
Hydrogen Today



Show Me the Green Hydrogen



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A \$2 billion change is coming to the coal town of Delta, Utah; population around 3678. Chevron and others are betting that green hydrogen can replace the coal-fired generators. Forty shipping-container size HydrogenPro electrolyzers will produce hydrogen from solar and wind power. The hydrogen will be stored 3000' underground in two caverns 200' wide by 1200' high (Empire State Building is 1450 ft.) created by dissolving salt with high pressure water. Hydrogen will be stored in the spring and fall to power Los Angeles summer and winter peaks. Natural gas turbines will blend up to 30% hydrogen. The project will be completed in 2025 employing 200, short of the previous 500 coal plant workers.

“Quotations”

“At the beginning there is nothing. There’s no concept of a robotic explorer or crawling across the surface of another world. And then, gradually, you start to think. You start to act. You start to build. And those machines come to life.” Steve Squyers, principal scientist for Mars Opportunity Rover. Designed to work for 90 days, it lasted 15 years.

“Giving your best effort is not the solution to a problem. Solving the problem is the solution.” Citizen solving homelessness.

“There’s nothing more permanent than a temporary fix.”

Hydrogen – It’s not about the future anymore.

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**** SAFETY FIRST ****

American Hydrogen Association Mission

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.

Editorial

State of the AHA

'23 wasn't the best of years. The insurance company totaled our loyal '96 van after a fender bender. We didn't finish the rainwater storage system in time to save water for the summer evaporator cooler season. I spent the summer designing PV ground mounts and practicing with the Canon video camera. As soon as the weather cooled down, I caught Covid – again.

It's 2024 now. My definition of happiness is having something to look forward to and we've got plenty to look forward to. After moving 12 times, the AHA finally has a permanent home. In the next few months, we'll make HQ friendlier with a solar hot water shower and install an additional 2 kW of PV for welders, A.C. and an electrolyzer. Besides the library, we're setting up a basic machine shop. There are bunks for overnight visitors. You'll be able to relax in the shade of the ironwood tree with friends new and old or just by yourself with Mama cat. Stand by for the Open House.

Local Projects:

- Hydrogen station
- Hydrogen University
- Minute movies
- Solar furnace
- Biogas & biochar
- Experimental architecture tiny houses
- Field trips
- Ethanol fuel still
- Hydrogen welding manual

Wherever You Are Projects:

- Conversations. Recruit graduates, amateur scientists, doctors, unemployed, veterans, Buddhists, a celebrity and your brother-in-law to lead the AHA for another 35 years.
- Field trips. Organize your own field trips. Explore with your kids and friends a regenerative farm, factory, university or county jail. Don't forget to stop for ice cream.
- Whole Hydrogen Catalog.
- Scan printed documents for our online hydrogen knowledge base.

The AHA is a pretty unique outfit. Members have decades of experience. We share knowledge, not truthlessness. We encourage getting your hands dirty and learning from the school of hard knocks. We're good at brainstorming. We're not hired hands for grant money and we don't spend resources lobbying. AHA's mission is to give you the tools and inspiration and hope you need, not to build a fancy building or collect \$100,00 a year executive salary. The AHA will keep you up-to-date and healthier, save you money and if we don't find you a career, the AHA will look good on your resume.

Just look around for opportunities to participate. Have you driven or refueled a fuel cell car? Have you even seen one? Have you converted your pickup or lawnmower? Have you given someone a copy of *Solar Hydrogen Civilization*? Used copies are \$5 on Amazon or eBay. Have you grilled a Hindenburger on a hydrogen BBQ? Do something you can be proud of. Be your own hero. Make history. If you think you'd like to be on the AHA Board of Directors, ask me for the Director's Handbook. It's not for everyone.

Everybody wants to be comfortable. We don't like being hungry or cold or sick or wet or homeless. More and more people are headed that way. On the other hand, we feel most alive when we're uncomfortable – when we're in love, in combat, climbing Everest or messing around with hydrogen. What will your family need in the future to thrive and not just to survive? The key to everything is energy and that's plentiful and affordable in the sun above our heads and geothermal energy below our feet without burning fossil fuels or uranium. We also have to fix education, climate change, infrastructure, national debt, and immigration. We'll never run out of sunshine, but we will run out of chances to create the future we want to live in. A Hydrogen Economy is wealth expanding.

