



# Hydrogen Today

"Clean Energy For A Better World"

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## Vision Statement For The International Renewable Resources Institute

by Roy McAlister and David Washchak

*Envision cars, trucks, trains and airplanes that clean the air as they operate. Vehicles that are fueled with hydrogen will clean the air to provide cleaner exhaust than the ambient air of congested city streets. Sustainable economic development based on hydrogen for electricity production, energy storage, and fuel for transportation along with carbon products will far exceed the wonders that have been produced by burning petrocarbons. Better health will follow as pollution is cleansed from the environment that supports all life on Earth. Well-earned satisfaction along with improved mental health will follow from participation in this paradigm change that facilitates the peaceful, healthful, and prosperous Renewable Resources Revolution.*

### BACKGROUND

The Industrial Revolution has provided wonderful technological advances, particularly in the very short one hundred and forty years since petroleum quickly replaced wood, dung, and animal oil to meet the energy needs of a world population that would quickly increase from the historic limit of about one billion persons to more than six billion persons. Discoveries of seemingly vast deposits of coal, oil, and natural gas allowed most observers to consider the dire predictions of Malthus to be misguided because of the mass-manufactured energy-intensive goods and services that were provided to support ever increasing populations. At no time in recorded human history had Earth's population grown so large. Discoveries of ready-to-burn fossil reserves prompted ridicule of the predictions of Malthus.

Civilization can not allow the Industrial Revolution and all the benefits that it has provided to be threatened by inevitable depletion, inflation, hardships, jealousies, and conflicts brought by continued dependence upon fossil fuels. It is immoral to create an enormous population that is dependent upon annually burning what nature took over one million years to accumulate as fossil reserves. And, it is embarrassing, unhealthful, and extremely expensive to degrade Earth's environment with the pollution from burning the fossil equivalent of some 180 million barrels of oil each day.

### THE INTERNATIONAL RENEWABLE RESOURCES INSTITUTE

One way to help solve the problem of dependence upon fossil reserves is to provide working demonstrations of technologies that facilitate a more profitable, satisfying, healthful, and sustainable economy. The International Renewable Resources Institute (IRRI) will offer to transfer such technologies for providing essential

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options for virtually any community in the world to achieve sustainable prosperity without pollution.

Delegates from the World's most polluted cities and troubled economies will be provided with technology transfers for converting sewage, garbage, and farm wastes into hydrogen, carbon, and essential soil nutrients. Technologies for converting any engine to air-cleaning capability by using renewable hydrogen will be taught. Engines in transportation, farming, manufacturing, and electricity generation applications will be converted to hydrogen and monitored as they produce exhaust emissions that are cleaner than the ambient air that enters these engines.

Converting the World's existing population of some 800 million engines to hydrogen operation will greatly improve the return on the gigantic investment that has been made in terms of mining, refining, casting, forging, machining, and assembling these engines. We have proven that engines operated on hydrogen last longer, produce more power, and require less maintenance than with operation on gasoline or diesel fuel.

Carbon products ranging from fibers that are stronger than steel to diamond plating along with activated carbon for purifying water and air will become stalwarts of the sustainable economy that the IRRI demonstrates and advocates. Essential soil nutrients including trace minerals, phosphorous, potassium, and fixed nitrogen will be returned to sustain productivity of farms instead of imprisoning such nutrients in landfills or allowing them to be drained as water-way pollutants to adversely impact the rivers, lakes, and oceans. Only the carbon and hydrogen that are perpetually supplied by natural passage through the atmosphere as carbon dioxide and water vapor will be taken from the sustainable supplies of sewage, garbage, and farm biowastes.

## **REVERSING GREENHOUSE GAS ACCUMULATIONS**

An important contribution of the technologies for producing hydrogen, carbon, and soil nutrients from biomass wastes is solving the problem of greenhouse gas accumulation. Replacing hydrocarbon fuels such as gasoline and diesel fuel with hydrogen will completely eliminate the release of 25 to 30 pounds of carbon dioxide when one gallon of such hydrocarbon fuel is mined, refined, and burned.

Presently much of the world's sewage, garbage and farm wastes are allowed to rot and decay into the environment releasing methane and carbon dioxide. Each

molecule of methane is at least 20 times more harmful as a greenhouse gas absorber of infrared radiation than a molecule of carbon dioxide.

By converting the biomass wastes into "cash crops" of hydrogen and carbon, both the methane and carbon dioxide pollution of the environment will be eliminated. In instances that large deposits of decaying landfills are now producing methane, appropriate technologies will be provided for making the methane into hydrogen and carbon or for directly producing hydrogen instead of methane from the biowastes.

Creating carbon products as durable goods will provide profits instead of environmental degradants. In large part, these durable goods can be designed for energy efficient recycling into the new and better inventions that are encouraged by investment in a future that is increasing secure against shortages of energy and materials.

## **STRATEGIC PARTNERS**

Teachers at all levels from kindergarten to graduate school will be invited to participate in internships and through internet www-courses to learn the math, chemistry, physics, engineering, construction principles, business, economics, and ethics for helping students prepare for conversion of the fossil economy to the sustainable hydrogen economy. In contrast, generally teachers now provide information that help students prepare to enter the job market with the same skills and expectations that have caused increasingly rapid depletion of Earth's fossil reserves.

Existing businesses that offer technologies to support advancement of renewable energy and materials will be solicited to provide the licenses, hardware, software, and mentoring needed to establish successful business ventures that are launched by the IRRI. Hydrogen Storage, Hydrogen Engines, Fuel Cells, Electrolyzers, Pyrolyzers, Carbon Fibers, Nanotubes, Nanostructures and Devices, Diamond Plating, Graphitic Structures, Activated-Carbon Products, Solar Dish Gensets, Wave Machines, Wind Machines, In-Stream Hydroelectric Generators, Biomass-To-Hydrogen, and Solar Water Splitting will be featured technology-transfer topics.

The International Renewable Resources Institute is designed to help achieve identified purposes of many persons and organizations. Illustratively, Rotary International with some 1.2 million worldwide members embarked on a ten-year program to "Preserve Planet Earth" and has endorsed what Ray Smucker named

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the "Pollution Free Planet" concepts that were launched by the Phoenix Rotary Club.

Rotary International has a long history of achieving worldwide benefits by sponsoring efforts such as free inoculations against infantile paralysis which has virtually eliminated dreaded "polio" as a common disease that killed or crippled its victims. Rotary will be invited to sponsor scholarships and exchange-student programs for delegates from the world's most polluted cities and troubled economies. Rotary mentors will be invited to help with www-courses that are offered throughout the world.

The World Bank and other financial institutions will be invited to provide loans and bond guarantees to new business ventures that are conceived and launched by the IRRI. Teams will be recruited to provide the strategic partnerships for ventures that provide goods and services that facilitate smooth transition from the present dependence upon fossil fuels to renewable energy.

Investing for a more secure, healthful, predictable, and thus profitable future will be the theme of short courses offered by the IRRI. Insurance companies that now face increasing loss and causality claims due to weather extremes traceable to greenhouse gas accumulations will be invited to invest in business ventures that are based on the technology transfers from the IRRI.

Armed forces of selected nations will be invited to participate with the IRRI. Programs will be offered by which persons that earn an honorable discharge and wish to volunteer will receive training to return to their home communities as entrepreneurs and technicians that install potable water distribution systems, renewable fuel gas and/or natural gas distribution piping, and modular electricity generation systems based on hydrogen-engine and fuel-cell technologies.

### **FULFILLING THE GRAND PURPOSE OF CIVILIZATION:**

The American Hydrogen Association sincerely believes that the Grand Purpose of Civilization is to achieve sustainable prosperity without pollution. We support creation of the International Renewable Resources Institute to help achieve this peaceful, gratifying, and universally profitable purpose. Progress towards this goal will benefit virtually all life on Earth.

Please contact the American Hydrogen Association and arrange to generously support the International Renewable Resources Institute and plan to invest in the business ventures that it launches.

