

Hydrogen Today



Show Me the Hydrogen



Mike Strizki's Joule Box

When Hurricane Sandy wiped out his town's power lines, Mike Strizki's solar hydrogen house became a very popular place. Neighbor's generators ran out of fuel and their grid-tied solar panels didn't work as long as the grid was down, so people would come over for a hot shower or to cook food. Strizki is now selling a home-scale version of his 100 solar panel, half-million dollar system called the Joule Box. See Joule Box features on page 2.

"Quotations"

"With guns you can kill terrorists. With education you can kill terrorism." Malala Yousafazi (Nobel Peace Prize at age 17)

"What we learn from history is that people don't learn from history." Georg Wilhelm Frederich Hegel (1770-1831)

"There are seven days in the week and someday isn't one of them." Shaquille O'Neal

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'We Deliver Clean Air'

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** SAFETY FIRST **

American Hydrogen Association Mission

Develop and prove 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.

Show Me the Hydrogen (cont...)

Strizki Joule Box Features

6 ft. x 6 ft. base (semi-portable)	Proton Onsite PEM electrolyzer
GPS solar tracking	Relion 1 kW fuel cell
Continuous operation	(4) hydrogen storage cylinders
(4) batteries	(12) 120 Watt solar panels
1 kW wind turbine	
Charge controller and inverter	
\$30,000-\$75,000	

Resources:

Renewable Energy Holdings Joule Box -
http://www.genmounts.com/uploads/2/0/3/0/20304569/reh_re_device_cutsheet1.pdf
Relion (Plug Power) fuel cells -
<http://www.plugpower.com/products/relion/>
Proton Onsite (Hogen) electrolyzers -
<http://protononsite.com/products/hydrogen-generator/>
Hydrogen House - <http://hydrogenhouseproject.org/index.html>
H2 to Go - <http://hydrogenhouseproject.org/h2-to-go.html>
Hydra Generator and Water Purifier -
<http://hydrogenhouseproject.org/hydra-mobile-generator--water-purifier.html>
H/Cell Energy Corp. - <http://www.hcellenergy.com/>
Millennium Reign Energy hydrogen refueling -
<http://residentialhydrogenpower.com/>

Editorial

There's a single string of incandescent Christmas lights around the AHA front porch. Somebody might break out the hot chocolate to celebrate, otherwise we're soldering, videoing, answering email, trying pizza recipes on the hydrogen grill and wrapping up unfinished 2015 business.

The 96 square foot hydrogen MicroDwell live-in ran head-on into daily 110 degree temperatures. What kind of insulation to use – fiberglass, polyiso, aerogel, spray-in? A room air-conditioner required buying more PV power and they had horrible reviews. Although evaporative coolers work very well here in the desert, they are over-sized for one room and without modification one would blast occupants with damp 70° air. We'll figure it out by next June. In this climate, 24" thick adobe walls are the perfect insulation, but would a 96 square foot space feel like a dungeon?

The repurposing crew salvaged a wood crate with \$90 worth of 3/4 inch sanded plywood and underneath they found a brand new \$900 Sealy foam mattress someone had thrown away. A perfectly good \$130 Texas Instrument nSpire graphing calculator was recovered at the cost of a scolding from an apartment manager for rummaging in the trash.

John Gotthold will soon be launching Radio Free Hydrogen online from California and we'll be starting regular information sessions with GoToMeeting to tighten up communications with all AHA members.

The Hydrogen Age is coming fast and it is now impossible for our staff to keep up with all the news. Please send us information on the people, companies, products and websites making history so that we can share with everyone. Better to hear something twice than not at all. Submitting an experiment report can get you some very valuable feedback. Other ways to help are donating books, tools, your coin jar or wild birdseed. Renew your membership, preferably at the \$100 sustaining level. How much longer do you think your comfortable life is going to last?

The Rest of the (Hydrogen) Story

Most Americans have heard of the Lowe Observatory near Los Angeles. Born in 1832, namesake Thaddeus Lowe grew up on a farm in New Hampshire. He left home in his early teens, more interested in the sky above than the dirt beneath his feet. Lowe happened to attend Dincklenoff's Travelling Show and his life was changed when he saw hydrogen soap bubbles rising up in the air. By 1857 he was doing well by assembling large balloons and giving rides.

