using hydrogen and how to work safely with hydrogen.

Table 1 lists some suggestions for beginners concerning electrolysis and we supply a *Safety Notice* with each Experiment Set-Up Sheet in our work with students.

Suggestions Concerning Electrolyzer Demonstrations

1. Use distilled water. (tap water is usually treated with chlorine. It produces chlorine which reacts with the electrodes to cloud the water. And, it smells bad.)
2. Add baking soda to form the

electrolyte. Add gradually until suitable conductivity is indicated by gas evolution on electrodes.

3. Use an open top canister that allows clear viewing of hydrogen and oxygen production. See experiment sheet for components to make a small demonstrator.

4. Do not attempt to contain gas production because pressure can build up to the point of being dangerous. Demonstrate with top open and allow hydrogen and oxygen to escape into a

Continued on page 8.

Cool Water Air Conditioning

- by Roy McAlister

Air conditioning requires more energy than most other modern comforts. In Hawaii, studies are progressing that show attractive prospects for circulating ocean water from depths of 2,000 feet to cool hotels, government buildings, and apartments.

Hawaii has many ideal settings for this worthwhile approach to conservation. Most of Hawaii's cities are near the coasts. The volcanic islands of Hawaii are steep mountains in deep water. Cold, deep ocean water can be filtered, piped to coastal cities, and circulated through heat exchangers to remove heat and dehumidify air in buildings at a fraction of the cost of conventional air conditioning.

The cost of the insulated piping and pumping system for circulating 45° F ocean water to and from buildings in a coastal city may exceed the first cost of installing conventional air conditioning systems. However, the projected operating costs are less than 20% of the operating costs of conventional systems. Large life-cycle savings are possible along with greatly reduced environmental impact.

Following installation, the cold water

circulation system requires very little energy to circulate the cooling water from the ocean depths. After being warmed by receiving heat from the buildings, the cooling water is returned to the ocean.

Similar opportunities for reducing the energy requirements and cost of air conditioning exist in many cities that are not near a sea coast. The well water of the most populated areas of Earth's continents is equal to the average annual air temperature at the surface of the earth plus about 1° F for each 80' to the depth of the water in the well. In most areas, the well water is considerably cooler than the desired inside air temperature in the summer. For instance, the well water in cities such as Chicago, Charleston, Cincinnati, Kansas City, Denver, Salt Lake City, and San Francisco is about 45-50° F. Much of the air conditioning heat load in the cooling season can be removed by circulating well water through heat exchangers within a building.

These cool-water air conditioning systems are worth considering. They are freon free and offer considerably reduced demand for fossil fuels along with reduced life-cycle costs. It is another way to help achieve prosperity without pollution.

An Old Engine For A New Purpose:

- By: Lou Smiley

The Stirling engine, which was invented around 1812 by Rev. Stirling, and patented in 1816, is powered by heat, any kind of heat, since the heat is applied externally.

This was carried a step further in 1872 when a Swedish immigrant, John Ericsson invented a solar dish concentrator to provide that heat.

Now this has been carried yet another step with the addition of an electrical generator, and is called a Solar Genset. A modern Solar Genset can produce an average of about 250 KWH per day, enough electricity to power four to five average sized homes. It's cheapest power is provided when it is most needed, in the hottest part of the day.

Since it runs only in daylight, all maintenance can be carried out in the cool of the night. A square mile can support about 4,000 gensets, which will produce 100 megawatts. Look around you and notice how much ground is covered by roads, cities, mines, cleared paths for highlines, airports, etc. The areas under the highlines, by the roads, and along the rail roads can support hundreds or thousands of gensets. Let's say that we have covered a lot of otherwise wasted land with gensets. What do we do with all the electricity provided? It is too

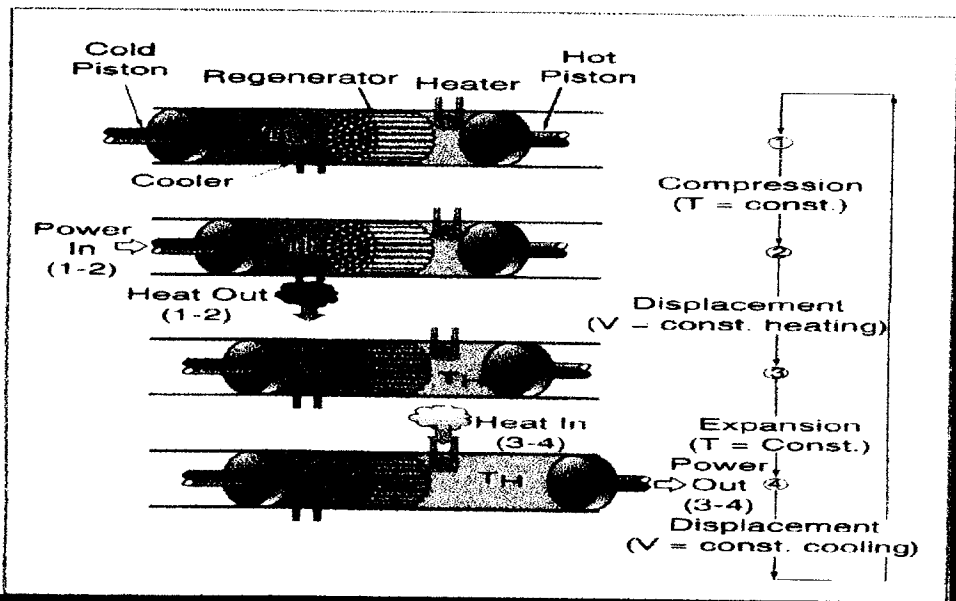
much for local needs.

We convert it into hydrogen and send it by pipeline to other parts of the country. The pipelines are already there. They are used now, mostly in winter, to move natural gas for cooking and heating. Some hydrogen will be used in its gaseous form as fuel in our cars, trucks, buses, and for cooking. Some will be pumped into tankers and shipped to foreign countries that are not fortunate enough to have large deserts for their power needs. (There will never be an ocean spill to clean up since in the case of a rupture, hydrogen escapes harmlessly into the atmosphere) Most of

it will be converted back into electricity to light our cities, power our air conditioners, and power for our manufacturers.

Hydrogen can be made back into electricity by combining it with oxygen from the air, and its only byproduct is pure water. Pure water is an important resource. (Notice how many supermarkets in your area sell bottled water.)

Another thing to consider is that once the gensets are in place, the price of the solar energy will never change, it is free.



Continued from *Web*, pg. 1.

month and start-up on the Web was about \$150.00. Maintenance fees and provider costs may be less than the BBS. Special thanks to all the members of AHA who donate money, so that others may benefit from information on the BBS and Web. If any of you would like to donate money specifically for this work, please send it to AHA with a notation...for Web Home Page. Thank you Marc Rubin, Marie Davis, Rod Gallagher, Howard Smith and to Mike Mueller for helping with computers.

By the time you receive this we will hopefully have an information, news, and donation 900 line. We will update the line with new information every month or so.

We have requested the number 1-900-Sun-fuel. The funds collected will go to the various programs we are now

working on to the general fund. We will also have the ability to register new memberships and member renewals.

Continued from *Pavillion*, pg. 1.

activities. Please inquire for additional information. Help make these events possible by making a generous contribution.

SCHEDULE OF EVENTS

World Championship of Golf - Dec. 30-31, 1995

Fiesta Bowl - Jan. 2, 1996

Grand Canyon Demonstrations - Jan. 5-11, 1996

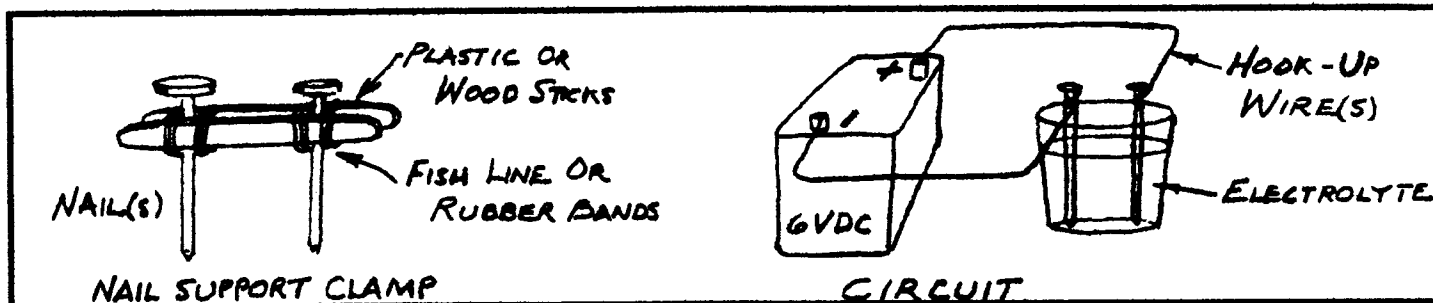
Mount Lemmon Demonstrations - Jan. 14-15, 1996

Kitt Peak National Observatory Demo - Jan. 17, 1996

Phoenix Open Golf Tournament - Jan. 21-27, 1996

Super Bowl - Jan. 28, 1996

Phoenix International Raceway's Copper World Classic - Feb. 1-4, 1996



well ventilated area.