### **Editors Sidebar**

#### **Iceland: The World's 1st Hydrogen Economy?**

Will Iceland become Earth's first true *Hydrogen Economy*? A host of countries are looking at ways to replace fossil fuels with hydrogen. This interest is motivated by economic, political and environmental concerns. See the 'End of Oil' article in this newsletter. Most oil producing countries have reached the peak of their production capabilities at this beginning of the Millennium. Saudi Arabia will reach it's peak in another decade along with one or two other OPEC members. Within the next 15 years the demand for oil is projected to outstrip production. It is clear that prices can only go up. Environmentally, burning fossil fuels causes pollution and scientists are increasingly concerned about global warming.

Consider that two-thirds of Iceland's oil consumption fuels fishing and industry; the rest is used for ground transportation. Fishing accounts for 65% of Iceland's exports, so the nation relies on low oil prices to supply fish to the world market at a competitive price. Therefore, the price of oil is an extremely important factor. If Iceland replaces fossil fuel bill with cost-effective renewable hydrogen, it can produce a sustainable economy.

If the hydrogen plan is carried out, Iceland could reduce its annual import oil bill of \$150 million to zero or even produce surplus supplies of hydrogen for export. This would have a significant impact on the Icelandic economy. Lessons being learned in Iceland will have benefits for many other regional economies.

Maximizing human assets is what the IRRI is all about. Solutions exist, we need to put those solutions in human hands that are dedicated to creating a sustainable economy.

### **HYDROGEN ACE SPORTS CAR PROGRESS**

Thanks to your support the Hydrogen ACE Sports Car project continues to progress. Inquiries about having AHA build additional Hydrogen Air Cleaning Engine Powered Sports Cars have come from all over the world. Watch for additional information about progress on our web site: [www.clean-air.org](http://www.clean-air.org).

Sponsors are needed to continue these projects to demonstrate how to produce more power and clean the air with engines that operate on hydrogen. Include your name in the list of honored sponsors that advance the cause of sustainable prosperity without pollution. Drive a performance car that cleans the air.



## THE WORM'S GLUT OR A SUSTAINABLE ECONOMY? *WE HAVE A CHOICE*

By Roy McAlister

Most human economists suffer from the same narrow-minded and shortsighted syndrome that would probably be found if a reporter could interview a worm in an apple. Interviewing the worm about "the economy" would find the observation that there has always been plenty to eat and lots of work. The more that is eaten the larger the living space. *So eat more, enjoy a bigger home, and don't fix what ain't broke*, would likely be central to the worm's view about what is important about the economy.

Consequences that the worm might report are also familiar. Eating more makes more environmental pollution.

The worm's economy in an apple is a very small, temporary, and special condition in the actual economy of life on Earth. As the apple is eaten the worm will increasingly find a harsh new reality about pollution and the economy of the real world.

This syndrome of reporting "the economy" of the special and temporary condition of the Industrial Revolution is as myopic as the worm's view of the apple economy. The Industrial Revolution is as dependent upon expending the Earth's fossil reserves as the worm's apple economy is dependent upon depleting the apple. Human expenditures of the world's fossil reserves are enormous. Humans

searching for the good life, burn the fossil equivalent of about 180 million barrels of oil each day. *In one year we burn as much coal, oil and natural gas as nature accumulated in one million years.*

In order to realize the human potential for doing more good than the worm that spoils an apple, it is imperative to comprehend "the economy" and include in the new definition the profound thought of inventing *the economy of sustainable prosperity*.

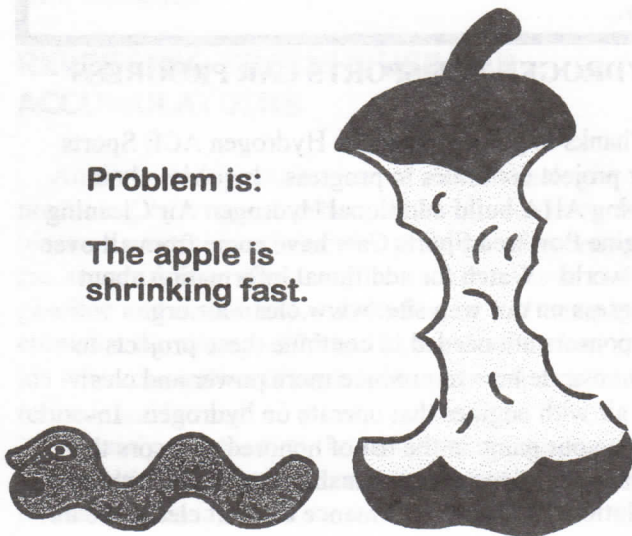
The basic need of the economy of sustainable prosperity is to add energy-intensive products to the world's inventory of goods and services. In order to sustainably provide energy-intensive products we must make additions from outer space. We must invest in technologies to harness energy from the sun and solar derivatives such as wind, wave, and 'falling water' along with conversion of biomass wastes to carbon and hydrogen.

In order to make the investments required to produce *the economy of sustainable prosperity* it is necessary to re-adjust our value system and provide moral and institutional support for making such investments as desirable as we have made investments in burning and depleting the fossil reserves. Presently the US provides subsidies amounting to about \$60 billion each year to support continued dependence upon depletable reserves of coal, oil and natural gas. Large subsidies are also provided for using up depletable reserves of uranium in nuclear electricity plants. In too many ways our institutions promote and our moral references accept depletion and pollution as necessary facets of the temporary economy we operate.

Every producer and consumer must become aware of the high opportunity cost of burning 100 gallons of oil compared to using this oil to produce durable goods. About \$3,500 worth of durable goods can be produced from 100 gallons of oil compared to burning it. At the pump price of \$1.00 per gallon, the opportunity cost is about \$3,500 less \$100 or about \$34 per gallon. At the pump price of \$3.00 per gallon the opportunity cost will be \$3,500 less \$300 or about \$32.00 per gallon. This is not acceptable in view of the world's 6.2 billion persons that demand enormous supplies of durable goods that are increasingly improved by greater content of polymer materials. Notice that critical contents of most carpeting, televisions, computers, clothing, vehicle interiors and wiring systems are substantially made from petrocarbon feed stocks.

**Problem is:**

**The apple is shrinking fast.**





Hydrogen is the common denominator to harnessing renewable energy to provide the economy of sustainable prosperity. Hydrogen can be produced from virtually any water, including seawater, and from biomass such as sewage, garbage and farm wastes. It can be stored in depleted natural gas and oil wells along with many other geological formations that offer similar porosity and natural seals that effectively held natural gas for millions of years.

### **Goals For 2001**

By: Kathy McAlister

Launching the International Renewable Resources Institute is the top priority for 2001-2002. It will provide the outreach programs needed for relief of poverty and environmental degradation in the world's most polluted cities and it will provide demonstrations of the best technologies for building new communities.

Sustainable farming is next. Solar Hydrogen is a key to achievement of a sustainable farm economy. AHA has been working to deter urban sprawl, develop renewable chemistry for fertilizer and pesticides, to encourage top soil development through row crops and double-cropping techniques. We provide classes on biomass conversion to hydrogen and the use of by-products such as carbon, fixed nitrogen and trace minerals to enrich the soil. Carbon can be utilized to produce new materials and to provide for conversion of farm equipment to operate on hydrogen. Farmers have grown beautiful corn and often the corn's end-use is to make ethanol for reducing emissions when mixed with gasoline in vehicle fuel applications. The U.S. ethanol industry set a new record for ethanol production, averaging 107,000 barrels per day.

AHA will be working with the farm communities through community colleges, the universities, 4-H, FFA education and the US Agricultural Department's re-educational programs. The purpose of this outreach is to demonstrate better agricultural economics with renewable hydrogen and carbon products.

The Transportation Sector is the economy's Achilles heel and must receive focused effort. AHA has been orchestrating many contacts during this past year to help convert the present transportation infra-structure to hydrogen. New technologies are being tested that will change the way we make, store and use hydrogen. This step can not fail...it is our most important effort and goal. This goal will start a forty-year transition period. People who accept this mission will have

a goal equal to Goliath. Truck, busses, rail, ships, airlines, and other transportation modes will need to be retro-fitted. A new generation of vehicles will be developed. If fuel shortages occur, farms and factories will produce much less and airliners will not get off the ground.

