## UNITED STATES OF HYDROGEN

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Alabama

DEPLOYMENT: Birmingham, AL

Air Liquide is building and operating a hydrogen fueling station in Birmingham

UAB developed a hydrogen-fuel-cell bus operated in Birmingham-Jefferson County

DEPLOYMENT: Montgomery, AL

Alabama State University currently has the world’s first hydrogen fuel cell sport utility vehicle, the Hyundai NEXO

Hyundai Motor Group building electric vehicles including hydrogen refueling stations as part of $7.4 B investment, some made in Montgomery

DEPLOYMENT: Opelika, AL
Hanwha Cimarron is building a manufacturing plant for its carbon fiber-wrapped hydrogen storage tanks in the Northeast Opelika Industrial Park

DEPLOYMENT: Theodore, AL
Chart Industries producing bulk hydrogen storage tanks in Mobile County

DEPLOYMENT: Tuscaloosa, AL
Mercedes-Benz utilizing Plug Power at Tuscaloosa, AL plant

DEPLOYMENT: Tuscaloosa, AL
University of Alabama granted DOE grant for advancing hydrogen gas turbines for use in electricity generation

Alaska

DEPLOYMENT: Anchorage, AK
Universal Hydrogen signed a letter of intent (LOI) with Ravn Alaska, an Anchorage-based regional airline, committing to purchasing five of Universal Hydrogen’s conversion kits that will integrate the company’s modular hydrogen capsule technology and hydrogen powertrain into Ravn’s growing regional turboprop fleet

OPPORTUNITY
Future Hydrogen Production in Alaska

Arizona

DEPLOYMENT: Coolidge, AZ
Nikola Corp. factory in Coolidge producing electric and hydrogen powered heavy trucks

DEPLOYMENT: La Paz County, AZ
The Department of the Interior’s Bureau of Land Management (BLM) awarded exclusive right to lease an area within the Brenda Solar Energy Zone (SEZ) to Heliogen in order to build a 20,000-tonne green hydrogen production plant.

### DEPLOYMENT: Litchfield Park, AZ

Arizona Hydrogen Manufacturing, Inc located in Litchfield Park

### DEPLOYMENT: Palo Verde, AZ

Idaho National Laboratory is partnering with PNW Hydrogen to use a low-temperature electrolysis system to produce clean hydrogen fuel from electricity generated by the Palo Verde Generating Station. The DOE is contributing $20 million in funding through its Earthshot Initiative.

### DEPLOYMENT: Phoenix, AZ

Air Liquide plans to invest nearly 60 million U.S. dollars to build, own and operate onsite plants and systems at a new manufacturing site in Phoenix, Arizona, in support of a long-term agreement to supply ultra-high purity hydrogen, helium, and carbon dioxide to one of the world’s largest semiconductor manufacturers.

PNW Hydrogen LLC will produce clean hydrogen from nuclear power at the Palo Verde Nuclear Generating Station in a project through the DOE’s H2@Scale and Hydrogen Shot Programs.

### DEPLOYMENT: Scottsdale, AZ

United Energies Development Corporation is constructing the patented Photovoltaic and Electrolyzer hybrid facility in Scottsdale.

### RESEARCH: Scottsdale, AZ


### RESEARCH: Tempe, AZ
Southwest Gas announced a pilot project to determine the optimal blend of hydrogen and natural gas for safety and the environment, including the physical impacts of hydrogen on distribution system infrastructure and common gas appliances.

Southwest Gas Corporation signed agreements with the University Nevada, Las Vegas (UNLV) and the Arizona State University in Tempe (ASU) to conduct a study to see how hydrogen-blended natural gas can further reduce carbon emissions while still providing clean and reliable energy without disrupting the daily routines of customers.

**OPPORTUNITY**

New report sees Arizona leading the way on clean energy.

Desert Mountain Energy is now offering consulting for the purpose of developing bedded and domal salt cavern hydrogen energy storage in Arizona.

**Arkansas**

**RESEARCH: Fayetteville, AR**

University of Arkansas researchers finding cost-effective methods for hydrogel fuel production process.

**DEPLOYMENT: Little Rock, AR**

Entergy Corp. joining forces with Mitsubishi Power to integrate green hydrogen into utility business.

**RESEARCH: Lowell, AR**

J.B. Hunt in Lowell testing hydrogen-fueled electric trucks produced by Navistar.

**RESEARCH: Russellville, AR**

Arkansas Tech University conducting an experimental investigation of a hydrogen fuel cell engine in a lightweight vehicle.
<table>
<thead>
<tr>
<th>California</th>
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<tr>
<td><strong>DEPLOYMENT: Alameda, CA</strong></td>
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<tr>
<td>First commercial hydrogen ferry in production in Alameda</td>
<td>READ MORE »</td>
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<tr>
<td><strong>DEPLOYMENT: Bakersfield, CA</strong></td>
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<tr>
<td>Mote is building a facility that will create hydrogen fuel from wood waste. The plant is expected to produce about 7 million kilograms of carbon negative hydrogen</td>
<td>READ MORE »</td>
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<tr>
<td><strong>RESEARCH: Berkeley, CA</strong></td>
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<tr>
<td>Lawrence Berkeley National Laboratory: Lab Call FY18 (Membrane): Stable Alkaline Membrane Based on Proazaphosphatranes Organic Super Base</td>
<td>READ MORE »</td>
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<tr>
<td>Lawrence Berkeley National Laboratory: Novel Bifunctional Electrocatalysts, Supports, and Membranes for High Performing and Durable Unitized Regenerative Fuel Cells</td>
<td>READ MORE »</td>
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<tr>
<td>Lawrence Berkeley National Laboratory: Integrated Systems Modeling of the Interactions between Stationary Hydrogen, Vehicle, and Grid Resources</td>
<td>READ MORE »</td>
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<tr>
<td><strong>DEPLOYMENT: Borrego Springs, CA</strong></td>
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<tr>
<td>San Diego Gas and Electricity is piloting a project to demonstrate hydrogen’s capabilities in long-duration energy storage</td>
<td>READ MORE »</td>
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<tr>
<td><strong>DEPLOYMENT: Downey, CA</strong></td>
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<tr>
<td>SoCalGas and ATCO are demonstrating hydrogen-natural gas blends in a model home</td>
<td>READ MORE »</td>
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<tr>
<td>DEPLOYMENT: Escondido, CA</td>
<td>San Diego Gas and Electricity is piloting the Palomar Green Hydrogen System blending hydrogen in with natural gas</td>
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<tr>
<td>DEPLOYMENT: Fremont, CA</td>
<td>EnerVenue raised $100m to build a nickel-hydrogen battery gigafactory and is expected to start construction in 2022</td>
</tr>
<tr>
<td>DEPLOYMENT: Indio, CA</td>
<td>SunLine Transit Agency and the City of Indio have launched a pilot of liquid hydrogen gas (H2) pump technology and a mobile refueling system</td>
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<tr>
<td>RESEARCH: Irvine, CA</td>
<td>UC Irvine granted DOE grant for advancing hydrogen gas turbines for use in electricity generation</td>
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<tr>
<td>DEPLOYMENT: Lancaster, CA</td>
<td>Energy company SGH2 is bringing the world’s biggest green hydrogen production facility to Lancaster</td>
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<tr>
<td>RESEARCH: Livermore, CA</td>
<td>Sandia National Laboratories: H-Mat Overview: Steels</td>
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<td>Sandia National Laboratories: Metal Hydride Compression</td>
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<td>Sandia National Laboratories: Maritime Fuel Cell Generator Project</td>
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<td></td>
<td>Sandia National Laboratories: R&amp;D for Safety, Codes and Standards: Materials and Components Compatibility</td>
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</tbody>
</table>
DEPLOYMENT: Port of Long Beach, CA