5. Use 3 to 6 volt d.c. power supply such as a wind generator, photovoltaic panel, dish genset, or a battery.

Safety Notice

Your most important task as a young scientist is to learn how to live and work safely. You must take every reasonable precaution to ensure your personal safety, the safety of others, and to protect the environment. This means that you must think ahead and apply safety precautions in addition to running your experiments and recording data. You must have a *fail-safe* plan to overcome unexpected accidents and events that could cause harm to you, your friends, or to the environment.

In the experiments to determine what happens if water carries an electrical current you may choose to experiment with water and additives that form acids or bases. These solutions in water may cause eye and skin irritation or burns. Passage of electricity through water causes bubbles of hydrogen and oxygen to be released. Hydrogen is combustible especially in the presence of free oxygen. So you might cause a fire. What is your *fail-safe* plan for all of these hazards?

Precautions To Prevent Injuries And Damage

Assume that sooner or later, something will go wrong. It is always good practice for scientists to use eye, ear, and nose protection and protective clothing such as fire-proof clothing and/or protective aprons, gloves, and shoes. Get into this practice and it will help assure your safety in case of splashes, fires, and unexpected spills.

It is always good to carry out experiments in protective hoods, away from things that will burn or be harmed, or outdoors away from things that could be harmed if the experiment becomes hazardous. It is always important to prepare for unexpected events and to have fail-safe provisions to shut down the experiment if needed. If you use a lead-acid battery as a source of electricity, *first* connect the circuit wires to the battery and then connect the other ends to the nails. This prevents the potential for sparks near the battery. It is helpful to use alligator clips on the circuit wires to make it easier to make connections.

In the water electrolysis experiments, if tap water or salt is used as an electrolyte former, chlorine may be produced at one electrode (nail). Chlorine is a harsh chemical. Do not smell fumes or vapors by placing your nose near the electrodes.

Use your hand to stir the gases towards your nose and gradually narrow the distance between you and the source of chlorine to get a sense of its presence by the harsh smell it produces.

In the experiment to determine what happens to water if it carries a current you may arrange to interrupt the electric circuit to stop production of hydrogen and oxygen to put out a fire. It is good to keep an ample supply of water handy or to have a faucet to wash off chemicals that may be spilled. Water is called the universal solvent and for most household chemicals. This is true, adding lots of water will reduce the acidity and harshness of household chemicals and wash away the residues. *So, protect yourself and be prepared to turn the experiment off, spray water on it, and/or wash it down when an accident happens.*

Be safe, have fun, and learn how to enjoy prosperity without pollution by using renewable resources. For more information about how to be a safe scientist and how to protect the environment please contact:

The American Hydrogen Association

216 South Clark, M.S. 103
Tempe, Arizona 85281

Telephone: 602-921-0433

Continued from Anaerobic, pg. 4.

new and established batches to help start the new batches. This liquid circulation also helps to distribute microorganisms and nutrients in both old and new mixtures.

In the *Wet Continuous Process* water is added to the solid to create a mixture with about 10% solids. This mixture is then digested in a stirred-tank, plug flow, or

lagoon-type vessel.

For more information: Dr. Philip Lusk, NREL, 409 12 St, SW, #710 Washington, DC 20024-2188, and ask for a free publication, "*Biogas from Municipal Solid Waste*" or at your library Conversion Techniques for VGF-biowaste Developments in 1992. (VGF stands for vegetable, garden, and fruit).

Continued from Ecogas, pg. 5.

process eliminates gases such as carbon dioxide and nitrogen which do not add heat upon combustion. The finished product is high-quality methane with much less variation in energy content, viscosity, and dew point than pipeline supplies of natural gas.

In comparison with natural gas, which may require thousands of miles of

Continued on page 9.

Continued from *Ecogas*, pg. 8.

pipelines and many compressor stations to connect distant gas fields with markets, delivery of landfill methane to local transportation markets requires much less pipe and only one compressor station which is used in the liquefaction process.

LIQUID METHANE

Cooling methane to about -260°F causes it to condense into a liquid that is only about 1/600 times the volume of the gas at room temperature. In order to reach the same reduction in volume by

pressurization at room temperature, the pressure would have to be over 9,000 PSI.

The density of liquid methane is approximately 45% of water or about 3.75 pounds per gallon. This liquid can be rapidly transferred by modern hoses and couplings for quickly refilling vehicles. Large vehicles such as buses, trucks, and marine vessels that have been converted to liquid methane can be filled in less than 10 minutes with the same amount of energy that diesel fuel provided. Liquid methane is often transported in trailer

trucks that deliver up to 11,500 gallons. Liquid methane tanker ships can deliver 30 million gallons of this cryogenic fuel.

Methane does not explode in unconfined environments. It may burn if mixed with air but it can not explode unless it is confined. Liquid methane boils away rapidly upon contact with warmer matter such as sea water or soil. At -160°F, the vapors reach the same density as air and additional warming causes the vapors to escape by buoyant dissipation. There are no oil-fouled beaches if methane leaks

Continued on page 12.

Experiment Set-Up Sheet

Name _____

Date _____

Observers _____

conductivity. Common kitchen supplies such as vinegar, wood ashes, salt, sugar, baking soda, and catsup can be experimentally compared for results.

Purpose

Discovery of what happens to water if it carries an electrical current.

Arrangement of Apparatus

Place distilled water in cup. Place washed and scrubbed nails in water as shown. Hook up nails to low voltage d.c. source.

Supplies Needed

2 Steel Nails
Plastic Cup
Nail Support Clamp
Distilled or Deionized water
Tap Water
D.C. Electricity Source
Electrolyte Additives

Procedure

Notes concerning supplies:

1. The d.c. electricity source must supply at least 3 vdc and a few amps. It can be a primary converter such as a wind generator, photovoltaic panel, solar thermal generator, or a hydroelectric generator. Or it could be a storage or secondary device such as a battery, fuel cell or a battery charger.
2. Electrolyte additives are substances that can be dissolved in water to change the electrical

1. Observe and record result of apparatus connected as shown.
2. Measure small amount of an electrolyte additive and dissolve in water. Observe and record results noting the type and amount of additive. Double the amount of additive and record results. Triple the additive and observe.
3. Repeat steps 1 and 2 with each electrolyte additive.
4. Use tap water in steps 1 and 2. Record results and compare with distilled water experiments.
5. Clean up and return all supplies to proper locations.

Hydrogen Politics

Praxair and Amoco Sign Letter of Intent

Feedstock to Supply Midwest's First Liquid Hydrogen Plant.

- Ref By: Jennifer Cain

Praxair signed a letter of intent with Amoco Oil Company for supplies of hydrogen feedstock to Praxair's planned liquid hydrogen production plant in East Chicago, Ind. Praxair plans to start-up this \$25 million plant, the Midwest's first liquid hydrogen plant, in the second quarter 1997.

Amoco will supply Praxair's new plant with hydrogen feedstock by pipeline from its petroleum refinery in Whiting, Ind. Praxair will purify and liquefy up to 30

tons of hydrogen per day for customers throughout the midwestern U.S.

The liquid hydrogen plant will be fully integrated with Praxair's East Chicago industrial gases complex where the company separates air to produce liquid and gaseous oxygen, nitrogen, and argon. Praxair also supplies gaseous hydrogen to steel, chemical and refinery customers in Northern Indiana via an extensive pipeline network. "Integrating the new plant with our East Chicago site provides Praxair

with a unique cost advantage versus building a stand-alone plant," said Edgar G. Hotard, Praxair president.

"U.S. demand for hydrogen grew at about twice the GDP economic growth over the last five years, and we expect this growth to continue in the future," added Hotard. "During the last 12 months, Praxair's volumes grew at a higher rate as a result of applications technology we developed for customers in the specialty chemicals, edible oils, glass and metals industries. Hydrogen is also replacing dissociated ammonia in many manufacturing processes."