Our first ten years were to educate the public—but it is an never ending job. Strategic planning will need to include education, advertising and promotion. The main goal is providing adequate education about renewable resources. Engineers and mechanics must plan to fulfill their destiny as have the farmers. The Philosopher Mechanic is about mechanics who convert transportation vehicles to renewables. One does this because it is a mission. Engineering and efficiently producing the components needed is an essential task in this effort to achieve sustainable prosperity.

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## **I AM THE INDUSTRIAL REVOLUTION'S MACHINE SHOP**

By: *Pauline Harrison and Kathy McAlister*

I am the place that makes machined parts that facilitate the Industrial Revolution. Since hosting the start of the Revolution with steam engine parts made according to sketches from James Watt and other early developers of heat engines, I have gone on to be the place for building many ingenious prototypes and the tooling to make vast quantities of inexpensive replicas that virtually everyone can afford.

After starting the Industrial Revolution, I am where skilled machinists worked closely with inventors to make farm equipment, Edison's tooling for making millions light bulbs so cheaply, that they were given away by utilities wanting to build demand for electricity, countless versions of bicycles, automobiles for the masses, and tools for every trade. This progress was provided by constant invention of new and better machines to make parts that have steadily been of better quality with closer tolerances and at higher production rates.

The lathe is a classic example of such progress. Once the principles were invented for tightly holding a piece and rotating it while forcing a cutting tool against it to form chips from the surface, virtually any part with a geometry concentric about the centerline of rotation could be made. The lathe has been constantly reinvented into tremendous variations and remarkable progress has occurred. Continued on page 16



## ROTARY RENEWABLE RESOURCE INSTITUTE (R.R.R.I.)

By David Wastchak, P.D.G.

David Wastchak is a member of Rotary International's Dream Team to solve some of the most pressing problems of the world including poverty and infectious diseases. The outline that follows is his recommendation regarding Rotary support of the concept of the International Renewable Resources Institute.

**Objective:** The Institute is to establish an educational program that will provide Rotarians with technology transfers to facilitate achievement of sustainable prosperity without pollution.

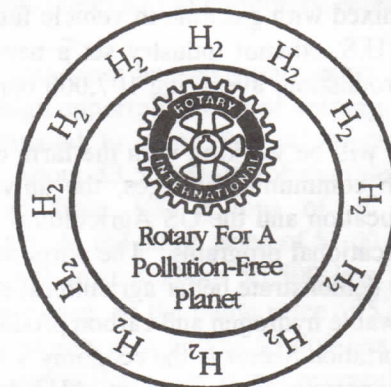
**Who May Wish to Participate:** Rotarian Scientists, Rotarian University Engineers, and Rotarian Entrepreneurs.

### Suggested Curriculum Topics:

- A) Historic use of fossil fuels as polluting sources of energy.
- B) Other Energy Sources:
  - 1) Sun
  - 2) Wind
  - 3) Wave
  - 4) Falling Water
  - 5) Biomass
- C) Learn the Technology and Fabricate Working Models of:
  - 1) A "Genset"
  - 2) "Hot Rocks" for cooking and heating
- D) Take Tours of:
  - 1) Local Power Plant
  - 2) Local Land Fills Making Energy
  - 3) Local Sewage to Energy Facilities
  - 4) Local alternative Energy Production Systems, i.e., Wind Generators, Total Energy (Engine/Generators) etc.
  - 5) Other
- E) Review current information and literature on the Hydrogen Economy
- F) Learn How To:
  - 1) Convert motors (car engines) to hydrogen
  - 2) Convert garbage into hydrogen
  - 3) Harness existing renewable energy sources
  - 4) Develop new industries in:
    - a) Engine Conversion
    - b) Collecting garbage
    - c) Water purification and distribution
  - 5) Making Hydrogen
    - a) Large scale

- b) To meet home energy requirements
- c) Other
- d) The role of governments in the advancement of alternative energy sources:
  - 1) Federal
  - 2) State
  - 3) Local
  - 4) Other
- 7) Forming partnerships with:
  - a) Local suppliers of energy, i.e., power companies
  - b) Local and federal Governmental entities
  - c) Private Enterprises
  - d) Service groups
  - e) Entrepreneurs
- 8) Rotary's Involvement:
  - a) Public awareness messages in local news mediums, i.e., newspaper, radio, etc.
  - b) Sponsor seminars on the use of alternative fuels with emphasis on the use of Hydrogen
  - c) Host specialized GSE teams on Hydrogen Technology
  - d) Support new RI foundation programs on Hydrogen use and the distribution of this new information

Join the RRRRI team and make history by having the best educated workforce in renewable energy.



**Fuel Cell Class**  
with topics including hydrogen production and investments.

**October 20-21st, 2001**  
**American Hydrogen Association**  
1739 W. 7th Ave  
Mesa AZ 85202-1906



## THE 'BANGLADESH SPECIAL'

By Roy McAlister

**Question:** How do you solve the problems of unacceptable high costs of diesel fuel for engine generators and arsenic in the well water? **Answer:** The Bangladesh Special.

### SPECIFICATIONS:

Engine-generator (genset) uses hydrogen and/or methane derived from garbage and sewage to provide 115/230VAC electricity at 25% to 40% energy conversion efficiency.

Waste heat from the engine is used for heating the oven and cooking wells that interchangeably receive fitted frying pan, soup and rice cooker or a pressure cooker. The pressure cooker lid may be removed for boiling food if desired. By cascading waste heat from the engine into the oven, frying pan or pressure cooker, at least 75% energy utilization is achieved in overall energy conversion efficiency. If the utility center is indoors during the heating season, the energy utilization may be 95% or greater when using hydrogen as fuel.

When hydrogen is used as the fuel in the engine, each pound of hydrogen will produce nine pounds of condensable water that may be taken at the drain faucet. Hydrogen and/or methane may be produced by anaerobic digestion of sewage, garbage, and agricultural wastes. After extracting hydrogen from biomass wastes the remaining nitrogen rich residue including essential soil nutrients may be used to fertilize crops.

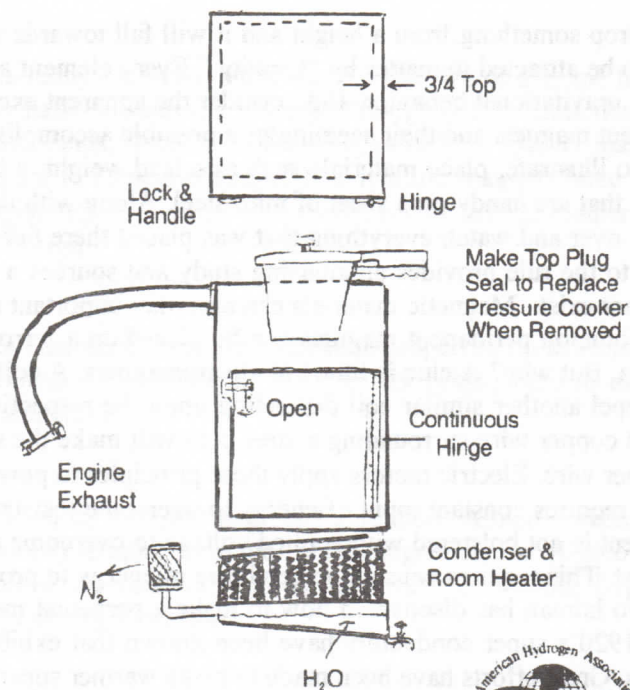
### ECONOMIC DEVELOPMENT:

New jobs are provided to collect wastes for the anaerobic digester, for installing pipelines to distribute methane and/or hydrogen, and to distribute potable water. Soil erosion caused by stripping the land to collect vegetation to burn for cooking and/or heating is avoided.

Improvement of the yield and food value of crops will be achieved by returning nitrogen and essential trace minerals to the soil.

**Structural Composites Industries**  
**325 Enterprise Place**  
**Pamona, CA 91768**  
**(909) 594-7777**  
**Fx: (909) 594-9542**

1) Metal Work is Polished Stainless Steel



2.) Insulation (after completion of metal work)

## AIR PRODUCTS AND CHEMICALS

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 FOR INDUSTRY AND SCIENCE

### Solar Hydrogen Economy Solves These Problems

Conflict surrounded the biggest spill during the 1991 Persian Gulf war when about 240 million gallons spilled from oil terminals and tankers off the coast of Saudi Arabia.