In 1858, the first Transatlantic telegraph cable failed only 10 days after going into service. Everyone was aware of the enormous value of delivering timely financial market news and Lowe was convinced that what we now know as the jet stream could carry him from New York to England in three days. To test his theory, he planned a trial flight from Cincinnati to the East Coast. He launched a few days after the start of the Civil War. Unfortunately he landed in South Carolina and was taken prisoner as a Yankee spy. An acquaintance vouched for him and he was allowed to return home. A few months later, he demonstrated a balloon to Lincoln in Washington, D.C. He sent the President a message by telegraph wire from the balloon and later volunteered his services to the Union army. Lowe designed acid-iron hydrogen generators that could be transported by wagon. From above the battlefield, Lowe could direct devastating artillery fire by semaphore on the southern troops.

Thad Lowe never made his balloon flight across the Atlantic, but he was visited by a young German inventor named von Zeppelin. Lowe went on to start the ammonia refrigeration industry. Then he built syngas plants and manufactured syngas appliances. He retired in Southern California where he built a resort on Mount Lowe. And now you know the rest of the hydrogen story.

For more, read: [Above the Civil War](#) by Eugene Block or [Thaddeus Lowe - America's One-Man Air Corps](#) by Mary Hoehling.

Hydrogen Events

The Phoenix American Hydrogen Association and Phoenix Alternative Energy Meetup meet the second Thursday of every month from 6 to 8 PM at Denny's Restaurant, 650 N. Scottsdale Rd. in Tempe, AZ (SW Scottsdale Rd/202, one mile north of ASU light rail station). Call 480-234-5070.

If you don't believe the Hydrogen Age is already here, grab a necktie and your passport and head to Hannover Messe (Fair) 2016, the world's largest industrial trade show. [Hannover Messe 2016 – Hydrogen + Fuel Cells + Batteries Group Exhibition](#), 25-29 April, 2016, Hannover, Germany. (Full ticket - \$84) <http://www.h2fc-fair.com/> Recorded presentations from this and previous shows are available on H2FCHannover YouTube channel.

[World Hydrogen Energy Conference](#), 13-16 June, 2016, Zaragoza, Spain.
<http://www.whec2016.com/index.php>

[International Conference on Hydrogen Safety](#), 11-13 Sept., 2017, Hamburg, Germany.
<http://www.ichs2015.com/>

Hydrogen on the Internet

Find out what chemicals your neighborhood oilwell frackers are using at <http://www.fracfocus.org/>.

Books & Publications

Most of the books reviewed in Hydrogen Today are available in the AHA library. Anyone can read them in house and renewed members can borrow them.

[Stan Ovshinsky and the Hydrogen Economy – Creating a Better World](#); George S. Howard, 2006
Academic Publications, Amazon, 304 pages.

Who was Stanford Ovshinsky who claimed to be an alumnus of the Akron Public Library? Who was the machinist from Ohio with a serious curiosity about the behavior of the materials he worked with? Well, Stan started making thin-film solar cells out of amorphous substances when corporate labs and university PhD's said the stuff was useless. Then when solar cells were made by the inch, he built the machinery to produce cells by the *mile*. Ovshinsky created NiMH batteries, LCD's (Liquid Crystal Displays), non-volatile computer memory before PC's were even around and re-writable CD & DVD disks.

He developed fuel cells and hydride storage that, along with the solar cells and batteries, would create what he called the hydrogen loop. His goal – end poverty, pollution and war.

Part of Howard's text is taken from a Stan Ovshinsky tribute book. We get flowery words about Ovshinsky, instead of his own words. Detailed descriptions of his children's careers doesn't help to understand the man. We do learn he hired the very best people and treated them well. The second half of the book is a dozen appendices, mostly Ovshinsky papers and presentations which again don't give us very much insight into his brilliant mind. You'll probably get more satisfaction listening to Stan for a couple hours on YouTube.

For more on this modest inventor, see PBS Nova's "Japan's American Genius":
<https://vimeo.com/135633566>

TU Delft (Netherlands) Forze Hydrogen Racing Team

Forze VI

Forze was founded in 2007 and is the high-tech hydrogen racing team from the Technical University of Delft. The team consists of students and professionals who are engaged in the development, production and implementation of hydrogen-powered racing cars, in order to combine motorsport with clean technology. The purpose of the team is to promote the use of hydrogen in racing cars. For eight years, Forze has released six vehicles and achieved many successes such as building the fastest hydrogen-powered racing car ever.

After the successful introduction of the Forze VI in the summer of 2013, the team has reached many highlights. The Forze VI is six times more powerful and efficient than its predecessors and is specially designed to compete against petrol powered vehicles. It is the first and fastest hydrogen-powered racing car ever measured on the Nürburgring Nordschleife [14 mile North Loop] in Germany.

