
Hydrogen Today



12,666 Miles/Gallon



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The PAC-Car II, built at the Swiss Federal Institute of Technology in Zurich, achieved 12,666 mpg using a hydrogen fuel cell and two small electric motors. (www.paccar.ethz.ch) Read all the details in “The World’s Most Fuel Efficient Vehicle: Design and Development of The PAC-Car II.” J. J. Santin and others, 2007. About \$64, 339 pages. Get an extra copy for Detroit.

“A new source of power called gasoline has been produced by a Boston engineer. Instead of burning the fuel under a boiler, it is exploded inside of the cylinder of an engine. The dangers are obvious. Stores of gasoline in the hands of people interested primarily in profit would constitute a fire and explosive hazard of the first rank. Horseless carriages propelled by gasoline might attain speeds of 14, or even 20 miles per hour. The menace to our people of this type hurtling through our streets and along our roads and poisoning our atmosphere would call for prompt legislative action even if the military and economic implications were not so overwhelming. The cost of producing gasoline is far beyond the capacity of private industry. In addition, the development of this new power may displace the use of horses, which would wreck our agriculture.”

U.S. Congressional Record 1875

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** SAFETY FIRST **

Editorial

More changes. Depending on whether you ask my wife or me, I've fallen or risen from factory mechanic to neighborhood bicycle mechanic. As my son says, "It is what it is." When I was fourteen, my pal and I built a 12 x 20 ft. shack from lumber salvaged from a barn. We christened it the "Lab." Indeed, we compounded rocket fuel and distilled alcohol that burned very well. Didn't taste too bad either. With a pot-belly stove, the place was warm, dry and comfortable year 'round. Should my fate ever include foreclosure, I know I could be content in such a Thoreauesque dwelling. In "Rancho Costa Nada," Phil Garlington, a laid-off journalist, tells how he built a home out of tires and cardboard on a \$300 lot in the desert miles beyond the middle of nowhere. He had plenty of neighbors. Enjoy and take care of whatever you do have.

Hydrogen on the Internet

Axial Vector Energy Corp. Virginia Beach, VA. Currently developing a RADAX type axial engine. Their initial application seems to be gensets. www.axialvectorengine.com

Partnership for Advancing the Transition to Hydrogen (PATH). International Coalition of Hydrogen Associations. Papers from all over the world on hydrogen projects, standards and education. www.hpath.org

Information Unlimited. Box 716, Amherst, NH 03031. Wide selection of electrical and optical supplies for the experimenter. Plans for lasers, a 1.5 million volt Tesla coil, giant kites, neon lights and dowsing rods. Check out their hydrogen howitzer, hydrogen mortar and 30 caliber hydrogen pistol. www.amazing1.com

Home Depot. Details on their compact fluorescent light (CFL) recycling program. www.homedepot.com Click on Eco Options.

Oilgae (Oil from Algae). Comprehensive info on the global algae fuel industry, including hydrogen from Algae. Based in India. A ton of algae uses up a ton of CO2. If you have any interest in algae at all, sign up for their free newsletter. www.oilgae.com

Counter-Rotating-Ring Receiver Reactor Recuperator



This mouth-full from Sandia National Lab uses a parabolic mirror to heat a chamber of water and nasty CO₂ to 1500° C, producing hydrogen, oxygen and carbon monoxide, precursors to synthetic fuel. They say it could be ready for market in 15 to 20 years. If people keep up this sort of thing, we may never see that \$20 a gallon gasoline.

Simple Experiment with H₂ Boost on Emissions from 1981 Bluebird Schoolbus



Hydrogen fed into the carburetor with a hose, 2000 RPM.

	<u>No H₂</u>	<u>H₂@2 PSI</u>	<u>H₂@4 PSI</u>	<u>H₂@6 PSI</u>
Carbon Monoxide	4.92	.20	.71	1.34
Carbon Dioxide	9.3	6.6	6.7	6.0
Oxygen	2.4	5.0	2.4	1.4
Hydrocarbon	1600	620	270	195

Hydrogen Events

Arizona State University Polytechnic Campus- ALT 401/Hydrogen Generation, Storage and Distribution. Jan 19-May 4, 2010. Contact lakshmi.munukutla@asu.edu

Hydrogen Education Foundation's Hydrogen Student Design Contest. Registration deadline: Jan 22, 2010. College teams develop a hydrogen community, including a renewable co-producing hydrogen supply, a hydrogen market analysis and a plan for fueling stations. Entries are due Mar 24th. Winners announced on Apr 7th. Winners receive \$5,000 and present a paper at the NHA Hydrogen Conference in Long Beach, Ca in May.