Toyota builds first 100% renewable power and hydrogen generation station at Port of Long Beach

Toyota Motor North America will build the world's first megawatt-scale carbonate fuel cell power generation plant to support its operations at the Port of Long Beach

DEPLOYMENT: Los Angeles, CA

HyDeal LA, initiative to achieve at-scale green hydrogen procurement at $1.50/kg in LA Basin by 2030

SoCalGas partnering with H2U Technologies to evaluate cost reduction of green hydrogen production in commercial settings

Zero- and Near Zero- Emission Freight Facilities Shore to Shore Project

LADWP embarks on hydrogen generation project

Port of Los Angeles has two hydrogen refueling station and 12-month demonstration contract with Toyota zero-emission Class 8 hydrogen fuel cell trucks as part of Shore to Shore Project

Mitsui E&S Machinery and PACECO have partnered to offer a demonstration of a commercially feasible hydrogen fuel model at the Port of Los Angeles. The New Energy and Industrial Technology Development Organization have plans to support the project with funding from a hydrogen supply chain

Southern California Gas Co. is proposing what it says will be the nation's largest green hydrogen energy infrastructure system, the Angeles Link, to deliver clean, reliable energy to the Los Angeles region

RESEARCH: Los Angeles, CA

NewHydrogen sponsored research at UCLA into efficient hydrogen
<table>
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<tr>
<th>DEPLOYMENT: Oakland, CA</th>
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<tr>
<td>Hyundai plans to build a hydrogen refueling station in Oakland as part of its “NorCAL ZERO” project with capacity to fuel 50 trucks back-to-back</td>
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<th>DEPLOYMENT: Oceanside, CA</th>
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<tr>
<td>NCTD building hydrogen fueling station in Oceanside</td>
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<td>Orange County Transportation Authority have bought hydrogen buses</td>
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<th>DEPLOYMENT: Palm Springs, CA</th>
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<tr>
<td>Hydrogenics links with StratosFuel on 2.5 MW California project</td>
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<td>SunLine Transit Agency in Palm Spring driving hydrogen buses</td>
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<th>DEPLOYMENT: Palo Alto, CA</th>
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<td>Electric Power Research Institute in Palo Alto gets award to test moving-bed gasifier to generate clean hydrogen</td>
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<th>DEPLOYMENT: Pasadena, CA</th>
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<td>Liox Power: HyMARC Seedling: Electrolyte Assisted Hydrogen Storage Reactions</td>
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<th>DEPLOYMENT: Pico Rivera, CA</th>
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<tr>
<td>SoCalGas and HyET Hydrogen are field-testing technology that separates and compresses hydrogen from natural gas blends</td>
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<th>DEPLOYMENT: Port Hueneme, CA</th>
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<td>Reversible Solid Oxide Fuel Cell Demonstrated at NAVFAC EXWC at Port Hueneme</td>
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<th>DEPLOYMENT: Richmond, CA</th>
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<td>Location</td>
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<td>Sacramento, CA</td>
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<td>San Bernardino, CA</td>
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<td>Santa Barbara, CA</td>
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<td>Santa Clara County, CA</td>
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<td>Santa Clarita, CA</td>
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</table>
DEPLOYMENT: Thousand Palms, CA

SoCalGas is partnering with Sunline Transit on “H2 SilverSTARS” to fuel hydrogen buses with hydrogen from RNG at a natural gas fueling station

DEPLOYMENT: Various

Overview station map of H2 fueling stations

Hyzon Motors working with Raven SR to build waste-to-hydrogen hubs, two in California

California is decarbonizing public transportation with a fleet of Xcelsior CHARGE H2 hydrogen fuel cell powered buses

Hyundai’s “NorCAL ZERO” project Will deploy 30 Class 8 XCIENT Fuel Cell trucks around Northern CA, beginning in 2023

SoCalGas, Cummins, received a DOE grant to advance hydrogen fuel cell technology for heavy-duty trucking and transit

SoCalGas submitted initiatives to the DOE “Earthshot” program at UC Irvine, UCLA, and with the Green Hydrogen Coalition

PowerTap Hydrogen Capital and Capstone Green Energy signed a strategic manufacturing and licensing agreement for the manufacturing of PowerTap’s third generation production and dispensing station, which will be in California

Tersus Power is aiming to develop a new hydrogen production and dispensing system capable of supplying 1,250kg of hydrogen per day to enable the rollout of a hydrogen highway in California

Chevron U.S.A. Inc. and Iwatani Corporation of America (ICA) have an agreement to co-develop and construct 30 hydrogen fueling sites in California by 2026

OPPORTUNITY

California Hydrogen Coalition: Major Push For Hydrogen As Part of State’s Zero-Emission Vehicle Strategy

California Is Trying to Jump-Start The Hydrogen Economy
**Colorado**

### DEPLOYMENT: Boulder, CO

University of Colorado Boulder: HydroGEN Seedling: Computationally Accelerated Discovery and Experimental Demonstration of High-Performance Materials for Advanced Solar Thermochemical Hydrogen Production

[READ MORE »](#)

### RESEARCH: Boulder, CO

NREL and Xcel Energy have partnered on the Wind2H2 demonstration project, researching how to improve the system efficiency of producing hydrogen from renewable resources in quantities large enough and at costs low enough to compete with traditional energy sources such as coal, oil, and natural gas

[READ MORE »](#)

### DEPLOYMENT: Denver, CO

AAA Denver is partnering with New Day Hydrogen LLC to have hydrogen-powered tow trucks and other emergency rescue vehicles in Colorado

[READ MORE »](#)

### DEPLOYMENT: Fort Collins, CO

Colorado State University acquires a fuel station to generate hydrogen

[READ MORE »](#)

### DEPLOYMENT: Golden, CO

- National Renewable Energy Laboratory: Industrially Scalable Waste CO2 Reduction to Useful Chemicals and Fuels
- National Renewable Energy Laboratory: Hydrogen Storage System Modeling: Public Access, Maintenance, and Enhancements
- National Renewable Energy Laboratory: HyMARC Seedling: Atomic Layer Deposition Synthesis of Novel Nanostructured Metal Borohydrides

[READ MORE »](#)
National Renewable Energy Laboratory: Advanced Ionomers and Membrane Electrode Assemblies for Alkaline Membrane Fuel Cells