Nürburgring Nordschleife

The Forze VI is provided with a light-weight body and a diffuser for improved aerodynamics and therefore she was ready to obtain a lap record on the famous Nürburgring Nordschleife in Germany. With the help of the former Dutch race driver Jan Lammers, Forze obtained a lap record of 10:43:56 minutes on May 7, 2015 after 2 1/2 years of hard work making it the fastest hydrogen-powered racing car!





Gamma Racing Day

After obtaining the lap record at the Nürburgring Nordschleife, Forze held many demonstrations and participated at the well-attended Gamma Racing Day in the Netherlands. The Forze VI got the opportunity to participate at the pre-show along with Formula One driver Max Verstappen. With more than 100,000 visitors during the whole weekend it was a great opportunity to once again demonstrate that hydrogen and motorsport is a great combination towards cleaner technology.



Electric lap record on Circuit Park Zandvoort

On 16th of November, Forze has unofficially broken the electric lap record with the Forze VI. The previous record was driven by a Tesla Roadster 3 years ago. The Forze VII has beaten the previous record with 5.5 seconds which shows the potential of hydrogen electric technology. The fuel cell lap record was driven by a student of the University of Technology Delft, Jan bot. Rick Everaert, Team Manager of Forze Hydrogen Racing says: We are pleased by and very proud of this new record. Finally, the true potential of hydrogen is shown and hopefully we will inspire people to work with hydrogen electric technology.

Supercar Challenge

Currently Forze is in its early stage of building a new hydrogen-powered racing car which can compete against petrol powered racing cars at the Supercar Challenge during the Gamma Racing Day in August 2016 which will be held in the Netherlands. It is expected that the Forze VII will accelerate from 0-100 km/h within 4 seconds, reaching a top speed of 220 km/h [137 miles/hour].

Fuel Cell

The Forze VI is a hydrogen-powered racing car as the propulsion is electric. However, the race car generates the power on its own by chemical process which consists out of hydrogen and oxygen. The big advantage of this technology is that it is refuel able just like petrol although it has no other emission than water.

The fuel cell within the Forze VI converts hydrogen into water and electricity with an efficiency rate of 60%. With this electricity we are able to power our electric engine which has a power of 190 kW or 260 bhp. This makes it possible that the Forze VI has got a top speed of 210 km/h.

H2 University

Seeing with Sensors

Last time we looked at a few inexpensive reality sensors. Whether you're a housewife checking a child's fever, a politician denying climate change or an AHA experimenter, you have to measure things in order to see the Truth. After people made claims about devices that greatly improved vehicle mileage per gallon, we'd find out they didn't even know how to measure MPG! No one may notice if you skimp on a cup of flour, but failing to heed readings on a bathroom scale, tire pressure gauge or outdoor thermometer can be lethal. Let's look at several more sensor examples. We won't be getting into any process control.

Voltage – When we got our first solar panels, we wanted to learn about the daily power output. A \$29 RS-232 capable voltmeter was connected across a fixed load resistor. The computer software that came with the meter printed out graphs that clearly showed every cloud that blocked the sun. Because the meter was on all day, it used up 9V batteries very quickly. Meters with USB connections are available today.

Hydrogen Flow Rate – Since we're hooked on barbecuing with hydrogen, we needed to know how long a full K cylinder would last so we wouldn't run out in the middle of open house. We didn't want to sit there with a stopwatch and burn up a whole tank. Of course, a pressure gauge will tell you when you're low, but doesn't really tell you how fast you're using fuel. So we ordered some variable area flowmeters with assorted ranges from McMaster-Carr. They'll also be used on engines. There was the challenge of connecting a ¼ inch pipe thread to a 9/16-18 left-hand welding fuel thread. Flowmeters are usually calibrated for air. Manufacturers provide a correction factor chart for other gases. The \$1000 Alicat Scientific digital flowmeter is on our dream sheet. It's programmable for dozens of gases, including hydrogen and HHO. Ask Santa for one.

Wind speed – The average wind speed here in Mesa, AZ is reported to be 6 MPH; about half the minimum needed for a worthwhile wind turbine installation. However, there seems to be a micro-climate around HQ with stronger winds and gusts strong enough to toss our 10' solar furnace over a six foot wall. We needed to determine if there was enough wind at this location to make a wind generator practical. We acquired an anemometer at a thrift store for \$5. With every rotation, a magnet closes a reed switch. An Arduino computer can easily count the pulses. The Arduino is programmed to convert RPM's to miles per hour by holding the anemometer out a car window and plotting pulses to the speedometer.