www.hydrogencontest.org

Proton Energy Systems Scholarship Program. Are you a high school student with a love for science? Here's a chance to win a \$100,000 scholarship. You must show financial need and write two essays, one describing what you want to accomplish in science and another answering why you should be the one to get the scholarship. Apply by Feb 10, 2010. www.protonenergyscholarship.org

Southwest Build-It-Green Expo and Conference. Mar 13-14, 2010. Phoenix, AZ Convention Center. <http://azbigmedia.com/content/soutwest-build-it-green-conference>

Northwest Solar Expo & Clean Technology Showcase. Apr 27-May 2, 2010. Portland, OR. For beginner homeowners to business pro's. Many opportunities for training. <http://nwsolarexpo.com>

Alternative Fuels & Vehicles National Conference + Expo. May 9-12, 2010. Las Vegas, NV. Sixteenth year for this natural gas, ethanol, biodiesel, propane, electric and hydrogen show. www.afv2010.com

American Solar Energy Society National Solar Conference. May 17-22, 2010. Phoenix, AZ. Saturday, the 22nd will be a \$5 Public Day. www.ases.org

AHA Hydrogen Breakfast. Every Friday morning, except holidays, at 6 am. Phoenix, AZ. Everyone with an interest in renewable energy is welcome. Bill Johnson's Big Apple, 3757 E. Van Buren St., just west of GWCC.

The Rest of the (Hydrogen) Story

In 1820, Goldsworthy Gurney, discovered that some calcium oxide held in the flame of his oxy-hydrogen blowpipe gave off a very intense light. These limelights, as they came to be called, were widely used in theaters in the 1860's and '70's until they were replaced with electric lights. The characters on the stage were said to be "in the limelight." And now you know....

Books & Publications

The Clean Tech Revolution: The Next Big Growth and Investment Opportunity, Pernick & Wilder, 2007. Harper Collins. \$18, 308 pages.

In these hard times, it's becoming both more important and more difficult to predict the future. This book covers some probable bright places to invest your time and money- solar energy, wind power, bio-products, green buildings, personal transportation, the Smart Grid, water filtering and power supplies for mobile (military) equipment.

The Freedom Element: Living With Hydrogen, Dr. Addison Bain, 2004
Blue Note Publications, \$16, 301 pages.

A 1994 chemistry textbook by an Arizona State University professor states: "The disastrous explosion of the airship Hindenburg... was due to the explosive combination of hydrogen and oxygen." Dr. Bain demolishes this myth once and for all. The first part of his book is a humorous look at how he developed the hydrogen fuel infrastructure for the huge NASA space rockets. The second part details his years of painstaking forensic research on the Hindenburg's demise in 1937. He interviewed witnesses in Germany and discovered pieces of cell fabric which he thoroughly analyzed. There are some good points on hydrogen safety. The title refers to the use of hydrogen freeing us from petroleum.

Anticancer: A New Way of Life, David Servan-Schreiber, 2008.
Viking, \$16, 258 pages.

After he got brain cancer, this neuroscientist refused to accept the standard medical explanations that it was hereditary or that the cancer was inevitable. He studied all the current research and reached his own conclusions, namely that pesticides, stress, sugar and lack of exercise drag down the natural cancer cell killing ability of our own immune systems. Read this book if you have children. Cancer has become the number two killer of our young, after accidents.

The Chemistry and Manufacture of Hydrogen (Book), Major P. Litherland Teed, 1919.
Knowledge Publications, \$19.95, 152 pages.
www.knowledgepublications.com

Why would anybody buy a 1919 book about producing hydrogen for army observation balloons? Well, for the same reason people still buy Homer's Odyssey. The chemistry that worked in 1919 works today and will still work 10,000 years from now. He covers the occurrence of hydrogen, hydrogen compounds and H₂ purification. He describes about 20 chemical and physical production processes. Teed does mention one method using mercury amalgam that probably would never be used today. There are many helpful charts and diagrams. This book is no substitute for Chemistry 101, but I often amaze my son by something I learned from my grandfather, born in 1875.

The Chemistry and Manufacture of Hydrogen (DVD), Roy McAlister, 2007.
Knowledge Publications, \$19.95, 4 hours.
www.knowledgepublications.com

Roy McAlister gives a page-by-page commentary on PLT's book that brings the material up to date. There's interesting historical background and information on internal combustion engines and hydrogen storage & safety. I suggest reading one chapter in the book at a time followed by the associated video. You'll save \$5 by buying them together.