By comparison, the Exxon Valdez spilled approximately 11 million gallons into the Alaska's Prince William Sound. From June 1979 to February 1980, about 140 million gallons spilled at the Ixtoc 1 well blowout in the Gulf of Mexico near Ciudad del Carmen, Mexico. Each year, 100 million gallons of oil leak, spill from storage or are dumped in the U.S.



## INVALUABLE EXCEPTIONS TO THE RULES

BY: ANIL NANJI AND ROY MCALISTER

Drop something from a height and it will fall towards the Earth, thus demonstrating the universal nature of matter to be attracted to matter by "Gravity." Every element and all combinations of elements known to science exhibit such gravitational behavior. But consider the apparent exception to this rule by a few materials that perform as permanent magnets and their seemingly impossible accomplishments of defying gravity.

To illustrate, place materials such as a lead weight, a block of wood, a piece of glass, a spoon and/or other objects that are handy on a sheet of mild steel. Along with this ensemble place a permanent magnet. Turn the sheet of steel over and watch everything that was placed there fall to the ground, except the permanent magnet. This exception to the rule provides an amazing study and sources a technology that makes modern life much better than if it did not exist. Magnetic materials can also play important roles in liquefaction and pressurization of hydrogen.

Common permanent magnets can be placed on a ferromagnetic support and remain there even if turned upside down. But why? A clue is found in electromagnets. A coil of insulated copper wire that is non-magnetic will attract or repel another similar coil depending upon the respective direction of current travel in the coils. A coil of insulated copper wire surrounding a steel core will make the steel become magnetic when electricity flows through the copper wire. Electric motors apply these principles to power much of the industrial revolution. Operating such magnets requires constant input of energy to overcome resistance losses to the flow of current in the copper wire. If the current is not bolstered with applied voltage to overcome resistive losses the current decays and the magnetic effect is lost. This requires constant expenditure of energy to produce the magnetic performance.

No human has discovered how to make a perpetual motion device for operation at room temperature, but since the 1920's superconductors have been known that exhibit zero electrical resistance if kept at very cold temperatures. Great efforts have been made to make warmer superconductors but this remains an elusive achievement.

A few materials seem to have internal superconductor circuits that produce magnetic properties and will continue to produce magnetic force at cold or elevated temperatures up to about 1000 degrees Fahrenheit without requiring application of energy. These materials comprise the family of permanent magnets. Seemingly, another exception to the rules! But is it really an exception? Modern theory concerning permanent magnets provides an explanation. Certain groups of atoms provide apparent flow of electrons in a circuit that has no resistance. This "perpetual motion" of electron current at an extremely small scale allows the permanent magnet to remain "magnetic" without running down.

Applications of permanent magnets range from highly specialized magnetic recording of digital data to permanent magnet motors and alternators. Most existing magnetic-storage media for digital information consists of tiny crystals of cobalt-chromium (CoCr) alloys. In theory these particle crystals can be made as small as 8 to 10 nm (a nanometer "nm" is one billionth of a meter) across before reaching the condition in which thermal vibrations can flip the magnetization of the grains causing loss of recorded memory. Another type of permanent magnet crystal based on iron-platinum (FePt) particles have stronger magnetization and could be made as small as 3 nm before thermal vibration causes memory loss errors. Memory capacity is a function of crystal volume. Storing in 3 nm compared to 10nm crystals allows at least 10 fold increased information storage density.

A vast variety of applications requires many other material formulations. Each material utilized for making permanent magnets has been designed to achieve a different objective. Popular materials that are used for permanent magnets include Neodymium Iron Rare Earth, Samarium Iron Rare Earth, Alnico 2, 5, or 8 types, Ceramic Magnets, and Flexible Magnets. Magnetic strength is measured in Gauss (reported by the symbol Br). The characteristic of resisting demagnetization is measured as an Orsted (Oe) and reported by the symbol He. The maximum energy available from a permanent magnet is the product BHmax and is symbolized MGOe which stand for Millions of Gauss Orsted. Table 1 (see page 10.) shows the relative magnetic strengths, cost, and maximum operating temperatures of some popular materials for making permanent magnets. Continue to next page.

**Magnets can be used to make liquid hydrogen, potentially at a lower cost. Superconductors operating at liquid hydrogen temperature may also be used in high performance electromagnets. Technical articles in this newsletter illustrate the importance of technologies that will be the bridges to the renewable infra-structure. Join AHA today, help produce a wealth expansion economy for present and future generations.**



## COMPARISON OF MAGNET MATERIALS

### Neodymium Rare Earth Magnets:

The most powerful class of magnet materials available today. A Neodymium magnet the size of a grape has the same strength as a Ceramic magnet the size of a tennis ball—9 times its volume! Though costly, these magnets can be used very effectively to miniaturize large components. Because of their high strength, smaller magnets can be used to get the same energy. Extremely resistant to demagnetization, Neodymium magnets have to be protected against rust—by encapsulating, painting, varnishing, or plating—and should not be used at temperatures above about 300 degrees Fahrenheit without careful design.

### Samarium Cobalt Rare Earth Magnets:

The most costly magnet material, Samarium Cobalt's can maintain their high magnetic properties up to almost 600 degrees Fahrenheit, and do not have any rusting problems. This material is extremely brittle, hard to machine, and should be handled with care to avoid chipping and cracking.

### Alnico Magnets:

The most temperature stable magnet material, can be used up to 1,000 degrees Fahrenheit! Alnico 5 should normally be used in long (in relation to the other dimensions) lengths, to avoid self demagnetization. Alnico 8 can be used short lengths. Very hard to machine, Alnicos are relatively costly materials, containing large amounts of cobalt. Alnicos require careful handling to avoid demagnetization.

### Ceramic Magnets:

Ceramic magnets are low in cost, yet relatively high strength, the most widely used magnets today. Ceramic 5 and 8 are significantly stronger than the Ceramic 1 types. A wide variety of standard shapes and sizes are available. Hard to machine, Ceramic magnets are highly resistant to demagnetization.

### Flexible Magnets:

Flexible magnets are very low in cost, easy to use, easy to cut with scissors or paper cutters, can be laminated with an adhesive on one side making it very easy to attach to your product. Normally magnetized with multiple poles on only one surface to give higher holding strength. High energy flexible magnets are similar in strength to the Ceramic 1 types, but are far easier to machine to specific shapes and sizes.

### Safety First:

Large Ceramic magnets and all Rare Earth magnets can be extremely powerful, and great care should be taken to avoid injury to personnel who handle the magnets. All hard magnet materials are brittle, so avoid dropping them or allowing them to snap towards each other. And remember that magnetic fields can destroy data on floppy discs and should be kept away from sensitive electronic equipment. Continue to page 10.

For more information contact: Magnet Sales Manufacturing (310) 391-7213 or (800) 421-6692

**THE UNITED STATES USES 710 MILLION GALLONS OF OIL PER DAY; EVERY 22 MINUTES, THE COUNTRY USES UP THE EQUIVALENT OF THE EXXON VALDEZ SPILL.**

**THE WORLD USES 2.73 BILLION GALLONS OF OIL PER DAY; EVERY DAY 31.5 BILLION GALLONS OF OIL ARE AT SEA BEING TRANSPORTED.**