Praxair recently started up a liquid hydrogen plant in McIntosh, Ala. and operates other liquid plants in Ontario, CA. and Niagara Falls, N.Y. The East Chicago plant will bring Praxair's total liquid hydrogen capacity up to about 121 tons per day. "It will also position Praxair as the only supplier in all four of the major liquid hydrogen markets in North America," added Hotard.

Praxair supplies all liquid hydrogen needs for the National Aeronautics and Space Administration (NASA) in the western U.S. and will supply all liquid hydrogen needs for NASA's Stennis Space Center in Mississippi, starting December 1995. The company also operates gaseous hydrogen facilities throughout North America, as well as major pipeline networks in Northern Indiana and along the Gulf Coast in Texas.

Hydrogen is used in a variety of manufacturing processes, including steel, metals processing, chemicals, pharmaceuticals, glass, electronics and for food processing. It also is used increasingly as the "cleanest fuel" in internal combustion engines and fuel-cell powered cars, buses, and trucks.

Praxair is the largest industrial gases supplier in North and South America, and one of the largest worldwide, with 1994 sales of \$2.7 billion. The company also is a leading worldwide supplier of ceramic and metallic coatings and powders.

JAPAN'S WE-NET PROGRAM NOW FUNDED

M. Murase of the New Energy & Industrial Technology Development Organization (NEDO) outlined the WE-NET (World Energy Network) research and development plans for Japan at the International Hydrogen & Clean Energy Symposium '95 held in Tokyo in February. The ultimate goal of the WE-NET project (as a part of the New Sunshine Project) is to build a hydrogen energy system on a worldwide scale. The system will work by producing hydrogen from water through electrolysis, using renewable energy sources. The hydrogen will then be converted into liquid or another transportable fuel and taken to energy consuming areas. The Agency of Industrial Science & Technology of the Ministry of International Trade and Industry (MITI) of Japan commissioned NEDO to start this large project. The project is expected to extend over a period of 28 years (until 2020).

Phase I will establish basic technology concerning the production, transportation and storage of hydrogen. At the same time, the information necessary for optimally designing a complete hydrogen energy system will be obtained. Establishing the technology necessary to design and construct a pilot plant is the primary goal of Phase I.

Phase II is constructing the technologies developed in Phase I. In Phase III, an international pilot system will be constructed. The WE-NET project will go to full-scale operation around the year 2030.

One consideration is the development of a hydrogen combustion turbine. Research is currently being conducted on various hydrogen combustion gas turbine cycles which may have the potential to operate at over 60% efficiency (higher heating value). At the same time, hydrogen/oxygen combustion technology and cooling of turbine blades, which are based on rocket engine, jet engine, and LNG gas turbine technology, are also being studied. It is expected that super-alloy cooling blades can be used because the gas temperatures are about the same as with fossil fuels.

Liquid hydrogen fueled vehicles are expected and Japan is developing new thermal insulation technology to prevent hydrogen from evaporating. Another storage technology concerns development of high performance metal hydrides for vehicle applications. New refueling systems are being developed in order to reduce the refueling time.

Renewable Energy Parks

The Future for Renewable Energy Looks Bright

- By: Staff Reporters

In 1990-92 Harry Braun and Roy McAlister met with Senator Richard Bryan (D-Nevada), Senator Harry Reid (D-Nevada), Governor Bob Miller (D-Nevada), Keith Thomas, and several other leading citizens and State legislators to introduce the concept of Renewable Energy Parks.

The concept of Renewable Energy Parks gained notice when the Defense Reauthorization Act of 1992 called for study to assess the feasibility of a solar development in southern Nevada. The purpose, as outlined by Harry Braun and Roy McAlister was to offset job loss at the Nevada Nuclear Test Site, as a result of the moratorium on nuclear testing, by developing new industries for manufacturing and using Solar Dish Generator-Sets (known as Gensets).

The initial feasibility study was issued in December 1993 and concluded that Renewable Energy Parks using wind and solar were feasible. In May 1994, the U.S. Department of Energy (DOE) formed an advisory Task Force charged with providing recommendations on how the Renewable Energy Parks could be implemented.

Southern Nevada is an electricity crossroads with high-voltage transmission lines connecting Las Vegas and major metropolitan areas in southern California and Arizona. This market access, combined with some of the best sunshine in the world, makes southern Nevada an ideal location for large scale solar-electric projects as replacements for fossil and nuclear electricity plants.

To take advantage of this opportunity, the State, DOE, and private industry are creating an economic development zone for solar-electric projects called the Solar Enterprise Zone. This represents a unique partnership between a State looking to develop new industries for the 21st century, a fledgling solar industry, and DOE by providing creative assistance to

fulfill the promise of its solar R&D investment with economic growth and jobs.

For western utilities this project provides the opportunity to participate in projects that use free solar energy instead of increasingly expensive fossil fuels.

In February 1995, a public-private development authority called Corporation for Solar Technology and Alternative Resources (CSTAR) was formed and charged with implementing the Renewable Energy Parks...now called Solar Enterprise Zones. CSTAR is designed to provide assistance through competitive processes to private developers. CSTAR has since been renamed CSTRR...Solar Technology & Renewable Resources.

CSTRR has a mandate to assist the development of a 1,000 MW solar-electric project over a 7 year period (1996-2002), which will allow industry to scale-up production. Southern Nevada would be the initial focus, with three other potential sites for large scale solar-electric projects.

Implementation will be split into two phases: (1) near-term goal of 100 MW; (2) issue a Request for Proposal (RFP) for projects of 1,000 MW. CSTRR has issued its first RFP for projects. It is expected the "incentive package" will contract for up to 100 MW of power, provide transmission to markets, and provide up to \$150 million in tax exempt financing. This package will also provide low cost land and Environmental Impact Statements at several possible sites.

CSTRR is a non-profit corporation and has a 10 member board with at least 5 members from the private sector. CSTRR's first board meeting was held in March 1995 with the Task Force members serving as the interim board. This Board sponsored a utility forum to outline the SEZ concept to western utilities and others in May. This forum

will lead to follow-up meetings with western area officials and utility regulators. CSTRR will own the power plants built and operated by private developers. This arrangement is necessary as a result of current rules surrounding tax exempt financing. One of the important recommendations of the Task Force is for CSTRR to expand its authority to allow for additional tax exempt financing of projects owned and operated by private developers.

On July 5th DOE presented a \$3 million grant to Sen. Richard Bryan & interim President Rose McKenney-James for the Nevada Operation's office. Terry Vaeth is the acting manager.

CSTRR will help provide technical studies and evaluate the three zones for solar and wind generation: The Nevada Test Site; Eldorado Valley near Boulder City, NV, and the Harry Allen Site; west of Mesquite.

CSTRR will be allowed to issue between \$3-5 billion in tax exempt debt over a 10 year period (or \$300-\$500 million per year). This would be sufficient to finance 1,000 MW or more of Renewable Energy Parks.

A recent study shows that investors in solar thermal power projects financed with tax exempt debt pay the same taxes over the plant's life as investors in equivalent fossil fuel power projects. The reason is that the total amount of capital investment in the equivalent solar plant is much greater than the fossil fuel plant. More tax revenues will be created by the taxes generated by the expansion in jobs as the result of the expansion of solar-hydrogen Renewable Energy Parks.

The DOE may continue to play an important role. The Office of Solar Energy Conversion will provide general support. The Nevada Operations Office will provide assistance and Environmental Impact Statements for the initial project

Continued on page 17.

Earth in Perspective

Recently, the Voyager spacecraft left our solar system on a no-return trip into deep space. As the Voyager reached the outer limits of our solar system, this traveling telescope turned towards Earth and took a picture. Even from the relatively short distance of 4.5 billion miles to the edge of our small solar system, Earth is hard to find in this picture. This high magnification picture shows a very faint blue dot in the vastness of space. Earth is a minuscule speck, a seemingly unimportant blue dot that takes a year to orbit around a relatively small star that contains over 99% of all the matter in this solar system.

Civilization must become much more aware of the perspective of the faint blue dot in the vast vacuum of space. It is by countless miracles during the billions of years before human appearance on Earth that we have a benevolent environment to

support us. We must do everything possible to protect the environment of the faint blue dot in space. It is the only hope for support of the wonderful interdependence of biodiversified life as we know it today.