Earth: The Sequel – The Race to Reinvent Energy and Stop Global Warming, Fred Krupp, 2008.
Norton, \$15.95, 304 pages.

Here's a look at the coming industrial revolution in energy that I suspect will be more profound than steam, internal combustion engines (ICE's) or the computer. Is using enough corn to feed a person for a year to make one tankfull of ethanol really the way we want to go? Discusses energy sources like photovoltaic cells, concentrated solar for heat storage, algae, biofuels, ocean tides & temperature differentials, geothermal and even coal as means for everyone to still make a living without ruining our earth.

If you think genius, dedication or good looks will overcome all, you should read these two books. Learn about the political, financial, technical and personality traps that await the optimist. You're going to need luck, beside the hard work and love.

The Next Great Thing: The Sun, The Stirling Engine and The Drive To Change The World, Mark Shelton, 1994.
Norton, \$19.95, 276 pages.

In 1974, William Beale founded Sunpower in Athens, Ohio to turn his efficient free-piston stirling engine design into a commercial reality. His goal was to build renewable energy, pollution free engines, refrigerators, compressors and generators. It took him years longer than he planned.

Powering The Future: The Ballard Fuel Cell and the Race to Change the World, Tom Koppel, 1999.
Wiley, \$27.95, 288 pages.

In 1975, the Canadian geologist, Geoffrey Ballard (1932-2008) and his buddies paid \$2000 for a derelict motel in southern Arizona as a laboratory to develop electric vehicle lithium batteries. He went on to spend years and a fortune building the Ballard fuel cell. Fuels cells are starting to show up now all over founded on his pioneer work.

The Incredible Secret Money Machine- A How-To Cookbook for Setting Up Your Own Computer, Craft or Technical Business, Don Lancaster, 1978.
Howard Sams, \$9.99 @ Amazon, 192 pages.

This classic should be on every craftsman's desk. Do you believe your work is more important than money or accolades? Would you rather be in control instead of going to meetings or doing reports?

Is your trade local, gentle on others and the environment? If this sounds like you, then Lancaster's book will give you hundreds of secrets on building your own money machine. He tells how to choose a catchy name set up shop right the first time, how to find and concentrate all the information vital to your business and why you should never deal with people who can't help you. Generate multiple sources of income. If you fix things, teach a class, sell an article or play the fiddle at birthday parties. You should be adding so much value to your product that no one can ever compete and your business is sustained by word-of-mouth and customers who keep coming back for more. You'll sleep better if you operate under the radar instead of under the table.

Alcohol Can Be A Gas (Book), David Blume, 2007.

The International Institute for Ecological Agriculture, \$31, 596 pages.

Bloom's book is a complete encyclopedia on ethanol, once you get past the name-dropping and what you need to do if you want to get persecuted by Chevron. He goes over oodles of feedstocks from buffalo grass to whey and how to do the magic of converting sugars or starch to alcohol. He covers the science of distillation and building your own still. The residue after the alcohol is removed can be cashed in as food for someone's menagerie or garden. He thoroughly discusses alcohol as a fuel and shows how to convert both carbureted and fuel injected engines. He includes topics like timing, cold starting, increasing compression and running diesels. Of, course, he gives the low-down on the Feds (Bureau of Alcohol, Firearms & Tobacco), whom you better treat right. Excellent, abundant drawings to clarify the text.

Alcohol Can Be A Gas (DVD), David Blume, 2007.

The International Institute for Ecological Agriculture, \$20, 2 hours and 40 mins.

In this video Blume covers some of the interesting history of the alcohol movement. He talks about alcohol politics, economics and biology and goes over some of the feedstocks that you can grow. There is little about actually making the stuff.

If you're on a budget and think you know what a carburetor is try:

The Secrets of Building an Alcohol Producing Still, Vince Gingery, 1994.

www.lindsaybks.com \$12.95, 76 pages.

Making Your Own Motor Fuel With Home & Farm Alcohol Stills, Fred Stetson, 1980.

Garden Way, \$2.50 @ Amazon, 186 pages.

How To Make Your Own Alcohol Fuels, Larry Carley, 1980.

Tab, \$2.36 @ Amazon, 195 pages

Mother Earth News still sells blueprints for their 6" still for \$15.

www.motherearthnews.com

Making Algae Biodiesel at Home, David Seig, 2008.

www.making-biodiesel-books.com , Softcover- \$168, 185 pages, ebook- \$99.99.