**TABLE 1.**  
**MAGNET MATERIAL CHARACTERISTICS**

Neodymium	Br (Gauss)	Hc (Oested)	BHmax MGOe	Max Oper Temp F/C	Relative Cost by Wt
24	9800	7500	24	176/80	60
27	10500	10000	26	300/149	70
27H	10600	10100	27	300/149	80
28	10800	10100	28	300/149	70
28UH	10900	10400	28	380/193	80
30	11000	10600	30	300/149	70
30H	11200	10700	30	300/149	80
30SH	11200	10700	30	350/177	90
32	11600	10800	32	300/149	70
32SH	11500	11000	32	350/177	90
33SH	11700	11100	33	350/177	90
35	12300	11300	35	300/149	70
35H	12100	11600	35	300/149	80
37	12400	11800	37	300/149	80
39H	12700	12200	39	300/149	90
40	12900	12400	40	260/127	90
42H	13300	12800	42	240/116	100
45	13500	11700	45	250/121	90
<b>Other Neodymium</b>					
Bonded ND (B10)	6500	5780	10.0	300/149	40
<b>Samarium Cobalt</b>					
18	8600	7200	18	500/149	100
22	9500	8600	22	662/350	110
26	10500	9200	26	662/350	120
26HS	10700	9800	27	716/380	130
28	10700	10300	28	716/380	130
32H	11500	10600	32	662/350	140
<b>Alnico</b>					
5 Cast	12500	640	5.50	1004/540	15
8 Cast	8300	1650	5.50	1004/540	15
2 Sintered	6600	550	1.40	1004/540	8
5 Sintered	10800	600	3.75	1004/540	10
8 Sintered	7000	1900	5.00	1004/540	10
<b>Ceramic</b>					
1	2200	1900	1.05	896/480	2
5	3950	2400	3.60	896/480	3
8	3900	3200	3.50	896/480	3
<b>Flexible</b>					
Regular Flex	1600	1370	0.60	212/100	1
HF1	2200	2000	1.10	212/100	2
HF2	2450	2200	1.40	212/100	2.5
HF3	2650	2200	1.60	212/100	3



## VALVE SPRINGS

BY: KURT GILLESPIE, BRIAN RITCHEL AND ROY E. MCALISTER

We live in a world that is filled with technological wonders. Most of the technologies are available because we have learned how to provide ordinary persons with more energy-intensive goods and services than any King or Queen of ancient times could imagine. Cars travel at high speeds on networks of roads over every continent. Airplanes fly high over polar ice and great expanses of oceans to wine, dine, and deliver passengers at destinations around the world.

One of our most amazing, but generally unrecognized, mechanical servants is the common spring that is found surrounding the stem of virtually every valve in some 800 million engines on the Earth's streets and roads. Returning the inlet and exhaust valves to their "normally closed" positions is the seemingly simple role of valve springs. It sounds rudimentary but this must be done thousands of times each second without hesitation in conditions, including cold operation at 60 degrees below zero, and hot engine conditions, cause oil to fry until it is darkened by oxidation and dehydrogenation.

Intake and exhaust valves are heated by combustion. Their large disk-like heads intermittently open and then close to seal as much of the area of the top of the combustion chamber as possible during the 4,000 degree F fire storm that sweeps across them during the last portion of the compression stroke and while the piston exercises the power stroke. Exhaust valves are further heated by the rush of 1,500 degrees F combustion products, as partially expanded gases are released from the combustion chamber following the power stroke.

Consider the role that valve springs perform to make your next 1,000 miles of automobile travel reliable and convenient. Suppose that you average 30 miles per hour with occasional speeds of 75 miles per hour on suitable freeways. Engine speed might be expected to range from idle at 600 revolutions per minute (RPM) up to 3,600 RPM for passing and cruising at highway speeds.

At 3,600 RPM a four-stroke engine requires each valve spring to operate every other revolution of the crankshaft. At this engine speed each valve spring is rapidly compressed and then must close its valve, all at the blinding rate of 30 times each second. The valve spring is first rapidly compressed and it stores energy as the cam shaft forces the valve to open. The valve is then quickly returned to the normally-closed position to seal against the seat provided in the engine head. Traveling 1,000 miles on a freeway at this speed would develop 1,439,999 very quick spring cycles to provide assured closing of each valve.

Slower or faster travel over the same distance in the same gear ratio would still require the same total number of valve spring cycles but the number of cycles per second would be proportionately less or greater depending upon the speed.

At all engine speeds, valve springs must provide enough closing force to instantly stop the travel of the valve that has been accelerated to a high speed by the opening force exerted by the cam shaft lobe. Force exerted by the valve spring must then quickly accelerate the valve back to the closed position.

Modern engines are expected to last more than 100,000 miles. To do so, valve springs must faithfully operate for more than 150 to 300 million strokes depending upon the engine type, transmission gear ratios, and wheel size. To the valve material this must seem like "forever" and the designer must design the valve spring for an infinite fatigue life.

The valve spring is a length of steel wire formed into a helix or a right-circular cylindrical coil. Steel suitable for the purpose must be formulated as an alloy that offers high strength, infinite fatigue life if stressed less than the fatigue limit, and the ductility to be formed into extremely smooth wire. Designers must consider all stresses and not allow the spring wire to exceed the fatigue limit. If the working stress does not exceed this lower fatigue limit, the valve spring will never fail by fatigue no matter how many times the valve must be closed.

Adequate valve springs posed difficult challenges during the early days of combustion engine development. Steel used for piano wire was found to make better springs than lower carbon bailing wire. Higher carbon content and finer grained steel produced better valve springs than low carbon steel that was easily bent and twisted without spring back to tightly hold bails of hay. Eventually engine designers developed the science of valve design regarding high strength alloys; specification details such as requirements for surface finish, heat treatment, grain size, grain orientation closed and ground ends; and maximum allowable stress — all to avoid operation at stress levels above the fatigue limit.

Among the many wonderful developments of the Industrial Revolution is the modern valve spring. We owe a great deal to the valiant developments and remarkable productivity facilitated by advanced tooling that make the seldom noticed valve spring such as essential success.

*Kurt Gillespie is the President of Century Spring Corporation in Los Angeles. Brian Ritchel is a design engineer with Century Spring and can be reached at 213-749-1466. Roy McAlister is a professional engineer and president of AHA.*



## NICKEL PLATING CONSERVES CRITICAL MATERIALS

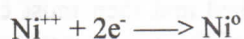
By: *March C. Williams*, METCO Metal Finishing, Inc.  
and *Roy E. McAlister*

Nickel is a bright metal that is denser and more corrosion resistant than iron. When alloyed with iron at more than 7% nickel concentration, the alloy becomes nonmagnetic and more ductile than magnetic iron alloys. "Stainless steels" are made of 18% chromium, 8% nickel, and 74% iron and provide excellent corrosion resistance but these nonmagnetic stainless alloys are not as strong as many alloys of iron with small amounts of carbon. These low alloy steels, which include special formulas with small additions of other elements, such as manganese, vanadium, and molybdenum are much less expensive than non-magnetic stainless steels.

Another approach to corrosion resistance and durability requires much less nickel and no chromium. Nickel plating an object made from a low cost material that has desired mechanical properties generally requires a very low percent of nickel. The finished part has excellent surface qualities and critical supplies of chromium and nickel are conserved.

Nickel has played an important role in electrochemical production of hydrogen and in fuel cells. Reversible electrolyzer electrodes for caustic electrolytes such as sodium or potassium hydroxide may be carbon steel. Nickel plating provides greatly improved corrosion resistance.

Nickel plating is an extremely versatile field of surface finishing and includes electroplating and electroless wet plating methods. Both methods can provide bright, protective surfaces. Electroplating is summarized by the chemical reaction of Equation 1:



Equation 1:

In other words, nickel ions are attracted to the surface that is to be plated by an applied charge of electrons. As nickel ions meet electrons at the surface of an object to be plated, a coating of nickel metal is applied. The process continues so long as new electrons are sent to the surface to meet nickel ions traveling through the aqueous electrolyte to the surface. New nickel ions must be constantly generated from a sacrificial anode of nickel. Plating is preferential on work piece surfaces nearest to the anode and remote areas are difficult to plate.

Electroless nickel plating is the most widely utilized form of nickel plating. Electroless nickel offers unique deposit properties including uniformity of deposit in deep recesses, blind holes, and on complex surfaces. This is because the nickel ions are provided by the plating solution and can be uniformly plated everywhere that is wetted by the plating solution and can be uniformly plated everywhere that is wetted by the plating solution. With surface-activation techniques, non-metals such as glass, polymers and ceramics can be electroless nickel plated.

Although there are four popular types of nickel baths for electroless nickel plating, most commercial deposition is from an acidic phosphorous bath. Attractive physical characteristics including excellent corrosion resistance, wear and abrasion resistance, ductility, lubricity, solder ability, and heat treatable hardness are provided by the resultant plating. The acidic nickel phosphorous bath may be low phosphorous (1-3% P), medium phosphorous (6-10% P) or high phosphorous (11-13% P).

Thickness of deposit usually ranges from 2.5 to 250 micrometers (0.1 to 10 mils or 0.0001 to 0.010 inches.) Measurement of thickness may be with a micrometer, electromagnetic or eddy current devices, coulometers, beta backscatter, and by X-ray fluorescence.