Anyone that has pondered the purpose of their life can find an answer by contemplating how essential the faint blue dot in space is to life and Civilization. We must dedicate ourselves to the development of a sustainable relationship with Earth.

But what materials can we use to satisfy the enormous energy requirements of Earth's 5.4 billion humans? Can we find clean energy to replace present dependence upon burning the fossil equivalent of 180 million barrels of oil per day? Renewable Energy Parks using solar, wind, ocean waves, falling water,

and biomass resources must be developed to replace our present dependence upon combustion of fossil fuels.

The smallness of Earth and our large population that has grown by dependence upon an embarrassing energy-conversion efficiency of only 0.1% from solar to fossil to electricity or vehicle propulsion make development of Renewable Energy Parks of paramount importance. Fortunately, technology developed by the Industrial Revolution allows these parks to be profitable.

The Grand Purpose of civilization is the achieve *sustainable prosperity* without pollution. To safely reach this destiny, we must develop awareness, expectation of satisfaction, and dedication to the development of appropriate renewable energy supplies to replace fossil fuels.

Maricopa County's Air is Polluted And Needs Cleaning.

As of July 1, 1995, Maricopa County is being placed in serious non-attainment by Georgia Atlanta Center for Disease Control and Federal Region IX Environmental Protection Agency particularly regarding Particulate Matter (10) micron and smaller (PM-10). Virgin desert dust plays less of a concern then the air pollutants from industry, motor vehicles, pesticides and biological contaminants. Phoenix is a mecca for persons with respiratory problems and diseases with its clean sun valley air. Winter tours flock to Arizona to enjoy the warm winter weather. This winter will spotlight Arizona during the festivities such as the Fiesta Bowl, Phoenix Open Golf Tournament, and Super Bowl XXX.

Now Maricopa has been reclassified as "Serious" under Section 188(b)(2) of the Clean Air Act. Mandatory sanctions force the implementation of "Best Available Control Measures." A computer modeling attainment demonstration is due within 18 months of being reclassified. The EPA's "Best Available Control Measures" must be in place within four years of reclassification and achieve PM-10 compliance by year 2001.

State officials will have to work quickly, as great pressure is mounting from the EPA, the political arena, lawyers and environmental groups to be in compliance. However, let's not bogged down by this situation. Let's do the best thing...convert to renewable hydrogen and other clean energy resources. Let us get the scientists and engineers in to do the job.

It has been suggested that AHA release the 1978 hydrogen powered pick-up from museum status and launch several more hydrogen powered angles of mercy. These pickups would be called to service as air cleaners to transport organ/blood donations from Sky Harbor Airport to the various medical facilities within the Valley. This would create media attention to cleaning the air that has caused lung diseases and many other health problems.

Each time a piece of the pollution puzzle that warns us that we are damaging our own and our children's lungs we have the opportunity to do something. This is our wake-up call to action here in Arizona. Please offer suggestions for implementing the hydrogen-powered delivery of organ/blood donations. Contact Timothy McKenna at 602-921-0433.

*Continued from Ecogas, pg. 9.
from a ship.*

The liquid methane tank for a vehicle can be much smaller and lighter than a high pressure storage tank for natural gas. Fuel flow to the engine is the same as with compressed natural gas because the liquid methane is heated to produce gaseous methane that is delivered by ordinary valves, lines, and regulators.

Methane is the major ingredient of natural gas which may also contain larger hydrocarbon molecules such as ethane, propane, and butane. Because these heavier hydrocarbons occupy less space per mass unit than methane there is slightly less energy in methane than natural gas although more energy is released for each mass unit.

CHEAPER and MUCH CLEANER THAN GASOLINE

In order to economically transport the renewable fuel produced from landfills, Ecogas liquifies it. This greatly benefits motorists that want improved range compared to compressed natural gas.

SHAW'S WELDING

Arc - Acetylene - Heliarc

In Shop Welding

Quality Work at Reasonable Prices

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

Members Forum

Save the World

\$29.95 plus Shipping and Handling

- By: Roy McAlister

Dennis Weaver, the movie star and charter member of AHA, demonstrates how to live in a sustainable way. Dennis and Gerry Weaver have built their home as an *Earth Ship*. (See *Hydrogen Today* Vol 6, No 1 '95, for a previous article about the Weaver's practice of the three R's meaning to Reduce, Recycle, and Reuse.)

Dennis Weaver advocates bringing together science, ecology and economics in a study called *Ecolonomics*. He has sponsored the development of a department at Colorado State University called Ecolonomics.

In a sense, what Ecolonomics is about is transition of the Industrial Revolution to the sustainable, peaceful, healthful, and satisfying Renewable Resource Revolution.

What is needed is much more public awareness, education, investment and profit taking from the sustainable opportunities of the Renewable Resources

Revolution. In order to help develop public awareness, please take time to tell your friends and neighbors about how to improve civilization by overcoming the present dependence upon non-renewable resources. Please order Dennis Weaver's *Earth Ship* and the *Solar Hydrogen* videos today. Show them to persons that should be practicing ecolonomics and creating prosperity without pollution.

To help in this regard, AHA is offering the following special package at a very special price. We are providing these two educational videos that would ordinarily cost \$40 for the special price of \$29.95 plus tax and shipping. Add \$1 for packaging and handling. Arizona residents please add \$2 for sales tax. Regular shipping requires \$2 for surface shipment to most US destinations, please advise of faster service if desired and include the proper amount. Purchases orders may be mailed to: AHA, 216 S. Clark Dr. #103, Tempe, AZ 85281.

Karen Kimmell Wins AHA's Ticket Raffle

A petite - cute as a button Indian girl volunteered to draw the winning ticket to the Phoenix Suns Basketball game as part of the 25th Anniversary of Earth Day. The winner was Karen Kimmell. Her father, Bill, has been a faithful member of AHA since 1990. Karen said, "That her father asked her if he should buy the tickets." Karen recalled her answer, "It would not hurt to try." Little did she know that he would enter her name and that she would be the winner of the drawing. Karen called AHA to thank everyone for the great time they had at the Sun's game. Thanks to all of you who bought tickets and to the great ticket sellers that made the occasion possible for the winners.

John Vernon was the raffle coordinator and those who saw the tickets, knew that he spent hours designing the raffle tickets, finding a sponsor, (Whataburger), and getting the printing done. That was just the beginning. He helped AHA sell the tickets. John, thank you very much. A big thanks to James Bailey and K. John Sanford who organized the 25th Anniversary of Earthday here in Arizona. And a very special thanks to Whataburger!

It was suggested that the next time AHA holds a raffle, that we should raffle off a semester's tuition at ASU. What suggestions do you have? It sure was fun helping someone win the tickets to the Suns game.

Roses To: A Very Special Thank You!

To all those who donated money and the committee for the Solar-Hydrogen Pavilion

To all those who donated money for membership to AHA

Blake Ayres for becoming a Charter Member

John Vernon for raffle coordination

To the Arizona Earth Day organization

Global Objectives for a great day of seminars

Marc Rubin and Marie Davis for computer work

May Ann Sweikart for working at AHA as a summer intern

Lou Smiley for editing and repair work

Clare VanArudal, Bill Wray and Mel Larsen for teaching the Hydrogen Conversion Class

Gentle Strength Co-op for scholarships

Ann Chase for Master's Degree and AHA's accounting

Steve Loney for doing tax reports

To George Meyers and Tony Machusay for Charter School development

Alan Margolis and B&B Printing for past/future newsletter donations

Accosanti project leaders

Tom Brunkin for handing out literature at the Midwest Renewable Energy Fair in Amherst, WI and For Andy Goul for demonstrations on solar-hydrogen at the Solar Potluck in Tucson, AZ

Many thanks to Mike Loomis, a great volunteer

- By: Kathy McAlister

Mike Loomis works for the City of Tempe's Water Instrumentation Department. He attended a Arizona Solar Energy Association meeting where Roy McAlister spoke about Solar Hydrogen. Mike soon picked niches where he could be helpful to both organizations. He became the AHA liaison to the Solar Energy Association and many other Valley organizations. He was tireless in presenting AHA's ideas regarding what became known as the 4-E project and later was renamed SCENE. If you need to know what is going on in this Valley, call Mike.