Algae can be almost 45% oil by weight, producing 15,000 gallons of oil a year per acre, about 1000 times the oil yield of corn. It grows in salt water or sewer water. I've discovered that algae can grow anywhere that we don't want them to. The trick is to pick a strain with high oil content and to keep them thriving where you do want them to grow. The book breaks you in with a simple, inexpensive set-up made with plastic jugs. After making your mistakes there, you can move on to a 140 gallon aquarium. Next are an algae greenhouse and plans for a \$200 photo-bioreactor. He then tells you how to harvest and extract the oil. Finally there is an overview of large-scale production in open ponds. The book does well with parts lists and photos, but needs an index. You could probably find much of this information on line, instead of paying so much for this book, but what are 20 or 30 hours of your time worth? You can start out by signing up for their free 6-part Algae Biodiesel on-line course.

The Hydrogen University

The Art of Scrounging

I need a bolt, specifically a 6 x 1 metric thread about 1 ¼ inches long. I could run over to the hardware store and buy one for \$0.65, if they have it. Or, in a few seconds, I can find one in my recycled polyethylene milk jug full of salvaged 6 mm bolts. Let's first get a few definitions out of the way. Salvage means getting something of value out of property that is damaged, worn out, obsolete, beyond economical repair or otherwise of no value before throwing it away. My Beta video recorder no longer works, but it's full of reusable bits and pieces. Scavenging is hunting for something of value to you in discarded or abandoned property. Day-old jelly donuts in a dumpster could be a life-saver for a homeless individual. Recycling is returning something to its original or an alternate use. Reusing materials saves you a lot of money. Sorry garbage truck drivers, but we should recycle 100% of everything we use. Scrap is resellable basic material content such as copper, steel and aluminum. Scrap can add \$cash to your project funds.

-Yard Sales. These work best when I'm looking for something in particular. I did buy a solar hot water pump and controller after the guy's collector froze and split for the second time. You can learn a lot by asking questions.

-Thrift Stores. Again best when looking for something special. I bought a treadmill for \$30 and used the variable speed motor on a milling machine. Also bought a 4" computer-controlled Celestron reflector telescope for \$40. I found the manual on-line. Good for books, too.

-Police and Public Auctions. You have to be prudent here. There's a good reason all this stuff ends up at auction. Look carefully for cracks or critical (and expensive) missing pieces. You really need to know your prices. I won a cello bid for \$30, not realizing the missing set of strings would cost another \$80. Don't get carried away by the bidding.

-Metal Distributors. They usually charge by the foot or by the pound. It's difficult to handle a standard 20' piece, but they'll be happy to cut it for you for a substantial fee. Most of these places have scrap bins full of cut-offs. Often you can find what you need there. There's no discount on price, but you don't have to deal with a full length/sheet or cutting charges.

-Surplus Houses. Local or mail-order establishments have an astounding variety of goods at low prices. Surplus Center, All Electronics and Fair Radio Sales are just a few examples of places to find wheels, fans, pumps, 12 HP diesel engines or Geiger tubes. Their catalogs will stimulate your imagination for hours.

-Roadkill. I've lost far more than I've ever found, but my wife brings home Snap-On wrenches, giant bolts, aluminum beer cans and folding knives.

-Auto Salvage Yards. Last week I picked up a real spare wheel for the '83 BRAT and a handful of valve caps on half-price day. Source for 12 volt motors and alternators.

-Recycled Building Material. Places like Habitat for Humanity's ReStore and our local Stardust recycle everything possible from demolition sites- lights, cabinets, sinks, windows, left-over paint. A \$1 door makes a decent desktop. I bought two glass patio doors for \$10 each, one for a solar still and the other for a solar hot water collector. Two dollars bought a 20 x 20 glass shelf for a solar oven cover.

-Craigslist and eBay. These have pretty much supplanted the *penny-savers* and the newspaper classified ads. I find them both a hassle, but they are economical and work well for buying or selling. Stainless steel Swage-lok fittings are about half-price on eBay.

-Books. Of course, always check your public library first. Amazon.com is an invaluable resource for used books. Unfortunately, they are damaging local booksellers who are now going more to DVD's, CD's and computer games than paperbacks. Find all the used book sales in your area at www.bookfinder.com. As I mentioned already, documentation can often be found on-line, although not always for free. A wiring diagram can make or break a repair.