National Renewable Energy Laboratory: Lab Call FY18 (Membrane): Spirocyclic Anion Exchange Membranes for Improved Performance and Durability

National Renewable Energy Laboratory: Lab Call FY18 (Reversible Fuel Cell): Bipolar Membrane Development to Enable Regenerative Fuel Cells

National Renewable Energy Laboratory, Los Alamos National Laboratory: Membrane Working Group

National Renewable Energy Laboratory: Dispenser Reliability

National Renewable Energy Laboratory: Market Segmentation Analysis of Medium- and Heavy-Duty Trucks with a Fuel Cell Emphasis

National Renewable Energy Laboratory: H2@Scale Analysis

National Renewable Energy Laboratory: Energy Storage Analysis

National Renewable Energy Laboratory: Membrane Electrode Assembly Manufacturing R&D

National Renewable Energy Laboratory: Material-Process-Performance Relationships in Polymer Electrolyte Membrane Catalyst Inks and Coated Layers

National Renewable Energy Laboratory: Fuel Cell Bus Evaluations

National Renewable Energy Laboratory: Hydrogen Station Data Collection and Analysis

National Renewable Energy Laboratory: Optimal Stationary Fuel Cell Integration and Control (Energy Dispatch Controller)

National Renewable Energy Laboratory: H2@Scale: Experimental Characterization of Durability of

National Renewable Energy Laboratory: NREL Hydrogen Sensor Testing Laboratory

Colorado School of Mines: HydroGEN Seedling: Accelerated Discovery of Solar Thermochemical Hydrogen Production Materials via High-Throughput Computational and Experimental Methods

Advanced Electrolyzer Concepts in Dynamic Loading
### RESEARCH: Golden, CO


### OPPORTUNITY

Colorado, New Mexico, Utah and Wyoming will jointly apply for federal money to create a regional hydrogen hub and compete for $8 billion set aside for such projects in the 2021 Infrastructure Investment and Jobs Act

### Connecticut

#### DEPLOYMENT: Danbury, CT

Danbury manufacturer given grant to turn nuclear into hydrogen

FuelCell Energy, Inc.: Proton-Conducting Ceramic Electrolyzers for High-Temperature Water Splitting


#### DEPLOYMENT: East Hartford, CT

United Technologies Research Center: HydroGEN Seedling: Thin-Film, Metal-Supported HighPerformance, and Durable Proton-Solid Oxide Electrolyzer Cell

United Technologies Research Center: High-Performance Polymer Electrolyte Fuel Cell Electrode Structures

United Technologies Research Center: High-Performance Non-Platinum-Group-Metal Transition Metal Oxide Oxygen Reduction Reaction Catalysts of Polymer Electrolyte Membrane Fuel Cells

#### DEPLOYMENT: Hartford, CT

Two hydrogen fueling stations in Hartford and Wallingford, third opening in New Haven

Windsor’s Infinity Fuel & Hydrogen creates zero-gravity fuel cells for space, under water
## Deployment: Stamford, CT
Stamford Health is installing hydrogen fuel cells at two locations.  
[READ MORE »](#)

## Deployment: Storrs, CT
University of Connecticut: HydroGEN Seedling: Proton-Conducting Solid Oxide Electrolysis Cells for Large-Scale Hydrogen Production at Intermediate Temperatures  
[READ MORE »](#)

## Deployment: Wallingford, CT
[READ MORE »](#)

Proton Energy Systems: HydroGEN: Benc  
[READ MORE »](#)

## Opportunity
Avangrid proposed constructing a 20 MW electrolyzer and hydrogen storage facility for its Connecticut gas and electric utilities  
[READ MORE »](#)

## Delaware

### Deployment: Harrington, DE
Xergy Inc.: Novel Non-Perfluorosulfonic Acid Proton Exchange Membrane for Fuel Cell Application  
[READ MORE »](#)

### Research: Newark, DE
University of Delaware engineers have demonstrated a way to effectively capture 99% of carbon dioxide from air using a novel electrochemical system powered by hydrogen, a significant advance for carbon dioxide capture  
[READ MORE »](#)

### Deployment: Wilmington, DE
Versogen green hydrogen start-up based near Wilmington  
[READ MORE »](#)
### Florida

**DEPLOYMENT: Amelia Island, FL**
Chesapeake Utilities Corp is working with Solar Turbines to explore using a blend of renewable natural gas and hydrogen to fuel an existing power plant

**DEPLOYMENT: Juno Beach, FL**
NextEra Energy is closing its last coal-fired power unity and investing in its first green hydrogen facility

**DEPLOYMENT: Orlando, FL**
University of Central Florida granted DOE grant for advancing hydrogen gas turbines for use in electricity generation

**RESEARCH: Orlando, FL**
University of Central Florida researchers designed the first nanomaterial that can be used to extract hydrogen fuel from seawater

UCF scientists received an $800,000 DOE grant to research how to implement hydrogen in modern, electricity-generating turbines, including exploring the best fuel blends and their combustion characteristics

**DEPLOYMENT: Rockledge, FL**
Mainstream Engineering: In-Line Quality Control of Polymer Electrolyte Membrane Materials

### Opportunity

Florida Leading the Nation in Hydrogen Development
Georgia Tech granted DOE grant for advancing hydrogen gas turbines for use in electricity generation

Georgia Institute of Technology: Durable, High-Performance Unitized Reversible Fuel Cells Based on Proton Conductors

Center for Transportation and the Environment Fuel Cell Hybrid Electric Delivery Van:

Plug Power will invest $84 million to build hydrogen refinery

**OPPORTUNITY**

Georgia joins the race to produce green hydrogen

### Hawaii

**DEPLOYMENT: Honolulu, HI**

Hawaii Hydrogen power park

University of Hawaii: HydroGEN Seedling: Novel Chalcopyrites For Advanced Photoelectrochemical Water Splitting

University of Hawaii: HyMARC Seedling: Development of Magnesium Boride Etherates as Hydrogen Storage Materials

**RESEARCH: Honolulu, HI**

Hawai‘i Natural Energy Institute (HNEI) at University of Hawai‘i developed patented invention that enhances longevity and performance of fuel cells

**DEPLOYMENT: Kaliua-Konam, HI**

Kaliua-Kona expecting county’s first hydrogen bus

**OPPORTUNITY**

Hawaii Lawmaker Pushes Expanded Role For Hydrogen Fuel
Idaho

RESEARCH: Idaho Falls, ID

Idaho National Laboratory: Dynamic Modeling and Validation of Electrolyzers in Real-Time Grid Simulation

Idaho National Laboratory: High-Temperature Electrolysis Test Stand

Bloom Energy is working with Idaho National Laboratory (INL) to independently test the use of nuclear energy to create clean hydrogen through Bloom Energy’s solid oxide, high-temperature electrolyzer

Bloom Energy working with DOE to test nuclear energy to create Hydrogen at Idaho National Laboratory