Traditionally, water use in Arizona has tended towards water-intensive lifestyles. Mike shares his concerns about Arizona's dependence on mined groundwater and the safety of drinking water. He believes

that conservation is an essential component in the elimination of groundwater overdraft. Overdraft or mining occurs when the amount of groundwater that is being pumped exceeds the amount of water that is being recharged by rainwater or city-treated water. The depletion of groundwater supplies leads to higher pumping costs. As a rule, the deeper you pump the poorer the quality and the higher the cost of cleaning water. Arizona's current trend in mining water could be disastrous for Arizona's population and economy. There is an added benefit of conservation, it is restoration of Arizona's remaining riparian areas.

One of Mike's current projects is the Electric/Solar Boat race on Lyman Lake in Arizona September 16, 1995. There

will be two classes of boats in the Electric division: Electric Runabouts and the Electric Hydroplanes.

Included in the race events will be the "Battery Marathon Race", and the "Solar Marathon Race". There will also be a "Hobby Level Race" of one hour. Each lap will be 1.4 miles in length and the races will last for a period of about 5 hours. Each competitor will be required to make at least one pit stop during the race. Drivers must be at least 12 years of age and have a minimum weight of 125 pounds. The winner will be the boat that crosses the finish line first with the greatest number of laps. Come on out to the races and meet Mike Loomis. Thanks Mike for all the good work that you do.

The News from Texas

- By: Roy McAlister

On April 30 - May 2nd, Herb Hayden, Clare Van Ausdal and Roy McAlister attended the Sixth Annual Alternative Vehicle Fuels Market Fair & Symposium at the Austin Convention Center. Over 150 exhibitors had displays on new engines, tanks, vehicle conversion systems, electronics for facilitating vehicle conversions, and various alternative fuel supplies.

While the focus was on CNG, there were several electric vehicles and an array of products for making, storing, shipping, and using liquid methane. Ecogas had a booth concerning biomass methane. Hydrogen was represented through our exchange of membership with the Texas Renewable Energy Industries Association.

Demonstrations were provided of the Ballard Hydrogen Fuel Cell Bus, the Blue Bird Bus with a new John Deere engine for using methane and various other buses and vehicles with piston engines. See articles in this issue of *Hydrogen Today* about the Ballard Bus and Blue Bird Bus.

Herb, Clare and Roy walked away from the convention greatly encouraged by the signs that Texas is determined to be a big player in the field of alternative fuels and renewable energy. The 100 kW Solar Park near Fort Davis began operating on Feb 8, 1995. The system was installed by Entech, Inc. and has generated over 75,000 kWh of electricity. There were multiple inverter failures during March, but that has been repaired. By mid-July the a new wind farm should be completed. Zond Systems Z-40 wind turbines are being used. Zond Systems' headquarters are in Tehachapi, CA. The Texas Department of Commerce worked with Kentech Corporation and other interested parties to develop a 35 megawatt wind energy project as a first step in providing 250 megawatts of wind generated electricity in Culbertson County in West Texas.

Tax Free Bonds to provide capital for Renewable Energy Parks may be on the way in several states. (See related article regarding CSTRR developments in Nevada.) States can authorize Tax Free

Bond issues on behalf of private activities allowed by Congress. Texas has close to one billion dollars per year available for tax free bonds. Bill 373, if signed by the Governor, will allow renewables to begin using the tax free bond money.

Texas is waiting for Governor Bush to sign Bill 373. Section 2.051(v) states "the commission shall establish rules and guidelines that will promote the development of renewable energy technologies consistent with the guidelines of the integrated resource planning process." Since Texas legislators support this development, low cost money for wind, solar, biomass and other renewable energy developments can be expected to produce energy at less than 4 cents per kilowatt-hour using tax free bond money.

McMaster-Carr

Supply Company

P. O. Box 54960

Los Angeles, CA 90054-0960

Serving Industry Since 1901

Telephone:

Sales Desk & Customer Service (310) 692-5911

All Other Departments (310) 695-2449

Fax (310) 695-2323

Machiavelli's Observations

- By Mike Linds & Roy McAllister



In spite of the "Machiavellian" reference to someone who is cynical, cunning, and unprincipled ... Niccolò Machiavelli was devoted to truth, freedom, and opportunities for advancement of the common person. He was born in 1469 in Florence and never had the chance to receive a formal education because his family was too poor.

In spite of these humble beginnings, Machiavelli would contribute much to the understanding of human nature and he is often considered the founder of the philosophy of history. It is unfortunate that because his writings bluntly revealed the potential for human character development towards cynical, cunning, and unprincipled behaviors that we connect him with these undeserved character flaws. Some of Machiavelli's observations are particularly poignant with respect to the need to adopt new paradigms that will stimulate the use of Solar Hydrogen as a replacement for

fossil fuels. Here is what he said about the difficulty of instituting change.

"It must be considered that there is nothing more difficult to carry out, no more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For the reformer has enemies in all those who profit by the old order, and only lukewarm defenders in all those who could profit by the new order. This lukewarmness arises partly from fear of their adversaries, who have the laws in their favor, and partly from the incredulity of mankind, who do not truly believe in anything new until they have had an actual experience of it."

Editor's Note: In this case, Niccolò Machiavelli's observations are all too true. Sustainable energy may be the essential difference between the success or failure of Civilization. It is worth becoming more than a lukewarm defender of Prosperity Without Pollution over Barbarianism. Find a way to make a contribution to the non-profit organization that advances the cause of achieving sustainable prosperity. Do it to improve Civilization's common wealth as it is measured in an improved environment and wildlife. If you are concerned about job development, do it to improve the economic climate for creating a billion dollars worth of renewable energy each week to replace imported fossil fuels. Do it because it advances peace, good health, and a sense of purpose.

Continued from Wind Energy, pg. 2. technology improvements. By 1980, wind-sourced electricity delivered to the grid at line voltage and within frequency tolerances for retail sales by the utilities cost about \$0.15 per kwh. At present, the cost varies from about \$0.05 to \$0.07/kwh which represents a tremendous improvement.

Four major utilities are staging competition at a site in Washington known as Goodnoe Hills. This site has excellent prevailing winds and will compare various types of HAWT designs. Two contenders have captured the

attention of the utilities. One contender, Kentech Corporation, has developed what they call a high tech 33 M-VA, computer-controlled mechanical yaw control that keeps the three-bladed adjustable pitch rotor facing into the wind. This system uses electronics to convert the varying frequency of the generator to line frequency.

Advanced Wind Turbines claims that their AWT-26 turbine is simpler, lighter, and more rugged. It uses a fixed-pitch two blade propeller with a transmission that maintains constant speed to control

output frequency. This two-bladed prop functions as its own down-wind weather vane to keep turned into the wind and eliminates the need for yaw control

The Goodnoe Hills project will test these concepts and award the most cost-effective contender contracts for as much as 115 Megawatts electricity generation capacity.

WIND MAKES WATER WAVES

Wind results from conversion of solar energy to mechanical energy which is expressed as moving masses of air. Transfer of wind energy to lakes and oceans results in wave energy. The most common feature of all large bodies of water is the virtually constant motion called waves. Ocean waves provide an enormous energy potential that is generally more constant than local winds. Many devices have been conceived for extracting useful energy from wave motion.

Ocean Power Technologies, Inc. (OPT) of Princeton N.J. is commercializing a new approach called *Hydropiezoelectricity* which utilizes the force of waves to stress plastic sheets that generate electricity. OPT has signed an agreement with AMP a large producer of electrical components to build a 1kw device for testing in the Gulf of Mexico starting in December of 1995. The *hydropiezoelectric* device that will be tested is about 50 ft long, 1 ft wide, and 1 inch thick. It is assembled from 100 layers of polyvinylidene fluoride (PVDF) polymer sheets and weighs about 400 lbs.

The device was developed jointly by George Taylor and Joseph Burns of OPT and was inspired by previous work by Professor Stephen Salter. According to Dr. Taylor, 1 lb of piezoelectric plastic can be stressed by waves to produce about 2.5 watts of power. Increasing the thickness of the material allows larger voltages. Increasing the surface area allows larger amperages so long as there is sufficient force available to cause the piezoelectric effect.

The age-old problem of intermittent availability of the wind is being solved by using excess electricity generating

Continued on page 20.

Book Reviews

The Straw Bale House

Written by: Athena Swentzell Steen, Bill Steen, David Bainbridge with David Eisenberg.

REAL GOODS: Independent Living Book Series

Review by Kathy McAlister

I met David Eisenberg at the Global Objectives Seminar here in Phoenix last May. David opened the door to a treasure house of information about straw bale construction. A slide show presentation showed how straw bales could be used for modern construction materials. Straw bale homes can be truly low-cost, safe, and energy-efficient.