The melting point and heat treating characteristics of the electroless nickel plating depends upon the amount of phosphorous alloyed in the deposit. The pH of the bath controls the phosphorous content of the plated alloy. Below pH 4, nickel deposition stops. The higher the pH (generally from 4.3 to 6.5), the lower the phosphorous content. Nickel-phosphorous alloys with more than 10% P generally have higher corrosion resistance and melt at lower temperatures. Nickel-phosphorous alloys with more than 8% P are typically non-magnetic. Plating baths with 8-9% phosphorous will provide a plating that melts at 890°C (1,635°F) compared to 1,455°C (2,651°F) for pure Nickel.

Nickel phosphorous alloys respond to heat treatment. Baking of the deposited nickel-phosphorous alloy provides structural changes. Hardness of 500-600 Vickers hardness number (VHN) are typical for as plated amorphous conditions. Baking at 399°C (750°F) for 1 hour will cause precipitation of nickel phosphides and



marked hardness increases depending upon the phosphorous content of the plated alloy.

Heating electroless nickel in air about 250°C (482°) causes discoloration which may be prevented by heat treating in a vacuum, reducing atmosphere, or inert gas. Physical property changes that are noted with heat treated electroless nickel plating include increased hardness, magnetism, adhesion, tensile strength, and electrical conductivity. However, corrosion resistance and ductility are typically decreased.

Electroless nickel can be customized as needed to develop many properties and is widely used in the chemical industry, in semiconductor devices, and for automotive components. Nickel alloys and nickel plating play important roles in fuel cells and electrolyzers.

About the authors: *March C. Williams is the technical director of Metco Metal Finishing, Inc., in Phoenix, Arizona and can be reached at (602) 276-4120. Roy McAlister is a professional engineer and president of the American Hydrogen Association.*

### ***Emission Trading and Carbon Sequestering*** By: *Kathy McAlister*

In the 1990, the U.S. total man-made greenhouse gas emissions included some 1,650 million metric tons of carbon mostly in the form of carbon dioxide, world-wide about 6,000 million metric tons entered the air. Signed in 1992 in Rio de Janeiro, the Earth Summit or the United Nations Framework Convention on Climate Change, marked commitments by most nations to stabilize the atmospheric concentration of greenhouse gases at a level that would prevent dangerous anthropogenic interference with the global climate system. In the decade since the U.S. will have increased greenhouse gas emissions by 15%. The U.S. has 4% of the world's population and accounts for more than 25% of global greenhouse gas emissions.

While the U.S. was wrangling over the 2001 election in Florida, the U.S. missed the Sixth Climate Change Conference in the Hague, Netherlands. The goal had been to establish an agreement to reduce emission to 1990 levels by 2000. The U.S. had agreed at the Kyoto Conference (ratified by the U.S. Senate) to commit to a 7% reduction below the 1990 by the year 2008-2012. Will it happen and is it sufficient to reverse climatic changes that were already evident by 1990?

Now many of the most affected corporations are proposing acceptance of natural or man-made systems that absorb carbon dioxide from the atmosphere. More trees on the continents and phytoplankton in the oceans are proposed as the answer. However during

the last century, atmospheric concentrations of carbon dioxide, methane, and other greenhouse gases have steadily increased in spite of all the green plant growth that has been accelerated because of increased availability of carbon dioxide. Almost all of the carbon sequestration accomplished by green plants eventually results in an equal amount of carbon returning to the atmosphere... as the plant tissue is consumed by an animal, burned, or rotted.

There are three new buzz words that have emerged in response to the Climate Change Conferences: clean development mechanism (CDM), joint implementation (JI) and emission trading (ET). These are the new points of discussion by project developers with expertise in project financing to estimate carbon values that will be eventually considered in the project proposals. Missing are the technologies that can actually provide long-term carbon sequestration. These essential technologies which will be the focus technologies at the International Resources Institute have not prominent in the plans of existing industries that continue to be dependent upon fossil fuels.

The World Bank has allocated \$150 million dollars into a Prototype Carbon Fund and much of this money has been promised by donor countries and private entities. The Oregon Climate Trust was formed by the State Legislators and requires that new energy production facilities in Oregon provide off-sets of approximately 17% of their carbon dioxide emissions. Forestry sequestration, large-scale hydroelectricity projects, and nuclear power stations are favored technologies for proposed offsetting of the carbon emissions from fossil fuels. Considerable discussion has followed about farms being operated as carbon sinks. The CDM market will be influenced by the projects selected for these mechanisms. It is proposed that effective monitoring be developed to assure that carbon-emissions reductions actually exist.

Another approach is the carbon emission commodity market. Estimates of the future market price of sequestered carbon has ranged from \$20 per ton to \$100 per ton. A corporation would propose a baseline and a set of assumptions that would be monitored for actual earned credits. If you were a utility company and reduced emissions of 3 tons of carbon, you would earn emission credits that could be sold or traded. Once you have earned these credits, you can trade the credits for cash. "Learning-by-doing approach" is planned. This is to assure that stakeholders will not be harmed and costs will be passed on to consumers and/or taxpayers.

Although they must get world governments to sign on to these agreements, the corporations seem to be



**WORLD CONGRESS  
FOR A HYDROGEN ECONOMY**

**NOVEMBER 1-4, 2001**

**DENVER, COLORADO**

**INTERNATIONAL ASSOCIATION FOR HYDROGEN  
ENERGY'S 2001**

**T. NEJAT VEZIROGLU**

A World Congress brings together the leaders in the hydrogen world with the public to move the Earth's energy to a Hydrogen Economy. Discussions, showcasing cutting-edge hydrogen technologies and meeting international and national leaders will provide an opportunity for all of us to develop goals for the World.

The goals are:

1. To preserve our environment and provide for prosperous national and international economies;
2. To announce to the public their role in bringing about the conversion to a Hydrogen Economy.

There will be concurrent focus sessions on particular aspects of hydrogen development and implementation. Plus plenary sessions bringing together the focused work of these sessions. The topics are:

- Topic 1: Hydrogen as a fuel for vehicles, existing and new.
- Topic 2: Hydrogen Production without Pollution
- Topic 3: Steps in the transition to Hydrogen Production.
- Topic 4: Storage of hydrogen: large scale and small scale.
- Topic 5: Transport of hydrogen: short distances and long distances
- Topic 6: Hydrogen for heating, powering buildings and the industrial infra-structure.

Sponsored by: Hydrogen Now, the American Hydrogen Association and Institute of Ecolonomics. Currently accepting submissions of presentations, exhibits, abstracts, and poster sessions. Help by participating by early registration, showcasing your hydrogen products for exhibition, and creating an awareness for the event. Planning for the future of Earth will take all of us. Contact:

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**"CONGRESS TO CONGRESS"**

**A DRIVE TO SURVIVE**

On the final day of the World Congress, (November 5th) founder of the Institute of Ecolonomics, Dennis Weaver, will launch a drive across America, from the World Congress to Washington D.C. Come meet members of Congress and our lobbying organization... "The National Hydrogen Association." Perhaps we can stop by to visit Roger Billings in Missouri. This will be a spectacular 2000-mile road test that will show our Nation and World that we can run cars on hydrogen. Plan to exhibit your vehicle at the World Congress and to participate in (or sponsor) the drive. This event will take planning and sponsors, sign-up with Dennis to help.

\*\*The World congress relies on public and private contributions and in-kind support. Your support ensures that the World Congress and the "Drive to Survive" reaches the widest audience and showcases the best we have today. Create a clear, bright vision for the future...write that check to day.