OPPORTUNITY

A step closer to clean hydrogen

Illinois

DEPLOYMENT: Boilingbrook, IL

Hyzon Motors manufacturing key HFC components in Illinois

RESEARCH: Chicago, IL

Argonne National Laboratory: HydroGEN Seedling: Platinum-Group-Metal-Free Oxygen Evolution Reaction Catalysts for Proton Exchange Membrane Electrolyzers

Argonne National Laboratory: System Analysis of Physical and Materials-Based Hydrogen Storage

Argonne National Laboratory: Tailored High-Performance Low-Platinum-Group-Metal Alloy Cathode Catalysts

Argonne National Laboratory: Lab Call FY19: Polymer Electrolyte Fuel Cell Electrode Structures with Encased Catalysts to Eliminate Ionomer Adsorption on Catalytic Sites

Argonne National Laboratory: Analysis of Fuel Cells for Trucks
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<tr>
<th><strong>DEPLOYMENT: Evanston, IL</strong></th>
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<tbody>
<tr>
<td>Northwestern University: HydroGEN Seedling: Degradation Characterization and Modeling of a New Solid Oxide Electrolysis Cell Utilizing Accelerated Life Testing</td>
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<tr>
<td>Northwestern University: HydroGEN Seedling: Transformative Materials for High-Efficiency Thermochemical Production of Solar Fuels</td>
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<tr>
<th><strong>RESEARCH: Evanston, IL</strong></th>
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<tr>
<td>Northwestern University: Efficient Reversible Operation and Stability of Novel Solid Oxide Cells</td>
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<th><strong>DEPLOYMENT: Urbana, IL</strong></th>
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<tr>
<td>Champaign-Urbana introduced its first zero-emission hydrogen fuel cell electric buses in 2021 (plus fueling stations)</td>
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<th><strong>DEPLOYMENT: Various</strong></th>
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<td>81 Illinois schools have hydrogen fuel cell systems donated by Ameren</td>
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<td>DOT deploying signs on “alternative fuel corridors” to direct to stations offering alternative fuels, including hydrogen fueling stations</td>
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<th><strong>OPPORTUNITY</strong></th>
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<tr>
<td>IL has high concentration of steel mills, which can replace coke with green carbon to decarbonize steel making</td>
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**Indiana**

<table>
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<th><strong>DEPLOYMENT: Carmel, IN</strong></th>
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<tr>
<td>Carmel retrofitting fleet vehicles with new technology that produces cleaner-burning and more fuel-efficient hydrogen energy</td>
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| **RESEARCH: Indianapolis, IN** |
Indiana University Purdue University Indianapolis: Mesoporous Carbon-Based Platinum-Group Metal-Free Catalyst Membrane Electrode Assemblies

**DEPLOYMENT: West Terre Haute, IN**

Wabash Valley Resources producing hydrogen energy and capture and story in West Terre Haute

**OPPORTUNITY**

Indiana is becoming America’s hydrogen innovation hub

Indiana has high concentration of steel mills, which can replace coke with green carbon to decarbonize steel making

**Iowa**

**DEPLOYMENT: Iowa City, IA**

University of Iowa scientists to develop technology to make hydrogen from sunlight and any source of water

**OPPORTUNITY**

Iowa could become hot spot for green hydrogen technology

**Kansas**

**RESEARCH: Coffeyville, KS**

Global CCS Institute; Global Carbon Capture and Storage Institute Response to the National Hydrogen Strategy Issues Papers

**DEPLOYMENT: Lawrence, KS**

Avium LLC, headquartered at University of Kansas gets grant to advance technology that can broaden the popularity and ease of owning cars with hydrogen fuel cells
### RESEARCH: Lawrence, KS

University of Kansas: Stationary Direct Methanol Fuel Cells Using Pure Methanol

### Kentucky

#### DEPLOYMENT: Calvert City, KY

Airgas builds a liquid hydrogen plant in Calvert City

#### DEPLOYMENT: Georgetown, KY

Toyota is establishing a dedicated line for hydrogen fuel cell modules at its Kentucky facility, scheduled to begin production in 2023

#### RESEARCH: Lexington, KY

University of Kentucky Center for Applied Energy Research: Precursor Processing Development for Low-Cost, High-Strength Carbon Fiber for Composite Overwrapped Pressure Vessel Applications

### OPPORTUNITY

Kentucky formed a regional hydrogen hub workgroup of academic institutions, individuals, organizations, and businesses focused on developing projects eligible for funding under the Infrastructure Investment and Jobs Creation Act of 2021

### Louisiana

#### DEPLOYMENT: Ascension Parish, LA

Air Products Announces $4.5 Billion Blue Hydrogen Clean Energy Complex in Eastern Louisiana

#### DEPLOYMENT: Baton Rouge, LA

Koch Engineered Solutions developing renewable energy complex to produce green hydrogen in Baton Rouge
Gron Fuels $9.2 million multi-year program will produce green hydrogen, renewable diesel, sustainable aviation fuels, and bio-plastic feedstocks

**DEPLOYMENT: Donaldsville, LA**

CF Industries plans 20-MW electrolyzer to produce hydrogen in Louisiana with thyssenkrupp for Green Ammonia Project

CF Industries Holdings Inc announces engineering and procurement contract

**DEPLOYMENT: Geismar, LA**

Praxair building one of nation’s largest hydrogen plants in Louisiana

Air Products hydrogen production facility in Geismar

**DEPLOYMENT: Laplace, LA**

The Port of Louisiana, US, is building a new hydrogen and ammonia production facility to provide zero-carbon fuel for the shipping industry and energy transfer

**RESEARCH: Lafayette, LA**

The University of Louisiana at Lafayette was awarded a $1 million grant from the DOE to develop high-performance metal-supported solid oxide electrolysis cells and innovative diagnostic methodologies to achieve net-zero or negative emissions and advance clean hydrogen technology

**DEPLOYMENT: New Orleans, LA**

Entergy Corp. joining forces with Mitsubishi Power to integrate green hydrogen into utility business

A memorandum of understanding (MoU) for a methane-hydrogen fuel cell tugboat development project was signed to develop an H2-powered inland tugboat that will operate across the Port of New Orleans waterway network

**OPPORTUNITY**

Louisiana could be key player in building a hydrogen economy
Louisiana’s newly released climate action plan lists “no-carbon hydrogen” as one of the three key policy pillars are needed for Louisiana to achieve net zero by 2050

**Maine**

**OPPORTUNITY**

Central Maine Power (CMP) is exploring how to help advance green hydrogen consumption in existing manufacturing processes

Renewable Hydrogen News: Power-to-Gas Mania Hits Maine

**Maryland**

**DEPLOYMENT: Various**

Ally Power is raising $40 million to build 6 hydrogen fueling stations around the DC, MD, and VA area

**Massachusetts**

**DEPLOYMENT: Boston, MA**

Giner, Inc.: High-Temperature Alkaline Water Electrolysis

Giner, Inc.: ElectroCat: Durable Mn-Based Platinum-Group-Metal-Free Catalysts for Polymer Electrolyte Membrane Fuel Cells