Through the slides, we viewed a community working together in Sonora, Mexico, where 17 women built a home with their own labor using knowledge gained from David and the book, The Straw Bale House. David shared stories about building experiences and showed a diverse collection of owner-builders, architectural styles, contractors and various mansions and vintage homes including the Nebraska pioneers' straw bale houses. Many of the slides showed homes, schools and commercial buildings in Nebraska using meadow hay from around the 1900's. The oldest building was a one-room schoolhouse built near Bayard, Nebraska in 1880's.

As long as human beings have been creating shelter, straw and grasses have been used in conjunction with a variety of building methods. Walls

made from tied bundles of straw, stacked in mud mortar, have been constructed for centuries.

Another ancient method used compacted loose straw coated with a clay slip for walls.

David is a co-author of the Straw Bale House and builds rammed earth, adobe, glass, steel and concrete homes.

He organized the straw bale wall testing program in Tucson, AZ. It is hoped that this book will help facilitate the process of developing bale building strategies for a multitude on conditions and purposes. If you are looking for a good book to read or a guest speaker, David (and the book) would be excellent to have at your conference.

This book is written for people who have never heard of straw bale buildings and those who are preparing to break ground. It is a practical hands-on book. Chelsea Green is the Publishing Company who has co-created and co-published the Real Goods Independent Living Book series. Chelsea Green books are both practical and inspirational, and they enlarged our view of what is possible as we enter the next millennium. Call

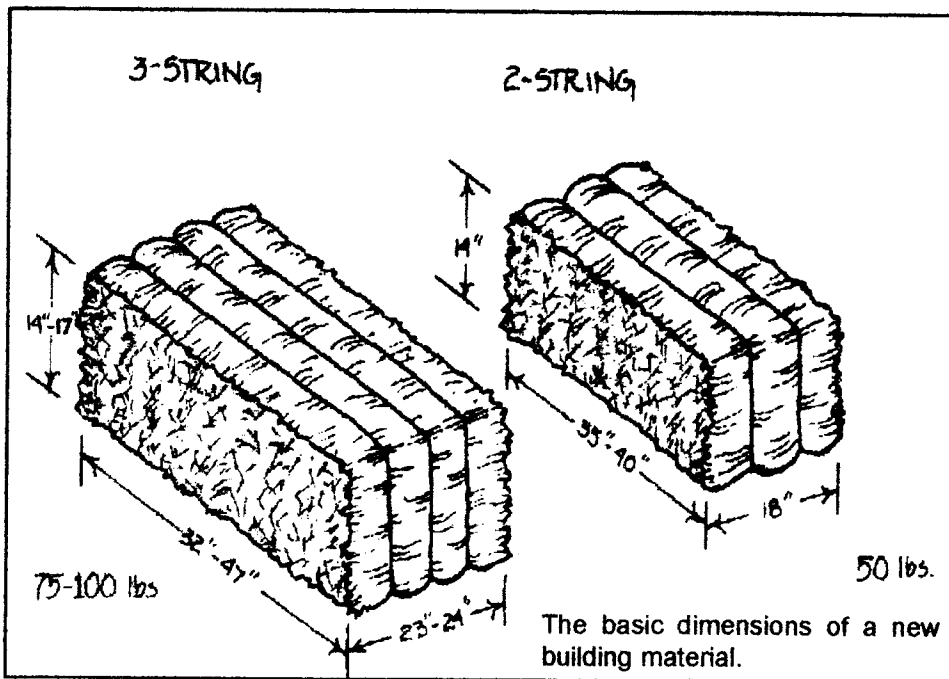


David Eisenberg working with straw bales.

1-800-639-4099 for more book selections.

Editor's comment: Thank you Sophi and Global Objectives for introducing us to David and Straw Bale House. David's seminar was great. A relate development is noted below.

A \$73,000 federal grant has been provided to the city of Tucson Arizona. to determine if straw bale houses are energy-efficient and affordable to build, repair, and protect against harms such as insects, fire, rodents, and rot. Two demonstration houses will be built. The first will be sold immediately. The other will be used for about one year by the city to demonstrate the straw-bale technology and to collect data about the insulation provided by straw-bale walls.



**Renewables Are Ready
People Creating Renewable Energy
Solutions**

Authors: Nancy Cole & P.M. Skerrett
(802) 295-6300, Fax: (802) 295-6444

By Kathy McAlister

Visionaries and concerned citizens across the country are forging a quiet revolution by switching to renewable energy sources in their homes and communities. The

accomplishments of this grassroots movement are documented in this new book, Renewables Are Ready: People Creating Renewable Energy Solutions.

An increasing number of "off-grid" citizens realize how much energy can be produced by clean, safe, renewable means. Without waiting for politicians and the media to wake-up to the economic and environmental benefits of renewable energy, individuals in every part of the US have taken charge of their own energy

destiny.

The book was written with the belief that US energy policy needs to be changed, and that greater renewable energy use is the path to progress. The power of change is at the local level. The stories you will read in this book illuminate the origins of the ground swell of public support for a renewable energy future. Much can be accomplished at the neighborhood and city level to encourage renewable energy commercialization. Local action is particularly effective when thousands of informed citizens are engaged in strategic projects all across the country. This kind of broad-based participation builds resolution and consumer demand that will be felt by utility companies, legislators, government administrative agencies, and the public at large. Such popular demand, combined with policy action at the local, city, state, and national levels will ensure that renewable energy production becomes standard practice in the US.

Editor's note: I met Nancy Cole at the Global Objective's Seminar in May. Nancy is Director of Public Outreach for the Union of Concerned Scientists, and has developed educational programs on global resources and renewable energy. She is a great speaker. Thanks to authors P.M. Skerrett and Nancy Cole for writing this much needed book.

Continued from Energy Parks, pg. 11.

sites. The Western Area Power Administration will provide transmission access to markets and power marketing assistance.

Response from the private sector has been cool to the traditional roles of the DOE. Enron, a large natural gas company has teamed with Amoco Corporation and plans to build a 100 megawatt solar electricity plant and the report from Bob Kelley who heads the Amoco/Enron Solar Development Company is "we are not interested in an R&D demonstration project." Amoco/Enron claims that they can mass produce a new multilayer photovoltaic array that converts a broader spectrum of solar energy into electricity. These new photovoltaics utilize very thin layers of multijunction semiconductor materials that are 100 times thinner than the normal human hair. Their mass

production plant will produce this material at a rate that adds 10-15 megawatts of capacity each year.

Amoco/Enron sees the role of the DOE as the buyer of all of the electricity that they can produce for 30 years at a price that allows them to make a profit on the venture. They claim that electricity can be made with their new mass-produced, very-thin, multijunction photovoltaic material for about \$.055/kwh which is much lower than any other photovoltaic system has ever accomplished.

If the project takes shape as Amoco/Enron proposes and DOE assumes the role of making a market for low cost renewable electricity wherever it is produced, there should be a tremendous shift towards mass produced photovoltaics and other renewables including solar-thermal, wind-

wave- and biomass-generated electricity. The U.S. dollar of the future could be based on the amount of energy it buys instead of being so much paper.

Maybe we will develop the continental-scale invention of Renewable Energy Parks that use wind energy in Canada and the Dakotas; wave energy on the coasts; and solar energy in Mexico, California, Nevada, Arizona, New Mexico, and Texas. Electricity generating capacity that exceeds demand can be applied to electrolysis of water to produce hydrogen that is stored in depleted natural gas fields and similar geological formations. Hydrogen can be transported through the national grid of pipelines along with natural gas and landfill methane. Advanced heat engines and fuel cells will produce electricity or drive clean hydrogen-powered vehicles.

Letters to the Editor

G7's Chance to Change the World

Open Letter To G7 Leaders;

The Hydrogen Economy

Welcome to Atlantic Canada or as we like to observe - the Geographic Center of Western Civilization. Beyond the media "hoopla" and the formal diplomacy of occasions like this is a real possibility to architect our future. During the G7 Summit in Halifax you have the potential to create a vision for the 21st Century economy of the World. As a concerned citizen of Halifax, Canada, North America, and the World, I would like to challenge you to move beyond the incremental thinking and vested financial interests which can so inhibit even the national leaders of our most powerful nation-states. Here is what I propose:

It is time to go beyond tinkering. We must re-visit the fundamental basis upon which the World Monetary System is built. While many people still believe that our money rests upon the Gold Standard, in reality what we have is a world financial system built upon an "Oil Standard" where wealth, power, and value are ultimately based upon ownership, access, and control of petroleum resources. This has happened because gold is simply a beautiful and scarce inert metal while petroleum/natural gas is the lifeblood with which modern civilization produces our food, heats and cools our homes, manufactures our goods, moves virtually everything everywhere, and now even powers up the electronic circuits of our information super-highway.

