

Hydrogen Today



Show Me the Hydrogen



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In Casa Grande, Arizona, less than 30 miles from AHA Headquarters, Air Products (Allentown, PA), has begun construction of a 10 metric ton per day green liquid hydrogen production facility and distribution terminal on a 60 acre site. They'll be using two Thyssenkrupp Nucera alkaline electrolyzers. They expect to be operating in 2023. The plant will employ 50 to 100 people. The main market will be California hydrogen car and bus refueling stations. The nearby Nikola factory in Coolidge, Arizona will be rolling out hydrogen fuel cell semi-trucks in mid-2023. A hydrogen supply in Phoenix would allow fuel cell vehicles to travel to Las Vegas, San Francisco and Las Vegas.

“Quotations”

“Train people well enough so they can leave, but treat them well enough so they don't.” Richard Branson

“Make noise, cause trouble. You may not win right away, but you'll sure have a lot more fun.” Florynce Rae Kennedy

“The butterfly counts not months but moments, and has time enough.” Tagore

“To acquire knowledge, one must study. But to acquire wisdom, one must observe.” Marilyn vos Savant

Hydrogen – It's not about the future anymore.

American Hydrogen Association Mission

Hydrogen Today:
Journal of the American
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ISSN: 1081-1273

**** SAFETY FIRST ****

Develop solar hydrogen technologies that will eliminate economic, environmental and energy hardships caused by burning one million years accumulation of fossil fuels every year *and*

Educate scientists, entrepreneurs and experimenters, parents and educators, CEO's, legislators, utilities, the media and farmers how to use solar hydrogen to create sustainable prosperity without pollution.

State of the AHA

After buying property in Arizona three years ago for a permanent AHA home, we expected to be operational soon after fixing up a couple of well-used buildings. However, COVID and 115 degree temperatures have not been very good lubrication for the wheels of progress.

2023 will be a year of change and challenge for us. There's no going back to 'normal'. Energy is going to cost a lot more, parts are going to be out of stock and one person will have to do the work of 2 and a half. However, the AHA mission isn't changing. Our purpose is to educate citizens about solar hydrogen so they can create a demand for clean hydrogen (and end oil spills, extreme weather, nuclear waste and bomb dropping).

New projects for the new year will be an Earth Day Hydrogen Expo, hydrogen how-to movies, installation of a Hysolgenics solar electrolyzer, hydrogen refueling station, machine shop, rain water collection and scanning 1000's of pages of printed hydrogen documents to make them available for you online.

Ongoing projects include engine conversions, Hydrogen University classes, solar furnace, tiny homes, hydrogen safety handbook, Whole Hydrogen Catalog, biochar & biodigesters and ethanol still. Our clean-air.org needs some TLC and hopefully we can resume the always fun road-trips and make new friends.

A friend used to always tell me, "Don't worry They'll take care of it." He was right, but now they is you and me.

Hydrogen Events

2023 Hydrogen & Fuel Cell Seminar, February 8-10, Long Beach [CA] Convention Center. \$1295. Get the latest news from Honda, NEL, PDC and Swagelok and then get some knowledge from dozens of lectures on hydrogen production, storage, transportation, safety, aviation & marine, pipeline blending and ammonia. Register at: <https://www.fuelcellseminar.com/>

Hydrogen on the Internet

AHA Weekly Online Forum. Thursday, 6:30 to 7:30 PM, Arizona Time. Join our conversation with your computer, tablet or smartphone. Click on this link to join: <https://global.gotomeeting.com/join/373085893>

You can also dial in using your phone at (646-749-3122).

<https://www.pdfdrive.com/> A search for “Hydrogen” comes up with titles of 99,662 books you can download for free.

How I Discovered Hydrogen

By Douglas Hawley

Philosopher Mechanic
Arizona

When I was a lad in the Adirondacks, I liked living off the land during summer vacations. I'd sleep in lean-tos, eat wild blueberries and apples from abandoned orchards and catch fish with my bare hands. For most of my life, I've had an interest in alternative technology such as bicycles, grow-it-yourself food and making things with repurposed materials. I'd watch a co-worker spend 10 minutes setting up a machine to saw a ½ inch bar in half, a task I'd do with a good hacksaw in 1 minute.

In 1998, I was teaching bicycle mechanics classes at the Tempe community Coop and I sat in on a hydrogen lecture by Roy McAlister, President of the American Hydrogen Association. Like every believer of the Hindenburg myth, I thought hydrogen would blow you to bits. I learned from him that as far as fuels go, hydrogen is the safest because of its unique properties. The next day I took his weekend class on converting internal combustion engines to clean hydrogen. I've been an AHA member ever since. I was especially motivated by a high school friend who burned to death in a gasoline fire. Roy volunteered me to edit *Hydrogen Today* in 2007 and later I joined the Board of Directors.