Advent Technologies, Inc.: Facilitated Direct Liquid Fuel Cells with High-Temperature Membrane Electrode Assemblies:

**RESEARCH: Boston, MA**

Northeastern University: HydroGEN Seedling: Developing Novel Platinum-Group-Metal-Free Catalysts for Alkaline Hydrogen and Oxygen Evolution Reactions

Northeastern University: Developing Platinum-Group-Metal-Free Catalysts for Oxygen Reduction Reaction in Acid: Beyond the Single Metal Site

**DEPLOYMENT: Braintree, MA**
<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braintree and Mansfield, MA</td>
<td>Air Liquide opens hydrogen stations in Braintree and Mansfield</td>
</tr>
</tbody>
</table>
| Cambridge, MA | RESEARCH: Cambridge, MA  
MIT researchers developed a model that shows hydrogen-fired power generation can be the more economical option when compared to lithium-ion batteries |
| Cambridge, MA | MIT researchers developed a hydrogen supply chain planning model and found that flexible scheduling for trucks and pipelines would allow them to serve as both storage and transmission |
| Mansfield, MA | DEPLOYMENT: Mansfield, MA  
Air Liquide opens hydrogen stations in Braintree and Mansfield |
| Newton, MA | RESEARCH: Newton, MA  
Giner ELX, Inc.: Electrochemical Compression  
INS GVD Corporation: Coatings for Compressor Seals |
| Northborough, MA | DEPLOYMENT: Northborough, MA  
Saint-Gobain: HydroGEN Seedling: Development of Durable Materials for Cost Effective Advanced Water Splitting Utilizing All Ceramic Solid Oxide Electrolyzer Stack Technology |
| Rehoboth, MA | DEPLOYMENT: Rehoboth, MA  
Daimler’s truck division shifting towards zero-emission vehicles (think H2) |
| Somerville, MA | RESEARCH: Somerville, MA  
Ivys Energy Solutions: Advancing Hydrogen Dispenser Technology by Using Innovative Intelligent Networks |
| Waltham, MA | DEPLOYMENT: Waltham, MA |
Giner, Inc.: FY18 SBIR IIB: Ionomer Dispersion Impact on Advanced Fuel Cell and Electrolyzer Performance and Durability

Giner, Inc.: High-Efficiency Reversible Alkaline Membrane Fuel Cells

**OPPORTUNITY**

Op-ed: Hydrogen is the missing piece of Mass. Clean energy economy

---

**Michigan**

**DEPLOYMENT: Ann Arbor, MI**

University of Michigan: HyMARC Seedling: Optimized Hydrogen Adsorbents via Machine Learning and Crystal Engineering

**RESEARCH: Ann Arbor, MI**

University of Michigan: HydroGEN Seedling: Monolithically Integrated Thin-Film/Silicon Tandem Photoelectrodes for High Efficiency and Stable Photoelectrochemical Water Splitting

**DEPLOYMENT: Brownstown, MI**

Honda & GM producing advanced fuel cell systems

**DEPLOYMENT: Detroit, MI**

General Motors: Highly Accessible Catalysts for Durable High-Power Performance

General Motors: Durable High-Power Membrane Electrode Assemblies with Low Platinum Loading

FusionOne’s first HydroPlas Reactor is expected to be in operation by mid-2022. The technology produces hydrogen from plastic, and additional reactor sites will be announced through 2022

**DEPLOYMENT: Southfield, MI**
DTE opens hydrogen technology park in Southfield

DEPLOYMENT: Wayne, MI


DEPLOYMENT: Upper Peninsula, MI

WEC Energy Group will test co-firing hydrogen with natural gas at one of its power generation plants in Michigan’s Upper Peninsula

DEPLOYMENT: Various

DOE is working with Michigan Economic Development Corp to enhance R&D and provide job creation

Michigan Department of Environment, Great Lakes, and Energy (EGLE) is offering a second round of funding for electric, hydrogen fuel cell or diesel-electric hybrid commercial and mass transit vehicles to replace older, diesel-fueled models

OPPORTUNITY

DOE is working with Michigan Economic Development Corp to enhance R&D and provide job creation

MI has high concentration of steel mills, which can replace coke with green carbon to decarbonize steel making

Minnesota

DEPLOYMENT: Maplewood, MN

3M Company: Novel Ionomers and Electrode Structures for Improved Polymer Electrolyte Membrane Fuel Cell Electrode Performance at Low Platinum Group Metal Loadings

3M Company: Low-Cost, High-Performance Catalyst Coated Membranes for Proton Exchange Membrane Water Electrolyzers
**RESEARCH: Maplewood, MN**

3M Company: Highly Active, Durable, and Ultra-Low-Platinum-Group-Metal Nanostructured Thin Film Oxygen Reduction Reaction Catalysts and Supports

**READ MORE »**

**DEPLOYMENT: Minneapolis, MN**

Construction expected next year on hydrogen production utilizing steam and water

**READ MORE »**

Centerpoint is working on a green hydrogen pilot project to blend less than 5% into existing natural gas system

**READ MORE »**

**RESEARCH: New Prague, MN**

Chart Industries, Inc. and Ballard Power Systems successfully tested a fuel cell powered by liquid hydrogen by pairing a Ballard FCmove™-HD fuel cell with a Chart liquid onboard hydrogen ("HLH2") vehicle fuel system at Chart's hydrogen test facility in Minnesota

**READ MORE »**

**DEPLOYMENT: Wayne, MI**

Prairie Island nuclear plant will transition to producing hydrogen from water

**READ MORE »**

**OPPORTUNITY**

The Natural Gas Innovation Act opens the door to establish a regulatory framework for flowing renewable natural gas, or RNG, and green hydrogen to Minnesota gas customers

**READ MORE »**

**Mississippi**

**DEPLOYMENT: Renova, MS**

Entergy Corp. joining forces with Mitsubishi Power to integrate green hydrogen into utility business

**READ MORE »**

**DEPLOYMENT: Various**
Hy Stor Energy LP and Connor Clark & Lunn are partnering to create the Mississippi Hydrogen Hub to use arrays of solar panels to generate electricity to electrolyzers that split hydrogen from water molecules. The zero-carbon hydrogen would be stored in underground salt caverns then piped or trucked away to serve as fuel for fuel cell vehicles or be blended into natural gas systems.

**Missouri**

[RESEARCH: St. Louis, MO](#)

Washington University in St. Louis: Corrosion-Resistant Non-Carbon Electrocatalyst Supports for Polymer Electrolyte Fuel Cells

**Montana**

[OPPORTUNITY: Butte, MT](#)

Mitsubishi proposed building a hydrogen plant that would extract hydrogen from the water in the Berkeley Pit

[OPPORTUNITY: Butte, MT](#)

Hydrogen projects are ripe for Montana, NorthWestern Energy

[DEPLOYMENT: Great Falls, MT](#)

Montana Renewables has secured financing for a renewable hydrogen plant, expected to be operational in late 2022

**Nebraska**

[DEPLOYMENT: Lincoln, NE](#)

Chemical and energy company Monolith received conditional approval for a $1bn loan from the US DOE to create a clean hydrogen and carbon black production facility

[DEPLOYMENT: Papillion, NE](#)
Siemens Energy is providing two SGT6-5000F turbines that run on up to a 30% hydrogen blend to power Omaha Public Power District’s (OPPD) new Turtle Creek Station peaking plant.