**Abundent Energy Created Earths'**

**POPULATION EXPLOSION**

<b>1804</b>	<b>1 billion people on Earth</b>
<b>1927</b>	<b>2 billion</b>
<b>1928</b>	<b>3 billion</b>
<b>1974</b>	<b>4 billion</b>
<b>1987</b>	<b>5 billion</b>
<b>1999</b>	<b>6 billion</b>
<b>2001</b>	<b>6,132,795,148</b>
<b>2013</b>	<b>7 billion</b>
<b>2028</b>	<b>8 billion</b>

**61% of the population lives in Asia  
97% live in less developed countries**

**2 billion children will be under the age of 18 when we run short of oil. Will you be energy independent that day?**



## WRITERS WANTED

by Byron Anderson

To encourage excellence in grassroots editorial style writing, AHA will post on our web site ([www.clean-air.org](http://www.clean-air.org)) selections of your published articles. Here are our guidelines:

- 1) We seek grassroots editorials and articles on renewable energy production, use, planning, social-economics and environment related topics. Subjects should include some reference or content relating to Hydrogen. (Grassroots means that you are not a journalist or a writer by trade.) All Languages are welcome. It would be helpful, if you would translate it into English. However, in a new section of our web page we may publish the article in your language.
- 2) The article must meet accepted publishing standards or have been published in a newspaper, magazine or other publication. (Include the date, reference the publication and your written request for republication in Hydrogen Today.)
- 3) The purpose is to document year-by-year excellence in grassroots writing about the Solar Hydrogen Economy and support of clean energy.
- 4) At the end of the year, the most compelling commentary on solar-hydrogen in practical life applications, economics, social/justice, or politics will be in a special feature on our web page. ([www.clean-air.org](http://www.clean-air.org)) (Hydrogen can be produced by natural resources i.e., solar, wind, wave, falling water, ocean thermal energy and biomass conversion technologies, etc.)
- 5) For selected articles we would like to have biographical information (with picture) of the writer(s).

Since this is the middle of winter 2001, we would like to have published articles from 1/1/2001. Your articles will show the impetus that helps progress from dependence upon fossil fuels to renewable resources. Grassroots writers are one of the most important forces of change.

**“Without ambition  
ONE STARTS NOTHING.  
Without work one  
FINISHES NOTHING”**

## U.S. is in an Energy Crisis:

By: Chuck Terrey, Engineer and V.P. of AHA

Time is rapidly approaching when the world production of oil will no longer be capable of meeting demand. The U.S. now depends on oil for more than 40% of its energy needs of which about 70% is imported. It is estimated that ANWR (Arctic National Wildlife Refuge) has from 10 to 16 million barrels of oil. This amount of oil adds about 1% to the world's oil reserve. ANWR cannot solve our energy problem. It will require 16 years to move 10-16 million barrels of oil through the Alaskan pipeline. However it will make a few big oil investors very wealthy — especially if they get a tax break and an oil depletion subsidy. It will probably delay work towards the one thing that can help the U.S. become energy independent: transition from a fossil fuel dependence to an economy based on renewable hydrogen fuel.

It is impossible for the U.S. to become energy independent by drilling for more domestic oil and natural gas. Nuclear power is also not an option. It would require more than 1,600 nuclear power plants to produce the 95 Quads of energy now consumed yearly by the U.S., and we are already importing our nuclear fuel.

Fossil fuels create pollution and global warming. Thousands of people die prematurely and millions are made ill by burning of fossil fuel. Even if we had an unlimited supply of fossil fuels, we would not want to continue wasting the environment by burning them. Hydrogen is the only fuel that can transform the internal combustion engine into an air cleaning machine. Hydrogen is the ultimate fuel for fuel cells. Renewable hydrogen fuel does not pollute, does not contribute to global warming and can lead us to a sustainable, prosperous economy. We know all of these facts and it is clear that the continued burning of fossil fuels is not in the best interest of the people.

### WHAT HAPPENED TO THE 1974 OIL EMBARGO Imported oil (one barrel equals 42 gallons of oil)

	1970	1998
OPEC	222,000,000	1,492,000,000
Non-OPEC	245,000,000	761,000,000
Other OPEC	160,000,000	1,458,000,000
Total:	627,000,000	3,711,000,000

**The answer: The U.S. is dependent and addicted to oil, 70% of which is imported ... over 5 billion barrels/yr.**



making the rules. From the Rio Conference to actually doing something, 20 or more years will have passed. By that time, it could be too late to prevent adverse climate changes. In that short time, (the next 20 years) civilization will have burned as much oil, as we did in the first 150 years of oil production! In the meantime, stakeholder representatives attend conferences and authoritatively pretend to be planning something of value. As this officious planning continues, the atmosphere is being changed.

Large-scale solar-hydrogen and renewable resources projects are needed. I attended the Rio conference, and cannot see that much has changed. Civilization is at a cross-roads, we must select a new path to energy security that avoids adverse global climate changes. The perceived slow pace of climate change has encouraged apathy but this cop-out civility could quickly change, when the public experiences inflation due to short supplies of energy and energy-intensive consumer goods. California's problems are man-made. Suppliers and energy commodity traders are responding to quick profit incentives under new rules that control retail sale prices by required deregulation of wholesale marketing of electricity. Oil companies are also taking record profits.

The Earth Summit's goals were not made to actually solve the global climate change problems. The hope was to start in the right direction which was to build awareness and even this goal is being delayed. Let's get to work and find better paths to energy sufficiency by taking the carbon out of fossil and freshly made hydrocarbon fuels before they are burned and using the hydrogen that is thus produced as the fuel for transportation and electricity production. Doing this can sufficiently curb greenhouse gas emissions to reverse the atmospheric changes that cause adverse global climate changes. This approach will facilitate renewable hydrogen production and sustainable wealth expansion for global prosperity without pollution.

Continued from page 5. Holding the part that is to be machined is provided with an adjustable chuck or collet. Turning power was initially supplied by the operator or a helper that cranked the chuck as it rotated in a bearing assembly. Eventually ball and roller bearings were developed to make the turning virtually friction free and extremely accurate. Today computers control motor drives that turn parts in automatic chucks at speeds that are closely adjusted over a wide range to automatically produce the best rate of chip removal and resulting finish. In many instances the motor drive can be stopped and locked to allow precise placement of non-concentric features by side feeding of powered tools to drill or mill features needed.

One of the most interesting aspects of the machine shop has been the specialization that has occurred. Machine shops tend to be shaped by the work that they accept and types of parts that they produce. Some shops are general and can arrange to make almost anything that someone invents with such flexible tools as a power saw, lathe, milling machine, and various grinding equipment. Others specialize to various degrees in making more specialized tooling. One example of a product made from highly specialized tooling is the mass produced aluminum can for distribution of beverages. Such cans are commonly formed by a reciprocating punch from a sheet of aluminum at the rate of 60 per second.

Fortunately for progress, the people found in machine shops are often amazing inventors and skilled technicians who somehow make it a daily routine practice to overcome numerous difficult problems. Unfortunately, the public seldom notices these truly great contributions. In the door comes an idea that may be at the stage of a sketch or it may be described in more formal blue prints or computer drawings. The machinist studies each part and considers the best approach and selects the machines that will be used to produce the desired result. Often this can only be done with a set-up that has not been known previously and/or preparation of specialized new tooling to facilitate the manufacturing steps needed.

Examples are the parts needed to convert an ordinary automotive piston engines to an Air Cleaning Engine or the "ACE." The fuel to do this job is hydrogen. But hydrogen is 14 times lighter than air and burns seven times faster than gasoline. Fuel handling equipment like diesel or gasoline fuel injectors have been specially designed for liquid fuels and cannot be used. New designs and new materials are required to do the job. What is required is the classic collaboration between the machine shop and the inventor.

**Air Cleaning Engines will be at the 2001 Rotary International Convention in San Antonio, Texas June 24-27th, 2001**



## **RENEWABLE ENERGY FOR A PHOENIX SUBDIVISION: WINNERS OF THE ARIZONA SCIENCE OLYMPIAD ENERGY EVENT ... *By: D.K. HARRISON***

Charles Hoyt has dedicated much of his life to improving Math and Science education in Arizona's High Schools. He helped conceive the Science Olympiad which was sponsored this year by the Arizona Alliance for Education. Thanks to Karen Conzelman, Steve Williams, and to their committees for another excellent Science Olympiad.

One of the Energy Events was won by Desert Mountain High School in Scottsdale, Arizona, Head Coach, Glen Drewnowski. Students Anita Bhavnani, Chris Meade, and Bill Meade built a model of a subdivision, scaled to represent 415 acres, subdivided into fourteen separate communities. The community buildings, pool, recreation areas, washes and common grounds covered 36 acres. Streets covered 69.9 acres, leaving 308.4 acres for 916 homes. Electricity, natural gas, automobile gas, water usage and waste were studied and represented in the subdivision's energy demands. The subdivision was to be located adjacent to the Salt River Pima-Maricopa Indian Reservation. Per discussions with the Salt River Pima Planning Committee, they want investment and jobs for their tribe.