The Rest of the Hydrogen Story

LH2 Aircraft

Interest in sustainable aviation is taking off, whether it's renewable jet fuel, battery-electrics or liquid hydrogen (LH2) turbojets. If you think this is something new, here's the rest of the hydrogen story.

At the end of WWII, German jet fighters had shown clear superiority over propeller aircraft, 1600 German rocket and nuclear scientists under "temporary limited custody," along with Werner van Braun's V2 rocket documents, had arrived in the U.S. and the military still stung from the surprise attack on Pearl Harbor. The Army started developing a rocket to put satellites into orbit for advanced communications and navigation. The Air Force sponsored cryogenic research at Ohio State University. It was clear by then that hydrogen was the best high energy fuel needed to escape earth's gravity. When the Army tried to buy LH2 in California, Shell said there was none available, National Cylinder Gas Company said it was uneconomical and unsafe, and Linde charged \$62 a kilogram. They got help from Herrick Johnston at Ohio State to build a liquefier.

After the Soviet Union exploded their own atomic bomb in 1949, the U.S. followed with thermonuclear hydrogen bombs and B-52 bombers to deliver them. Department of Defense Intelligence and the CIA needed to observe Soviet development of long-range missiles so Lockheed built the U2 spy airplane. Not only did it need to fly high enough to be out of range of missiles, it should be undetectable. Jet fuel flamed out or froze above about 12 miles.

In 1955, NACA (National Advisory Committee for Aeronautics, predecessor of NASA), started a secret 3-year Project B at Lewis Lab (Cleveland) to convert a twin engine Martin B-57 bomber to LH2. One of the engines ran on both hydrogen and jet fuel. One wing tank held LH2 and another wing tank held helium to pressurize the hydrogen. The pilot had to manually vent the tanks to adjust pressure. LH2 supply was still a problem. They acquired leftover equipment from the Air Force hydrogen bomb program. The project proved once and for all that hydrogen turbojets worked.

In 1956, not to be outdone by the CIA, the Air Force started a super-secret spy plane project called Suntan. Lockheed Skunkworks, with U2 experience, would build the CL-400 aircraft with wingtip engines. They installed a small hydrogen liquefier in a WWII bunker to cryo-test components and materials. Experiments to deliberately explode hydrogen generally failed. Pratt & Whitney designed an LH2 engine, the 304. They installed a 227 kilogram a day liquefier from Johnston at Ohio State at their Connecticut factory. For reasons of safety, noise and security they moved to the middle of nowhere in Florida. The Air Force hired Air Products to build a 4500 kilogram/day liquefier plant next to Pratt & Whitney. It was called a fertilizer plant to disguise its function. Somehow word got out about hydrogen and the neighborhood got the unpopular idea that they were building hydrogen bombs. A 27,000 kg/day LH2 facility was added that later supplied NASA space programs. Project Suntan was cancelled in 1958 because of LH2 logistics and disagreement about its range.

Although hydrogen airplanes didn't make the big time, all the technologies like volume LH2 production, cryo-pumps, transporting, quick refueling, insulated containers, ortho to para hydrogen conversion and safety was crucial later for NASA's Apollo and Space Shuttle programs.

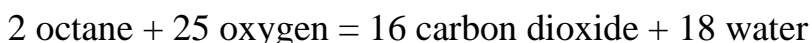
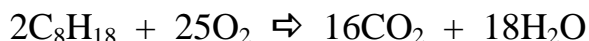
In 1937 (the year the Hindenburg caught fire), German Hans Joachim Pabst von Ohain ran one of the first jet engines on hydrogen. The first flight of a jet aircraft was in 1939.

Hydrogen University

Presto Chango – Gasoline to CO2

The chemical formula for octane gasoline is C₈H₁₈. It has a molecular weight of 114 (8 carbons with a weight of 12 + 18 hydrogens with a weight of 1). A gallon weighs about 6.26 pounds. Your hard-earned dollars go into the gas tank, but where does the gasoline go? Don't look in the rear-view mirror and we're not talking about the kids driving around the block 100 times on Saturday night.

Here's the reaction for burning gasoline in your internal combustion engine. Gasoline combines with oxygen from the air and produces water, which is OK and carbon dioxide, which is not OK.



$$2(114) + 25(2 \times 16) = 16(12 + 2 \times 16) + 18(2 \times 1 + 16)$$

$$228 + 800 = 704 + 324$$

$$1028 = 1028$$

In this balanced equation, we can see that the weight ratio of gasoline burned to CO₂ formed is 704 to 228. If a gallon of octane weighs 6.26 pounds, every gallon we burn produces:

$$6.26 \times 704/228 = 19.3 \text{ pounds of CO}_2$$

In the U.S., we burn about 370 million gallons of gasoline every day.