The Arduino is a currently hot \$15 microcomputer pretty easily programmed in the 'C' language. There are hundreds of open source programs, or 'sketches' as they like to call them, available online. I suggest buying a starter kit for about \$65, which includes an Arduino R3 clone, breadboard, connectors, LCD,

switches, LED's and many bits & pieces you'll need anyway. Most community tech workshops now have Arduino classes. There are a hundred books on the Ardy, but I found these basic books helpful:

[Programming Arduino – Getting Started with Sketches](#), Simon Monk, 2012

[Make: Getting Started with Arduino](#), Banzi & Shiloh, 2015

[Beginning C for Arduino](#), Jack Purdon, 2012

pH – How do you measure pH inside a pressurized biodigester? There's no need for continuous monitoring, so it could be as straight-forward as opening a valve, drawing a sample and sticking in a piece of litmus paper. We wanted a finer measurement, so we ordered an aquarium pH sensor on eBay for about \$8. Arduino interface boards are available, but we tried a \$29 DATAQ (4) channel USB data acquisition box. It takes a few minutes to download their software to your computer and you're up and running. Students doing science fair projects can request one for free.

Temperature – We're talking solar furnace red-hot temperatures here – about 1200° F. Common handheld IR thermometers only go up to around 900°. The Raytek 3i can measure 5432°, but one of those costs \$3000. Anyway infrared can only see the outside of an object. Thermocouples are wires of dissimilar metal that produce a small voltage proportional to temperature when they are joined together. For our temperature range, we're interested in K-type TC's, available from McMaster or on eBay. Thermocouples only put out a few millivolts, so to increase the output we got an analog TC amplifier board from Adafruit and also used a cheap (4) channel thermocouple meter from eBay. There are numerous ways to secure thermocouples to the measuree, but I predict none of them will work for your project.

Although once reluctant to order directly from China through eBay, the prices were too hard to resist. For a few dollars you can have your own humidity sensor, RFID or fingerprint scanner, GPS receiver or heartbeat monitor. Quality is fair at best, although everything so far has worked. A half dozen different thermocouples all measured within 1 degree. Look elsewhere if you expect reliability. The module you thought you ordered may come as loose components in an unlabeled bag with no schematic or any instructions. Shipping on small packages is an unbelievable dollar or two, if not free and most arrive in a week to 10 days.

Resources:

<http://www.alicat.com/products/mass-flow-meters-and-controllers/mass-flow-meters/>

<http://www.raytek-direct.com/category/raytek-3i-plus-series-portable-ir-thermometers>

<https://www.adafruit.com/products/1778>

<https://www.mcmaster.com/#>

<http://www.dataq.com/products/di-145/>

Thanks

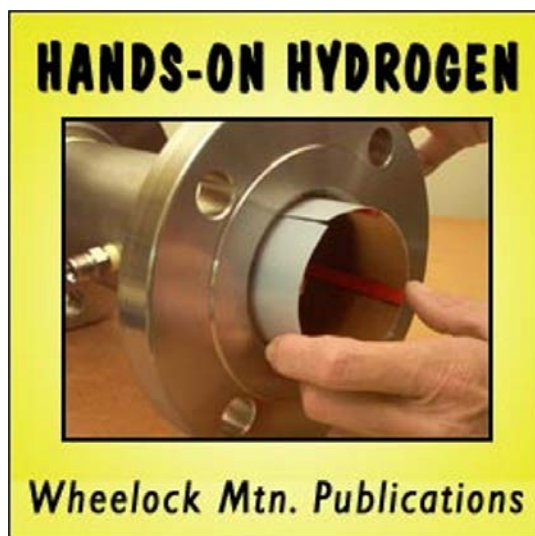
Farid – TU Delft Forze article

Shields – Ream printer paper

Ben – Fresnel lens

Jon – Small House book, refrigerator

Dave – Civic tune-up, floor jack



Ebooks for Do-It-Yourself Experimenters

By Phillip Hurley

- Build Your Own Fuel Cells...\$14.95
- Build A Solar Hydrogen Fuel Cell System...\$16.95
- Practical Hydrogen Systems: An Experimenter's Guide...\$16.95
- Build Your Own Solar Panel...\$12.95
- Solar II...\$12.95
- Solar Supercapacitor Applications...\$16.95
- The Battery Builder's Guide...\$16.95

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Books are now available in paperback at:

http://www.amazon.com/Phillip-Hurley/e/B001K8XF3K/ref=sr_tc_2_0?qid=1449887967&sr=8-2-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 and H2 bookmark)
- Life Membership- \$1000
- Corporation/Institutional Membership- \$1000/year
- "Solar Hydrogen Civilization" book only - \$24.95 postpaid.
- Email *Hydrogen Today* only
- Send AHA New Chapter Packet
- "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>

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Prosperity Without Pollution.

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