My future would have highways with Maglevs and 6 lanes for bicycles, tiny home villages, rivers with trout again and 16-year-olds not dying from bullets and heart attacks.

Douglas H. Hawley
Editor & Board Secretary

“Nobody makes a greater mistake than he who does nothing because he could only do a little.”
Edmund Burke

AHA Wish List

- 40' x 60' steel workshop
- Drilled well, \$33,000
- Nexo or Mirai
- 1 kW wind turbine
- Microscope
- 5 gallons Henry 587 Dura-Brite reflective roof coating
- 3D printer
- Deep cycle batteries
- High temperature infrared thermometer



Native mesquite, palo verde and date palms from seed for future Maricopa oasis.



Model NASA LH2 delivery train. (Addison Bain)

The Rest of the Hydrogen Story

Lighter Than Air

The nation's pride and joy, a 777 foot long airship, was ready for its first intercontinental flight. In 1930, the dirigible was by far the fastest way to cross oceans; taking days instead of weeks by ship. Linberg had flown the Atlantic only three years before. Fifteen gas bags made out of impermeable oxen intestines held 5.5 million cubic feet of hydrogen. In the spacious lounge, guests sat on comfortable, but weight-saving wicker chairs. The metal frame was hidden by painted canvas and balsa wood. Passengers could enjoy the passing scenery from a balcony. There was even an asbestos-lined smoking room.

On board were the Air Minister, Imperial Air Force VIP's and the airship designer. They departed the mooring tower on a rainy evening, October 4th. At 2 AM the next day, a forward hydrogen bag ruptured and the airship went into an uncontrollable dive over Allonne, France. British airship R101 nosed into the ground at an estimated 13 MPH and immediately the hydrogen caught fire. Forty-eight people perished. There were only six survivors. Ironically, the ship may have been overloaded with cases of champagne to celebrate the flight.

The Duralumin frame was cut up and returned to England for melting down. Germany's Zeppelin company bought 5 tons of the scrap and reused it their airship LZ129, better known at the Hindenburg.

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).

AHA Hydrogen Safety Handbook

<http://www.bikesintl.com/hydrogen-safety-handbook/>

Hydrogen Events

2024 Center for Hydrogen Safety Americas Conference. May 21-23, Las Vegas, Nevada, \$1050. Topics are Safety best practices, Codes & standards, Storage & transportation, vehicle refueling, 1st responder training and natural gas blending.

<https://www.aiche.org/chs/conferences/center-hydrogen-safety-conference/2024>

Hydrogen University

Where, Oh Where Has The Hydrogen Gone?

The news going around lately is that the hydrogen molecule is so small that they leak out of everything and that hydrogen is an “indirect greenhouse gas” (GHG). The assumption’s made that since approximately 5% leaks out of the natural gas (aka methane, CH₄) system that tinier hydrogen must leak even more. However, the natural gas grid leaks like a sieve because of corroded pipes, dirty or worn out valves and sloppy maintenance. It’s cheaper for gas utilities to let gas leak than to repair the leaks.

In the atmosphere, OH⁻ radical reacts with methane to produce methylum (CH₃) and water. A quarter of atmospheric hydrogen combines with OH⁻, turning into water and blocking the OH⁻ from removing methane. Articles state that nobody knows how much hydrogen leaks, but estimate anyway 2.9%, 5.6% or 9.2%. How small is hydrogen? Actually helium is the smallest atom with a radius of 31 picometers (.000000001 inch). A hydrogen atom is 53pm, an H₂ molecule is 120pm. Methane is 340pm.

Atomic hydrogen can permeate through the wall of a solid steel tank, but it’s about as often as a prisoner escaped Alcatraz. Tanks are required to be regularly inspected or pressure tested for cracks. Leakage from correctly assembled fittings and hoses is negligible. Instruments are available to detect hydrogen leaks at 10 parts per billion concentrations.