Nevada

RESEARCH: Henderson, NV
Southwest Gas announced a pilot project to determine the optimal blend of hydrogen and natural gas for safety and the environment, including the physical impacts of hydrogen on distribution system infrastructure and common gas appliances.

RESEARCH: Las Vegas, NV
Southwest Gas Corporation signed agreements with the University Nevada, Las Vegas (UNLV) and the Arizona State University in Tempe (ASU) to conduct a study to see how hydrogen-blended natural gas can further reduce carbon emissions whilst still providing clean and reliable energy without disrupting the daily routines of customers.

DEPLOYMENT: North Las Vegas, NV
Air Liquide hydrogen plant expected to open early 2022 in North Las Vegas to produce hydrogen from renewable natural gas.

Air Liquide committed to producing renewable hydrogen for the West Coast mobility market with new liquid hydrogen plant.

New Hampshire

OPPORTUNITY

New Jersey

DEPLOYMENT: Howell, NJ
New Jersey Resources Corp. is building a green hydrogen production and distribution facility.
### DEPLOYMENT: Newark, NJ

Bloom Energy operates a fuel cell production plant in Newark

READ MORE »

### RESEARCH: Newark, NJ


READ MORE »

### DEPLOYMENT: Princeton, NJ

TreadStone Technologies, Inc.: Novel Structured Metal Bipolar Plates for Low-Cost Manufacturing

READ MORE »

### DEPLOYMENT: Various

SJI partnered with Atlantic Shores on a green hydrogen pilot program, which will research, monitor, and analyze the deployment of hydrogen technology and natural gas blending, expected to be fully operational in 2028

READ MORE »

### New Mexico

#### DEPLOYMENT: Albuquerque, NM

Pajarito Powder: Active and Durable Platinum-Group-Metal-Free Cathodic Electrocatalysts for Fuel Cell Application

READ MORE »

BayoTech is building its first of 50 planned “hydrogen hubs”; a hydrogen dispensation station for hydrogen-powered vehicles expected to be operational by summer 2022:

READ MORE »

#### RESEARCH: Albuquerque, NM

Sandia National Laboratories: Lab Call FY19: Electrode Ionomers for High Temperature Fuel Cells

READ MORE »

Sandia National Laboratories: Hydrogen Stations for Urban Sites

READ MORE »

Sandia National Laboratories: Hydrogen Quantitative Risk Assessment

READ MORE »
## RESEARCH: Farmington, NM
San Juan College has a new certification program focusing on hydrogen fuel cell technology's implementation within the automotive industry

## RESEARCH: Los Alamos, NM
- Los Alamos National Laboratory: Lab Call FY18 (Reversible Fuel Cell): Microstructured Electrodes and Diffusion Layers for Enhanced Transport in Reversible Fuel Cells
- Los Alamos National Laboratory: Lab Call FY19: Low-Cost Gas Diffusion Layer Materials and Treatments for Durable High-Performance Polymer Electrolyte Membrane Fuel Cells
- Los Alamos National Laboratory: Fuel Quality Assurance R&D and Impurity Testing in Support of Codes and Standards

## DEPLOYMENT: Prewitt, NM
Escalante H2 Power is transforming the Escalante Power Plant from coal into a hydrogen power plant

## DEPLOYMENT: General
The New Mexico Economic Development Department (EDD), Energy, Minerals and Natural Resources Department, and Environment Department (EMNRD) entered into a Memorandum of Understanding (MOU) with Los Alamos National Laboratory (LANL) and Sandia National Laboratories to build a zero-carbon hydrogen economy not only in New Mexico but across the United States

## OPPORTUNITY
- New Mexico’s oil and gas regions could become leaders in hydrogen power, congresspeople say
- Northwest New Mexico seeks to become hydrogen hub
- New Mexico’s robust resources and highly skilled workforce capable of supporting a diverse industrial sector gives it a leading edge as other states vie to become the next hydrogen powerhouse
Colorado, New Mexico, Utah and Wyoming will jointly apply for federal money to create a regional hydrogen hub and compete for $8 billion set aside for such projects in the 2021 Infrastructure Investment and Jobs Act

New York

**DEPLOYMENT: Brentwood, NY**

NY invests in green hydrogen demonstration project at Brentwood Power Plant on Long Island

**DEPLOYMENT Buffalo, NY**

Plug Power moving forward with plans for a “green hydrogen” plant in Genesee County

**DEPLOYMENT: Newburgh, NY**

In Newburgh, Danskammer Energy is working with Mitsubishi Energy’s Green Power project

**DEPLOYMENT: Capital Region, NY**

National Grid and Standard Hydrogen are awaiting regulatory approval for their Energy Transfer System hydrogen infrastructure

**DEPLOYMENT: Niagara Falls, NY**

Linde will construct a proton exchange membrane (PEM) electrolyser plant in Niagara Falls that will produce green hydrogen on a commercial scale, expected to be operational in 2023

**OPPORTUNITY: Oswego, NY**

The U.S. Department of Energy awarded Exelon Generation a grant to explore the potential benefits of on-site H2 production at the Nine Mile Point Nuclear Station in Oswego, New York
<table>
<thead>
<tr>
<th><strong>DEPLOYMENT: Rochester, NY</strong></th>
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<tbody>
<tr>
<td>Ionomr Innovations is building a fuel cell and green hydrogen electrolysis research and development center at the Metro Business Park</td>
</tr>
<tr>
<td>READ MORE »</td>
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<table>
<thead>
<tr>
<th><strong>OPPORTUNITY: Rochester, NY</strong></th>
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<tbody>
<tr>
<td>Avangrid proposed utilizing hydrogen for transportation and is assessing opportunities to construct a multi-use hydrogen production and distribution facility</td>
</tr>
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<td>READ MORE »</td>
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<table>
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<tr>
<th><strong>RESEARCH: St. Bonaventure, NY</strong></th>
</tr>
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<tbody>
<tr>
<td>An associate professor of chemistry at St. Bonaventure University has been awarded a National Science Foundation (NSF) CAREER grant for his research proposal titled “Investigating the Molecular Corking Effect for Potential Hydrogen Storage.”</td>
</tr>
<tr>
<td>READ MORE »</td>
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<table>
<thead>
<tr>
<th><strong>RESEARCH: Troy, NY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rensselaer Polytechnic Institute: Cyclic Olefin Copolymer-Based Alkaline Exchange Polymers and Reinforced Membranes</td>
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<td>READ MORE »</td>
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<table>
<thead>
<tr>
<th><strong>RESEARCH: Upton, NY</strong></th>
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<tbody>
<tr>
<td>Brookhaven National Laboratory: Platinum Monolayer Electrocatalyst</td>
</tr>
<tr>
<td>READ MORE »</td>
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<table>
<thead>
<tr>
<th><strong>DEPLOYMENT: Yaphank, NY</strong></th>
</tr>
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<tbody>
<tr>
<td>The Yaphank Fuel Cell Park at the Brookhaven Landfill generates 4 megawatts of energy from three SureSource 3000 carbonate fuel cell power plants</td>
</tr>
<tr>
<td>READ MORE »</td>
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<table>
<thead>
<tr>
<th><strong>DEPLOYMENT: Various</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>McDermott International's CB&amp;I Storage Solutions and New Energy Development Company completed engineering for two 50-MW energy projects that can each produce nearly 24,000 kg/day of renewable hydrogen</td>
</tr>
<tr>
<td>READ MORE »</td>
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</tbody>
</table>
### Opportunity