Our money supply and potential wealth is, therefore, tied to a source of energy which is limited, inequitably distributed throughout part of the world, and which adds carbon dioxide and other pollutants to our air, land and water as we ever more voraciously consume this natural resource in our universal desire to raise our standards of living.

I propose that you, our leaders of the largest, most prosperous nations of the world consider, the establishment of a "Hydrogen Economy" where the value of money is tied to a fixed unit of hydrogen. Hydrogen is a gas and a fuel which can be created anywhere there is a source of any type of energy. It can be produced from petroleum or natural gas, from coal, from solar, wind, hydro-electric, tidal, bio-chemical, mechanical energy of any sort, or even nuclear fission or fusion. Furthermore, when hydrogen is burned or used as a means of transmitting energy - the only by-product is H₂O - water. There is no carbon dioxide or any other pollution.

Why bring this up at a G7 Conference? Because the creation of a universal energy currency which is non-polluting and can be manufactured by rich nations or poor, in massive industrial scale, or by low-tech household-size enterprises can conceivably help us escape from the terrible dilemmas of wealth creation, distribution of wealth, inequities between rich and poor, and pollution among the nation-states of our planet earth.

Anywhere that electricity can be produced, hydrogen can be created through the simple process of electrolysis. Not only can homes be heated, automobiles powered, and industries fueled by hydrogen, but many of the world's leading corporations have quietly been testing and perfecting these technologies for their own advantage. Hundreds of millions of dollars have already been spent by such companies as Exxon, Daimler Benz (Mercedes), Mazda, Lockheed, Sulzer, INCO, Hydro-Quebec, and your own governments in the development of hydrogen based technologies.

In the U.S. there has been a bill submitted to Congress in support of hydrogen developments. In Canada - Quebec,

China's Future

Dear AHA:

The force that first got me interested in our hydrogen future was China. China's 1.8 billion subsistence level peasants are now moving from a 7,000 year old no-energy existence to a "modern" electricity and fossil fuel-based existence. This vast number of new polluters is staggering. In Asia a group of people nearly 10 times the US population will soon want to drive cars. No CAFE standard or "reduced"-emission vehicle can protect Earth's air from this onslaught. Only zero-emissions will do.

What role can we play? We must develop and export our clean technologies to China before she becomes hopelessly wedded to filthy energy sources. I use the word "filthy" deliberately. China has vast coal reserves. Enough for 900 years of production even for its vast population. That coal is high sulfur soft coal which is now burned in the dirtiest ways imaginable to produce electricity.

Please ask your readers to start a dialogue to address this huge problem. Is the answer reformation of the soft coal into hydrogen? Any articles you could run in future issues of "Hydrogen Today" on the China problem would be greatly appreciated.

Rick Smith

The Hydrogen Center (207) 879-1985

Ontario, and British Columbia have all sponsored programs committing public money towards the development of hydrogen energy systems. In Japan and Germany, auto manufacturers have tested and even deployed test fleets of hydrogen powered cars. In Italy, France, Russia, and the U.K. laboratories and scientists have made many breakthroughs in how to utilize these technologies.

Continued on page 20.

LETTER FROM THE FUTURE

Nov. 6, 2025

Dear Great-Grandchildren,

Today I am 96 years old, and I feel that I owe you one last letter. Our world seems to be grim but life wasn't always like this. When your great-granny and I were young, we walked through green pastures, fished in clean trout streams, and listened to birds singing. Above us, the sky was filled with clean air and white(!) clouds. There were butterflies flitting about during the day and extraordinary moths such as great lunas and cecropias flocking to our lights at night.

I know it's hard to believe, but the profusion of bees and other insects, bats, and birds made it unnecessary to tediously fertilize plants artificially. We saw bears, eagles, wolves, coyotes and many other animals in the wild. Hawks, wild turkeys, deer, and bears were common right on our own property.

We walked on clean, uncluttered beaches and saw porpoises, whales and pelicans.

We reveled in forests which supported ancient stands of giant Sequoias. The ocean met the coast with clean, salt filled spray and it was full of great and small edible fish of many varieties. There were rain forests in the tropics and in our own country. We once hiked along a mountain trail in Henry Pittier National Park (now deceased) and saw dozens of six-inch, blue mirror-winged morpho butterflies fluttering along right next to us under the forest canopy. They're just a memory now. We would give anything if you could see and enjoy the beauty and magnificence of nature as it still existed when we were young.

Now the oceans are dying, poisoned with pollution of all sorts. Birds are gone from the skies, frogs are gone from the streams and ponds, fish are gone from the seas and waterways and wild animals now only exist in zoos and museums. Smog, which once bedeviled only Los Angeles and other large cities, is now pervasive everywhere and it burns our eyes and sears our lungs.

With the vast forests gone and the blue greens (cyanophytes) of the oceans almost extinct, the future of our dwindling oxygen supply is critically imperiled. Ten billion people are now fighting over the vanishing supplies of food, fresh water, oxygen and elbow room.

This is the legacy my generation has left to you. I apologize, because I didn't resist the greedy vandals and polluters enough. There were too many of them and they had so much power and money. They just laughed at people like us and called us tree huggers and ecofascists and they prevailed. They even called our science "bad," especially when it interfered with their profits. Now, their great grandchildren and you are both fighting for life on a dying planet. I am so sorry.

Great-grandpa Geno E. Primoff
R.D. 1, Box 171A
Roxbury, NY 12474
(607) 326-4070

Be Healthy by Building Tilth

Dear Kathy,

We noticed in your article, "in order to get started, packaged chemical fertilizer can help you become familiar with the remarkable results of nurturing the soil". We, as individuals, do not have the power to eliminate the vast sources of chemicals our world has chosen to use. An individual can, however, choose to discontinue the use of chemical fertilizers, chemical pesticides, and seek alternative choices which do not further destroy, and contaminate our soil and aquifer. Chemical fertilizers do not nurture the soil.

I work for a local municipality treatment plant which produces in excess of 50,000 tons of anaerobically digested sludge, at 96 degrees F. This process is not "composting"; it is digestion. The primary difference being that composting blends organic sources of carbon and

nitrogen, maintaining about 50% moisture content, aerobically creating an internal temperature of 140 degrees F. to 170 degrees F. assuring complete breakdown of organic material, and adequate pathogenic organism kill. Thermophilic anaerobic digestion may destroy pathogenic organisms, however, to the best of our knowledge, there are none in operation in this valley.

We are concerned for our soil, and our health, and grow our food organically/bio-dynamically. We make compost, and give back to the earth what it gives us. We are particular what we use in our compost. We choose not to use sludge, because of the many untreatable diseases which survive in it. We choose not to use steer manure, because of wide-spread tuberculosis in cattle, and because of dairy cows receiving over a hundred different antibiotics.

We grow healing herbs, to strengthen our immune systems. Soil, water and air are

the beginning of our food chain. It is important to have it healthy, seeing we are the end product. We can only be as healthy as the air we breathe, the food we eat, and the water we consume. All the wonderful organic compost will not begin to nurture the soil if you turn right around and add chemical fertilizer.

We suppose we still live a contradiction; we drive automobiles which use fuel. Up to a point, we allow chemicals in our store purchased food, in our cleaning products, and in our medical care. We attempt to find suitable natural ways to live, in a world which only knows and believes in chemicals, our destroyer.

James and Jennifer Muir
jmuir@xroads.com

Editor's note: Thank you for your interesting letter. Do you have more information on composting and recipes for herbal immunity enhancing? As you noted, human wastes present a

Continued on page 20.

Continued from *Tilth*, pg. 19.
gargantuan disposal problem and the traditional approach of placing sewage sludge in landfills results in imprisoning essential mineral nutrients rather than returning them to the farms that sourced them. What do you recommend for recovering these values from human wastes for use as soil nutrients? To overcome the aversion to carrying

around human wastes I suggested using prepackaged fertilizer to quick-start production of green manure for building tilth in the top soil. Success in this step would encourage another way which might be to plant a bed of alfalfa or other cover crop to start the organic-enhancement process.