Industrial processes such as petroleum refining and chlor-alkali produce hydrogen as a by-product. If it’s not economical to purify or transport the hydrogen, it’s vented to the atmosphere. The hydrogen could be flared, but that produces water vapor, another GHG. Water vapor does not accumulate in the atmosphere like

CO₂ or methane because it quickly condenses into clouds or rain. Liquid hydrogen cryogenic tanks release boil-off hydrogen through pressure relief valves. Nowadays, super-insulated and cryocompression tanks reduce or capture boil-off.

If hydrogen is 14 times lighter than air, why doesn't it leak into outer space? Even molecules of hydrogen have to reach Earth's escape velocity of 25,000 MPH. Mechanisms such as solar wind do let around 3 kilograms per second of hydrogen ride off into the sunset.

We need more research, better leak detection and common sense safety regulations, not more myths.

Books & Publications

Fundamentals of Hydrogen Safety Engineering I. Vladimir Molkov, 2012. Venus Publishing, 216 pages.

As the title suggests, this book is for professionals designing safe hydrogen facilities. It assumes you already know that hydrogen is lighter than air. Chapters cover regulations, unignited releases, confined dispersion, ignited mixes and jet fires. The Navier-Stokes equations are there if you need them.

How much safety do you need? Malkov discusses finding a risk level comfortable for everyone involved. What is the right size for a *hydrogen* system PRD (Pressure Relief Device)? That is to say, will the PRD release all a tank's contents before a fire causes the tank to explode. Where is the safest place to vent a PRD? If there is a high pressure leak and if it catches fire, how many meters long will the flame be?

Even if you're not an engineer, but a plant operator, 1st responder, experimenter, teacher or hydrogen delivery truck driver, the safety knowledge here may help stop some avoidable human error disasters. Don't use hydrogen in your birthday balloons.

Part II covers deflagrations and detonations.

No Miracle Needed – How Today’s Technology Can Save Our Climate and Clean Our Air. Mark Jacobson, 2023. Cambridge University Press, 437 pgs.

If you’re tired of bad news every day, try No Miracles Needed. Stanford professor Mark Jacobson has been studying renewable energy for 30 years. He gives many examples of technologies that can squelch global warming, improve health, create good jobs and provide real energy security. We can do it today without CO2 from fossil fuels or radioactive waste.

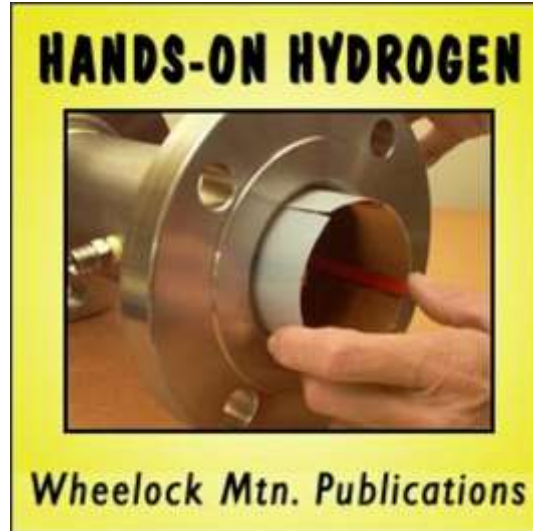
Electricity can be generated cheaply from solar panels, wind turbines or geothermal heat. With no place to go, terawatts of curtailed electrical energy are wasted every year in the U.S. Curtailed or intermittent energy can be stored as hydrogen for years. Current large-scale batteries only last for hours. Improving energy efficiency with heat pumps, electric vehicles, building insulation and telecommuting will save the cost of new power plants.

Sometimes the author does go into excessive detail. The history of the transformer is not particularly relevant.

Maybe no miracles are needed, but you need to ask your city council or Congressperson why we aren’t doing all this; not investing in the future we want our children to live in.

Thanks

- Claude C. – Casa Grande tour to Southwest Solar and Air Products Green H2 Project.
- Marie D. – Website hosting renewal.
- Addison B. – Model hydrogen locomotives.
- John G. – Hysolgenics 1 kw electrolyzer.
- Claude C, Clyde S. – Electrolyzer spare parts, Mexican lunches.



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/Veteran & 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.