**Hydrogen heats up in New York**

New York is considering a program to develop resources like hydrogen and biomethane, as well as fuel cells and natural gas paired with carbon capture systems, at scale.

New York released an Initial Draft Scoping Plan that outlines how the state can achieve its ambitious emissions reduction mandates. The plan states that “Across all modeled pathways, New York’s hydrogen demand is met with green hydrogen.”

New York’s Governor Kathy Hochul has released a blueprint to develop a renewable hydrogen hub in the state linking several regions into a single hydrogen production and consumption network.

### North Carolina

**Opportunity**

Dominion Energy is analyzing which of their two North Carolina training facilities (Gastonia and Cary) will run a pilot project to advance how hydrogen can be used as a clean energy source.

### North Dakota

**Deployment: Beulah, ND**

Bakken Energy and Mitsubishi Power creating world-class clean hydrogen hub in North Dakota.

The Mandan, Hidatsa and Arikara Nations have a memorandum of understanding with Bakken Energy and Mitsubishi Power Americas to be the natural gas supplier for the Great Plains Hydrogen Hub.

**Opportunity**

North Dakota could be largest, lowest cost producer of blue hydrogen in North America.
Ohio

DEPLOYMENT: Canton, OH

Canton Ohio public transit has 14 hydrogen buses in their fleet, and a fueling station

DEPLOYMENT: Columbus, OH

Ohio State University granted DOE grant for advancing hydrogen gas turbines for use in electricity generation

pH Matter LLC: FY18 SBIR Phase II Release 1: Multi-Functional Catalyst Support

RESEARCH: Columbus, OH

DNV opened a dedicated hydrogen testing and research laboratory in their materials performance and testing laboratory that aims to quantify the performance of materials used within hydrogen transportation and storage

DEPLOYMENT: Monroe County, OH

Long Ridge Energy Terminal announced plans to transition its 538 MW combined-cycle power plant to run-on carbon-free hydrogen

OPPORTUNITY

Ohio has high concentration of steel mills, which can replace coke with green carbon to decarbonize steel making

EQT Corporation, Equinor, GE Gas Power, Marathon Petroleum (including its affiliate MPLX), Mitsubishi Power, Shell Polymers and U. S. Steel have formed a new alliance to work with stakeholders on a shared vision for a low-carbon and hydrogen industrial hub in Ohio, Pennsylvania and West Virginia that can be a national model for sustainable energy and production systems

Oklahoma

DEPLOYMENT: Ardmore, OK
Australian energy company Woodside has secured a lease and an option to purchase land at the Westport Industrial Park in Ardmore, Oklahoma, to build an initial 290MW hydrogen facility that could be expanded up to 550MW in the future.

<table>
<thead>
<tr>
<th>OPPORTUNITY</th>
<th>Energy Secretary hopes to make Oklahoma ‘epicenter’ of hydrogen fuel industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Oklahoma Hydrogen Production, Transportation, and Infrastructure Task Force (OK H2 Task Force) report details Oklahoma’s strong potential in hydrogen</td>
<td></td>
</tr>
</tbody>
</table>

**Oregon**

<table>
<thead>
<tr>
<th>RESEARCH: Corvallis, OR</th>
<th>Oregon State University: Novel Hybrid Microbial Electrochemical System for Efficient Hydrogen Generation from Biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oregon State University research into the design of catalysts has shown that hydrogen can be cleanly produced with much greater efficiency and at a lower cost than is possible with current commercially available catalysts</td>
</tr>
</tbody>
</table>

| DEPLOYMENT: Eugene, OR | Northwest Natural Holding Co. is building a 2-MW to 10-MW green hydrogen production facility |

| OPPORTUNITY: Klamath, OR | Avangrid proposed the colocation of green hydrogen production at Avangrid Renewables’ Klamath Cogeneration Plant |

**Pennsylvania**

| DEPLOYMENT: Clinton County, PA | Keystate to Zero proposed hydrogen gas production plant in Clinton County, PA slated to begin in 2023, awaiting permits and funding |
**DEPLOYMENT: Lancaster, PA**

Pennsylvania’s first green hydrogen plant planned for Lancaster County

**RESEARCH: Philadelphia, PA**

Drexel University: Polymerized Ionic Liquid Block Copolymer/Ionic Liquid Composite Ionomers for High Current Density Performance

**DEPLOYMENT: Pittsburgh, PA**

The first battery-electric freight train, the FLXdrive, reduces fuel consumption by 11% and can cut 300 million tons of emissions per year

**RESEARCH: Pittsburgh, PA**


**RESEARCH: State College, PA**

Pennsylvania State University: Developing a New Polyolefin Precursor for Low-Cost, High-Strength Carbon Fiber

Pennsylvania State University: Advanced Anion Exchange Membranes with Tunable Water Transport for Platinum-Group-Metal-Free Anion Exchange Membrane Fuel Cells

**OPPORTUNITY**

Why Pennsylvania could be poised for a new wave of energy leadership with hydrogen

EQT Corporation, Equinor, GE Gas Power, Marathon Petroleum (including its affiliate MPLX), Mitsubishi Power, Shell Polymers and U.S. Steel have formed a new alliance to work with stakeholders on a shared vision for a low-carbon and hydrogen industrial hub in Ohio, Pennsylvania and West Virginia that can be a national model for sustainable energy and production systems
### Rhode Island

**RESEARCH: Narragansett, RI**

University of Rhode Island researchers found that when producing hydrogen from seawater, sediment in the water made the production process more effective

**DEPLOYMENT: Providence, RI**

Air Liquide built one hydrogen fueling station, with plans for more

### South Carolina

**DEPLOYMENT: Aiken County, SC**


**RESEARCH: Clemson, SC**

Clemson University: Laser 3-D Printing of Highly Compacted Protonic Ceramic Electrolyzer Stack

### Opportunity

Duke Energy filed plans to retire coal power plants and replace them with natural gas-fired plants that will use a minimum 30% hydrogen blend, with plans to shift to 100% hydrogen by 2030