Books & Publications

How to Give Up Plastic: A Guide to Changing the World One Plastic Bottle at a Time. Will Callum, 2019. Penguin, 224 pgs.

The world uses a million plastic bottles a second. Only about 10% are recycled. The rest are incinerated, landfilled or end up in rivers and oceans. We're aware of the harm caused by plastic pollution – wastewater treatment plants clog up, wildlife starves with stomachs full of indigestible plastic bits and we breathe, eat and drink microplastic particles. Conscientious citizens pick up tons of ugly plastic on beaches and in a few days they're covered again. Is it going to make any difference if you trade in your plastic water bottle for a stainless steel one?

The author, a Greenpeace activist, does not offer a plethora of ways to cut your plastic footprint. He suggests buying a washing machine that filters out plastic scrubbing particles from detergents. More importantly he gets you looking around and makes you extremely aware of plastics' presence. Find new uses for your plastic grocery bags. A major grocery chain employee told me once that one of his jobs was to collect the plastic bags customers put in recycling bins and throw them in a dumpster. Polyethylene milk and water jugs can be remelted into home projects. My city no longer recycles glass containers, so I break them up, polish the shards in a rock tumbler and use them for decorative, colored stones.

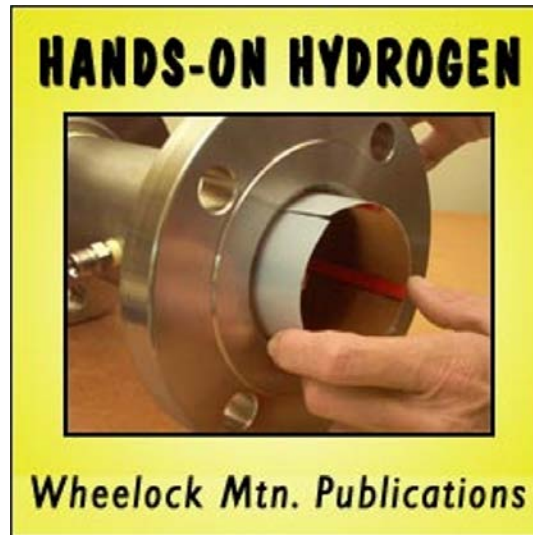
After reading this book, you'll start creating ways to eliminate plastic and you'll want to talk to your friends about it.

Hilda Hydro: Girls Go Green. Ann Hoffman, 2007. Wildhorses Publishing, 192 pages.

This story is about two young sisters who decide to drive a souped up hydrogen-fueled Ranchero from Phoenix to a family reunion in upstate New York. Through their many adventures, we learn about renewable energy and that teenage ladies can accomplish whatever they set their minds to. Good for all ages, but especially budding young scientists. After you read it, donate it to your library. <http://clean-air.org/store.html>

Thanks

- Claude C. – Chain link fencing, evaporative cooler and porch repair.
- Clyde S. – Porch repair.
- Warren H.– Cat food, patio tables, 2 x 4's, bullnose bricks and (10) new 230W solar panels.
- Addison B. – Hydrogen aviation files.
- Dave H. – Oil change.



Books for Do-It-Yourself Experimenters

By Phillip Hurley

- Build Your Own Fuel Cells....\$16.95
- Build A Solar Hydrogen Fuel Cell System....\$16.95
- Practical Hydrogen Systems: An Experimenter's Guide....\$22.95
- Build Your Own Solar Panel....\$14.95
- Solar II....\$16.95
- Solar Supercapacitor Applications....\$11.95
- The Battery Builder's Guide....\$20.95

These are easy-to-follow directions for building your own hydrogen hardware. Hurley even gives you part numbers and throughout he stresses safety lessons.

Books are available in paperback on Amazon:

https://www.amazon.com/Phillip-Hurley/e/B001K8XF3K/ref=sr_tc_2_0?qid=1545928563&sr=1-2-ent

AHA Membership Form

Name _____

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").
- Student, Military & Senior (55 and over) Membership- \$25.00/year
- Sustaining Membership- \$100.00/year (autographed book)
- Life Membership- \$1000
- Corporation/Institutional Membership- \$1000/year
- "Solar Hydrogen Civilization" book only - \$24.95 postpaid.
- Email *Hydrogen Today* only
- "Hilda Hydro - Girls Go Green" - \$8.95 postpaid

Mail to: American Hydrogen Association
P.O. Box 4205
Mesa, AZ 85211
USA

Or go to: <http://clean-air.org/store.html>

Join the AHA and use our services to learn how every community can achieve sustainable
Prosperity Without Pollution.

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. Mail to the above address or to the *Hydrogen Today* editor at editor@clean-air.org Thanks.