Letters Policy

Hydrogen Today welcomes all letters to the editor. All letters are subject to editing, and will be printed as space allows.

Please address letters to:

Editor, Hydrogen Today
American Hydrogen Association
216 S. Clark Drive, Suite 103
Tempe, AZ 85281

Continued from *G7 Letter*, pg. ??.

You have the possibility to move us from a world monetary system based upon scarcity whether of gold or oil to one with the potential of a system based upon abundance - where anyone can create a universal fuel - hydrogen - upon which we could conceivably base our currencies. This shift from a scarcity mentality to abundance thinking is almost inconceivable in our own acceptance of what we consider human nature. Yet, if you can make this breakthrough in your meetings this June, you can collectively profoundly change our economic future.

The incredible power that you all have despite the restraints of realpolitik and your bureaucracies is the ability to affect the public agenda.

You have come to Nova Scotia to fine-tune or adjust the workings of our global financial system to enhance stability and promote its efficiency. The foundation of our current economic system emerged out of the traumas of World War II, the Bretton Woods Conference, and the founding of the International Monetary Fund and the World Bank almost 50 years ago.

Dramatic changes in world politics and economics in just the last few years have totally transformed the world we live in. These changes include the collapse of Communism as an economic model, the impact of technology upon instant international transfers of billions of dollars of currency with the click of a mouse, and for all intents and purposes the dissolution of the gold standard as the fundamental backbone of the world

monetary supply.

In the last 100 years we have lived through two world wars, created the automobile, the airplane, and the computer, landed men on the moon, conquered diseases, been through sexual revolutions, and have learned how to manipulate both the fundamental atoms of which all matter is constituted as well as the DNA molecule which designs life-forms as we know them and as we may create them.

Surely, we can have the vision and foresight to re-engineer our counting houses for the betterment of humankind and a more sustainable future.

Sincerely,
Dr. Harvey Silverstein

Harvey Silverstein Associates - **Change Agents**
Facilitating Strategic and Organizational Change
6 Oakhill Drive
Halifax, Nova Scotia B3M 2T9
CANADA

24 hour Voicemail:
(902) 4574278
(902) 4570708 Fax

Electronic Mail: hsilvers@fox.nstn.ns.ca

Continued from *Wind Energy*, pg. 15.

capacity to produce hydrogen and oxygen by electrolysis. Oxygen can be used for industrial and medical applications. Hydrogen can be used to generate electricity at times that the wind speeds are too low to meet electricity demands. Hydrogen fuel cells and hydrogen fueled engine generators provide quick and clean generation of electricity to meet demand.

We propose a continental-scale invention to allow North America to achieve energy independence. Wind energy in the Dakotas, Wyoming and Canada will be utilized to produce electricity in Renewable Energy Parks. Solar energy in Mexico, Arizona, Nevada, New Mexico,

and Texas will be used in Renewable Energy Parks to generate electricity using Dish Gensets and Photovoltaics. Near cities, Renewable Energy Parks will use sewage and garbage to produce renewable electricity. In coastal areas, Wave Machines can supply electricity. At times that the electricity generation capacity exceeds demand, hydrogen and oxygen will be produced by electrolysis. Hydrogen will be stored in depleted natural gas reservoirs and similar geological formations. This hydrogen will power fuel cells and high-efficiency engines to produce electricity to meet demand as needed. These Renewable Energy Parks can expand to exceed North

America's electricity requirements and hydrogen will be used for replacing gasoline and diesel fuel. (See related article in this issue)

Wave power is an indirect form of wind energy that is available on coastal waters including areas that receive relatively little direct sun shine. It brings hope for development of Renewable Energy Parks for many coastal cities that have prevailing ocean waves. North Dakota, Wyoming, and several other inland areas have tremendous opportunities to harness wind to become energy producers on par with oil-rich countries such as Kuwait and Iran.

Calendar of Events

Monthly Meetings

Southern California Chapter of AHA Monthly Meeting
Contact: Dick Williams (800) 854-5225.

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

Events

Oct 15-18 - Los Angeles, CA - 13th National Natural Gas Vehicle Conference - Contact: (703) 841-8446.

Oct 23-27 - Nice, France - European Photovoltaic Solar Energy Conference & Exhibition - Contact: Fax +49 89 720 1291.

Nov 6-9 - Cannes, France - International Gas Research Conference - Contact: (312) 399-8300 USA.

Nov 6-11 - Caracas, Venezuela - 3rd International Congress Energy, Environment & Technological Innovations - Contact: Dr. Giuseppe Giannetto ++58 2-6931103/6931551, Fax: ++58-2-6930629/7311767.

Nov 8-9 - Atlanta, GA - 18th World Energy Engineering Congress - Contact: (404) 447-5083.

Nov 8-10 - Hat Yai, Thailand - "International Conference on Towards Relatively Sustainable Energy and Mineral Resource Development in Developing Countries" - Contact: Asst. Professor Rotchanatch DDarnsawadi (074) 211030-49, Fax (66) (074) 212802 or 212805.

Nov 8-10 - Atlanta, GA - Eighteenth World Energy Engineering Congress - Contact: Association of Energy Engineers, 4025 Pleasantdale Rd. Ste. 420, Atlanta, GA 30340.

Nov 13-15 - Providence, RI - Solar & Electric Vehicles '95 - (413) 774-6051.

Nov 14-16 - Washington, DC - 1st Joint Annual Meeting of National BioEnergy Industries Association & Utility Biomass Energy Commercialization Association - Contact: Brandy Smith, NBIA, (202) 383-2540.

Nov 15-18 - El Paso, TX - Texas Renewables '95:

(Texas-Mexico Border Energy Forum II) -
Contact: Russel Smith (512) 345-5446.

Nov 20-24 - Melbourne, Victoria, Australia - "International Symposium on Energy, Environment and Economics" - Contact: Prof. T. Nejat Veziroglu, Clean Energy Research Institute, University of Miami or Prof. Bill Charters, Dean of Engineering, University of Melbourne.

Dec 6-8 - San Diego, CA - Society of Automotive Engineers: Alternative Fuels Conference - Contact: (412) 776-4841.

Jan '96 - Tempe, AZ - AHA Solar Hydrogen Pavilion - Contact: Roy McAlister (602) 921-0433 Fax: (602) 967-6601

Jan 22-23 - Dearborn, MI - 4th Annual Environmental Vehicles EnV'96 - Contact Maurice Isaac or Robert C. Stempel Fax: (313) 663-7835.

Jan 23-25 - Los Angeles, CA - LNG Powered Heavy-Duty Transportation - (713) 952-9500.

Jan 29 - Feb 2 - Houston, TX - Energy Week Conference - (713) 621-8833.

Feb 20-23 - Mexico City, Mexico - "EPM Mexico-Engineering Production & Machinery - Contact: Rita Dommermuth, Hannover Fairs USA, (609) 987-1202.

Mar 25-28 - Vancouver, BC, Canada - Towards Sustainable Transport - (819) 953-1601.

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

June 15-21 - Denver, CO - World Renewable Energy Congress IV.

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

Sept 15-19 - Nashville, TN - Bioenergy '96 - The Seventh National Bioenergy Conference - Contact: Phillip Badger, (205) 386-3086, Fax: (205) 386-2963.

From the Editor's Desk

To all of you who have been faithfully waiting for this issue of Hydrogen Today, we thank you for your patience. As you can see, Hydrogen Today is going through some substantial changes.

First and foremost is the way in which we are putting the newsletter together. This entire issue has been published using desktop publishing software on our main computer system at AHA. Thanks to a new scanner, all of the graphics and stories you have read were edited using this computer system. It took us little more time than we estimated to set up the

system because the computer is greatly overloaded with projects, and the quality of the graphics at this point in time are a little less than perfect. None the less this change will provide us with the means to publish every other month and with donations of new equipment the quality should surpass anything we've done yet.

Our next newsletter is scheduled to be published near the end of November. This issue will focus on our participation at Super Bowl XXX. Be ready for national exposure in the media and help spread the news.

We need your help with the newsletter now more than ever. We need writers to fill the pages with stories; feedback on the new look of the newsletter and suggestions for improvement; donations of computer publishing equipment; and most importantly your renewed membership. The ground work has been laid for the future, but the real work has only just begun to build the Hydrogen Economy.



Chris Lewis

The Hydrogen Association
216 South Clark Drive, Ste. 103
Tempe, AZ 85281
USA

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

Mr. Charles H. Terrey
322 W. Harmont Dr.
Phoenix, AZ 85021



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