Much economic analysis centered on energy conservation, efficiency improvements and recycling. They recommend using low energy lighting, on-demand hot water units at each faucet, composting toilets, sub-earth ventilation and high efficiency heat pump air conditioning. This would reduce home energy requirements by 50%. For transportation, they recommended hydrogen power for both internal combustion engines and fuel cell powered automobiles to improve transportation energy requirements and eliminate pollution. They concluded that geothermal energy was not available in Phoenix, wind power was unreliable and the subdivision did not generate enough waste to grow biomass such as *Euphorbia Lathyris* to utilize pyrolysis generated synthetic fuel. Limited hydropower presently exists on canals, but practical use is limited by water availability. They decided to utilize solar, hydrogen and water flow power within their subdivision.

Subdivision zoning restrictions require solar panels to be "an integral part of the roof" making sun-tracking units illegal. Discussions with Realtors found that installation of renewable energy devices on homes could drop house values 15% to 20% and stagnate house appreciation to only about 2%. Homeowners want maintenance free, 100% energy availability. Lower energy cost or clean energy is not highly marketable to most homeowners. Renewable energy service similar to lawn service will only interest a few percent of home purchasers. They reported that 38 Federal, State and local organizations were anxious to discuss renewable energy installations with them. They identified 32 State Solar Laws, touting State Tax savings. However, they found that home property value loss probably exceeds tax gains.

Their solution maintains homeowner value, appreciation and marketability by giving up uneconomical tax incentives. To make one typical house totally energy independent would cost about \$40,000 (\$36.6 million/our subdivision). With conservation, house design and lifestyle modification about \$20,000 per home would be possible (18.3 million/our subdivision). Augmenting present service by providing 90% of energy needs would cost about \$6,000 per home (\$5.5 million per our subdivision). Despite energy self-sufficiency, present energy supplier investment in equipment, federal, state and local tax costs would be reapplied elsewhere to reduce savings as has been seen with gas and electricity deregulation. They recommended investing \$4,400 per home (\$4 million per subdivision) returning the investment in less than 2 years. Thereafter, a 75% reduction in energy cost and evaluation in land value is expected.

Key resources identified were the sun, the CAP canal to the East and the Arizona Canal to the South. The key problems that exist now are high peak energy requirements compared to average/minimum demand creating wasted capacity. Homeowners wanted to use renewable energy, reduce pollution, but only at lower cost, 100% availability, no risk or personal maintenance. The science students primary goal was to produce Hydrogen/Oxygen. Hydrogen to fuel the cars, homes and electrical generation. Oxygen would be used for medical facilities. Revenues from the hydrogen/oxygen would pay back the subdivision investment and fund future expansion. They expected that hydrogen/oxygen would operate at full system capacity at all times.

Their model showed twelve 0.5MWDC current flow turbines in the CAP canal without reduction in flow capacity. Mirroring peak energy demand, their model illustrated 200 Phototherm solar panels producing 35KW of DC electrical energy and 12 million BTU/hr of hot water. They installed an ammonia cycle heat engine turbine to convert the collected energy to DC electrical power. They would need to contract with the tribe to use a small amount of their water from the Arizona Canal. DC electrical power would be used for water electrolysis to produce hydrogen and oxygen. They also installed seven 1.5 MW micro-turbines to provide AC electrical power. Hydrogen would fuel the micro-turbines for electrical power generation. Seven micro-turbines were chosen to give one back-up and the ability to ship one at a time to the factory for maintenance and upgrade. Fuel cell vehicles were proposed for running around the subdivision. This subdivision would be environmentally clean and energy independent along with the capability to meet future needs.



## ACE PROJECT CURRENT NEEDS

Engine Computer	\$1,500.00
4 Chrome Wire Wheels @\$410 each	1,640.00
4 General Tires @ \$90each	360.00
Software for on Board Dyno	800.00
Land & Sea On-board Dynamometer	3,200.00
Mfr. Drive Shaft	300.00
Clutch & Brake Pedals \$45 ea—linkage \$40	130.00
Seats @\$40 ea - Leather reupholster \$720 ea	1,400.00
Interior panels—Tonneau cover	900.00
Dash	200.00
Gauges	300.00
Hydrogen Gauge	100.00
Drag tests	200.00
Independent verification tests/documentation \$450 ea	900.00
Printing & Brochures	1,000.00
Body	3,000.00
New Top	1,400.00
Trim	300.00
Windshield	150.00
<b>Subtotal</b>	<b>\$16,160.00</b>

**Options to be added:**

Exhaust Gas Analyzer \$4,200 (5 gas sample bottles 8,000)	12,200.00
Ram Air upgrade	60.00
Supercharger upgrade	3,800.00
Independent verification tests/documentation	900.00
Travel to shows and drive to survive tour	13,360.00

Contact: D.K. Harrison  
(602) 255-0159

Update: [www.clean-air.org](http://www.clean-air.org)



## Help Ace the "ACE" Project

AHA's Air-Cleaning-Engine (ACE) Sports Car project is nearing completion. Soon, a beautiful Hydrogen-Powered Sports Car will be on the streets cleaning the air. But, your help is needed to finish this project to demonstrate how an ordinary engine can use hydrogen to produce more power, last longer, and clean the air.

A famous humanitarian, who wishes to remain anonymous, has generously committed to AHA \$8,000.00 in matching funds for individual contributions of up to \$50.00. Please contribute \$50 in your name and \$50 for a friend. Please consider contributing for several friends. Help your friends become new members of AHA. Sponsor new members and contribute to the ACE project. Help us turn \$8,000 into \$16,000 to get the ACE on the road. This is a critical opportunity for your American Hydrogen Association to advance the new paradigm of *appropriate cars that clean the air*.

Make your checks payable to "American Hydrogen Association" and note "ACE Project" and/or "new member sponsorship" in the memo field. Mail your checks to the following address to expedite the progress of this matching fund drive:

American Hydrogen Association  
1739 W. 7th Ave  
Mesa, AZ 85202-1906  
(602) 255-0159 or (480) 827-7915

The American Hydrogen Association is the North and South American Division of the Hydrogen Association. Your contributions are tax-deductible to our 501 (c)(3) non-profit organization.

Thank you for providing practical solutions to Civilization's dilemma of dependence upon annually burning over one million years of fossil accumulations.

Roy E. McAlister, P.E.  
President  
American Hydrogen Association

## Help Put The ACE Project On The Road

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone-Home(\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ Office(\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_



**REGISTRATION FORMS**

***"The problem is clear, the air isn't,"***

*a quote from the Pollution-Free Planet Committee*

- Yes, I want to join AHA, or give a gift to help make a transition to clean Hydrogen energy.
- Yes, Enroll me in the Fuel Cell Class October 20th and 21st, 2001.

A \$50.00 deposit is required to hold your reservation, and the total cost is \$350.00 per student/per class. Those that have taken the class previously may be able to find space to take the class free. AHA wants everyone to learn the technology. You must sign-up, so that space is reserved for you.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone-Home(\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ Office(\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

Regular membership (\$39/year)  Family membership (\$49/year)  Senior/student membership (\$25/year)  
 Sustaining membership (\$100/year)  Corporation/Institutional (\$2,500/year)  Fuel Cell, (includes Hydrogen Production and Investment) Class deposit (\$50.)  Other donation. For foreign mailing, please add US \$8.00 Consider a life income gift. Make a tax advantaged gift to AHA while retaining income on the capital for life. Donations to the American Hydrogen Association are Tax Deductible to the extent allowed under IRS 501 (c) 3 for a non-profit Organization. Enclose Check or Money Order and Mail to:

**American Hydrogen Association** 1739 W. 7th Ave, Mesa, AZ 85202-1906

Phone: (480) 827-7915 or Fx: (480) 967-6601

**www.clean-air.org e-mail: aha@clean-air.org**

**THE HYDROGEN ASSOCIATION**

1739 W. 7th Avenue  
Mesa, AZ 85202-1906  
USA

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