-Word Of Mouth. Without mentioning the H word, talk about your projects with your neighbors, coworkers and at meetings. People are often delighted to get rid of what is trash to them and treasure to you; sawdust and horse manure, for example. Everybody knows I'm a bike mechanic and I've come home and found three bicycles left in the driveway.

-Dumpsters. Last and certainly least. I found the wheelbarrow I've been using for a dozen years in a dumpster. A TV worked fine after replacing the fuse. My cat and I were both happy with a scratching post made from a dumpster carpet remnant. However, dumpsters are definitely hazardous. There's broken glass, dirty diapers, syringes, heavy objects, battery acid, cadavers and nails. If you must, use gloves and safety glasses. Furthermore, because of liability issues, scavenging without permission is usually illegal. The police will give you a ride downtown if you're caught. The alley behind my house has been a good appliance dumping ground. Sometimes a truck will drive through the alley and throw something off and another truck will come along and pick it up before I can get to it.

Stop before you buy anything and look at what's around you. Hydroxide catalyst for your electrolyzer can be leached from somebody's wood ashes. I've forgotten how many times I've refilled my inkjet printer cartridge. The river bottom supplies me with stones for raised garden beds and the same clay the Hohokams used for their pottery 600 years ago. When you disassemble something, besides adding free

bolts, washers and switches to your junk box, you learn the principles of how the thing worked, why it was designed a certain way. I'm always curious too about any mode of failure. Why did it overheat? Was there a lube or a material failure? Abuse? That all goes into your mental toolbox.

Beg if you must, borrow if you can, but don't steal. Keeping a lost wallet, archeological artifacts or removing goodies from the Salvation Army donation box are no-no's. Scroungers have ethics, thieves do not. If you don't need something, leave it for somebody else who does.

Remember to share. Clean some junk out of your way and out of your life. Donate it or post it on your community freecycle website. And don't forget to say 'Thank You', even when something's free. Accomplish more with your life, get two or three lifetimes for the price of one and have fun doing it.

Wilderness Energy Electric Bicycle Conversion Kit



It's pretty easy to electrify your bicycle with this kit. Everything is included- front hub motor, battery pack with three 12 V sealed batteries, charger, controller, thumb throttle and even a rack for the battery. The cables all connect with plugs. The zippy 600 watt motor gives you a 20 mile range at 20 mph, the maximum speed in many locales for unlicensed, uninsured and unregistered operation. It takes about 6 hours and 4 cents worth of electricity to recharge. It's free if you have PV. The kit does add 34 hefty pounds to your bike, giving it a motorcycle feel which you quickly get over. You'll probably want to add a little pedal on hills. Have some fun, save expensive wear and tear on your car and cut the smog. I've been using the same batteries for three years. See www.wildernessenergy.com for all the details. 16, 20, 24 26 inch and 700 wheels are available. Priced at around \$450.

Show Me the Hydrogen

Hydrogen Fueling Station

Charleston, WV. The DOE opened a hydrogen facility at Yeager Airport last August. The airport and the Air Guard will make use of a Rush H2 ICE Silverado, a small dual H2/gasoline pick-up, a fuel cell forklift, a fuel cell Chevy Equinox SUV and an electric GEM with an on-board H2 fuel cell recharger. Twenty-six pounds of hydrogen are produce a day from 300 gallons of water using a grid-powered electrolyzer. The H2 is stored at 500 psi. "It's a great use of coal," commented the president of the WV Coal Association.

AHA Membership Form

Name(s) _____

Address _____

City _____ State _____ Zip _____

Country _____

Telephone _____ email _____

- Regular Membership- \$39.00/year
 - New members receive a free copy of Roy McAlister's "Solar Hydrogen Civilization".
- Family Membership- \$49.00/year
- Student & Senior (60 and over) Membership- \$25.00/year
- Sustaining Membership- \$100.00/year
- Corporation/Institutional Membership- \$2500/year

Print this form and mail with your check or money order to:

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2350 W. Shangri La
Phoenix, Arizona 85028
USA

AHA publishes *Hydrogen Today* to help educate the public about new developments in renewable energy and the science and people behind them. Join us in making a better world. You can help too by writing for *Hydrogen Today*. Tell others about your grassroots alternative energy projects, either scientific or social. Review a book, product, service or event. A picture is still worth a thousand words. The range should be approximately 300-1000 words. Send to the above address or to the *Hydrogen Today* editor at bikesintl@netzero.com.