### Tennessee

**DEPLOYMENT: Charleston, TN**

Plug Power hydrogen plant generates 6.4 tons of hydrogen daily

**DEPLOYMENT: East TN**

A collaborative project between Southern Co. Gas, Electro-Active Technologies, and T2M Global to advance tech for producing clean hydrogen from waste was funded by the DOE
<table>
<thead>
<tr>
<th>Research Location</th>
<th>Project Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nashville, TN</td>
<td>Vanderbilt University: Fuel Cell Membrane Electrode Assemblies with Platinum-Group-Metal-Free Nanofiber Cathodes</td>
</tr>
<tr>
<td></td>
<td>Vanderbilt University: Composite Polymer Electrolyte Membranes from Electrospun Crosslinkable Poly(Phenylene Sulfonic Acid)s</td>
</tr>
<tr>
<td>Oak Ridge, TN</td>
<td>Oak Ridge National Laboratory: Novel Plasticized Melt Spinning Process of Polyacrylonitrile Fibers Based on Task-Specific Ionic Liquids</td>
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**Texas**

<table>
<thead>
<tr>
<th>Deployment Location</th>
<th>Project Description</th>
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<tbody>
<tr>
<td>Austin, TX</td>
<td>H2@Scale Project Launched in Texas</td>
</tr>
<tr>
<td>Austin, TX</td>
<td>Researchers at UT created a framework to integrate hydrogen gas into existing US infrastructure</td>
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**Opportunity**

<table>
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<tr>
<th>Location</th>
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<tr>
<td>Bridge City, TX</td>
<td>Entergy proposed building a 1,215-megawatt (MW) hydrogen power plant</td>
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**Deployment**

<table>
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<th>Location</th>
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<tbody>
<tr>
<td>Clear Lake, TX</td>
<td>Linde expanded its withstanding agreement with Celanese Corporation and will now supply Celanese’s manufacturing facility in Clear Lake, Texas, with CO2 and hydrogen to use as an alternative feedstock to produce methanol with lower carbon intensity</td>
</tr>
<tr>
<td>Corpus Christi, TX</td>
<td>Apex Clean Energy, Ares, EPIC Midstream, and PCCA have entered into a nonbinding memorandum of understanding (MoU) to explore the development</td>
</tr>
</tbody>
</table>
of leading green hydrogen production, storage, transportation, and export operation, including a newly constructed dedicated pipeline and a green fuels hub on the Texas Gulf Coast

**OPPORTUNITY: Corpus Christi, TX**

Avangrid Renewables identified an opportunity for an electrolysis project to convert wind power into green hydrogen and ultimately into green ammonia

**DEPLOYMENT: Dallas, TX**

Home Depot opens automated Dallas fulfillment center with hydrogen-powered forklifts

**DEPLOYMENT: El Paso, TX**

El Paso Electric utilizing gas turbines that were designed to be operated on up to 100% hydrogen in the future

**DEPLOYMENT: Houston, TX**

Entergy Corp. joining forces with Mitsubishi Power to integrate green hydrogen into utility business

Proenergy’s string-test facility is hydrogen-ready and will host tests with the clean energy carrier in the future to explore real world operating conditions for hydrogen fuel mixes

**OPPORTUNITY: Houston, TX**

The Texas Gulf Coast is well equipped for widespread hydrogen adoption like a hydrogen hub, thanks to its booming industrial sector, a large existing hydrogen market, and a regional geology that support storage. A working group of 11 companies has expressed interest in developing large-scale carbon capture and storage infrastructure in Houston

**DEPLOYMENT: La Porte, TX**
Linde’s new plant, scheduled to start up in 2021 will produce over 30 tons per day of high purity liquid hydrogen

<table>
<thead>
<tr>
<th>DEPLOYMENT: Port Arthur, TX</th>
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<tbody>
<tr>
<td>Port Arthur develops steam methane reformer hydrogen production facility</td>
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<tr>
<td>Carbon Capture Project at Air Products’ Port Arthur Hydrogen Production Facility</td>
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<table>
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<tr>
<th>RESEARCH: San Antonio, TX</th>
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<tr>
<td>Southwest Research Institute: Hydrogen Compression Application of the Linear Motor Reciprocating Compressor</td>
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<th>DEPLOYMENT: Various</th>
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<tr>
<td>Big Hill Materials plans to invest $6-8 billion over the next 7 years on hydrogen projects including 5 natural gas/hydrogen fuel power plants with carbon capture technology, two hydrogen electrolysers, a hydrogen and carbon blending plant, and a hydrogen fuel/natural gas/oil trading facility</td>
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<table>
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<td>Texas could become nation’s leader in production of hydrogen energy</td>
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<tr>
<td>How The Lone Star State Is Building A Green Hydrogen Future</td>
</tr>
<tr>
<td>Texas has resources, infrastructure to become global hydrogen hub—Houston specifically</td>
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**Utah**

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<th>DEPLOYMENT: Central UT</th>
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<td>Mitsubishi Power and Magnum Development announced the launch of the Advanced Clean Energy Storage project</td>
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<th>DEPLOYMENT: Delta, UT</th>
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</table>
Intermountain Power Agency Orders MHPS JAC Gas Turbine Technology for Renewable-Hydrogen Energy Hub in Delta

Conversion of 1,800MW Intermountain coal plant in Utah to 840MW gas-hydrogen facility moving forward

Mitsubishi Power and Magnum Development announced the launch of the Advanced Clean Energy Storage project

DEPLOYMENT: Salt Lake City, UT
Dominion has a pilot program blending 5% hydrogen into their test system at their training academy

DEPLOYMENT: South of Salt Lake City, UT
130 miles south of SLC engineers working on salt dome to create that will become one of the largest renewable energy reservoirs

DEPLOYMENT: West Valley City, UT
Grid-scale energy storage with renewable hydrogen production and utilization forms core of Advanced Clean Energy Storage project in central Utah

OPPORTUNITY
Colorado, New Mexico, Utah and Wyoming will jointly apply for federal money to create a regional hydrogen hub and compete for t$8 billion set aside for such projects in the 2021 Infrastructure Investment and Jobs Act

Virginia
DEPLOYMENT: Arlington, VA
Strategic Analysis, Inc.: Analysis of Advanced Hydrogen Production Pathways
Strategic Analysis, Inc.: Hydrogen Storage Cost Analysis
Strategic Analysis, Inc.: Fuel Cell Systems Analysis
<table>
<thead>
<tr>
<th>Deployment: Chickahominy District, VA</th>
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<tbody>
<tr>
<td>Balico, LLC is working with Mitsubishi Energy’s Green Power project</td>
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<thead>
<tr>
<th>Deployment: Pembroke, VA</th>
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<tbody>
<tr>
<td>NanoSonic, Inc.: FY17 SBIR II Release 1: Novel Hydrocarbon Ionomers for Durable Polymer Electrolyte Membranes</td>
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<td>NanoSonic, Inc.: Cryogenically Flexible, Low Permeability Hydrogen Delivery Hose (D)</td>
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**Washington**

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<tr>
<th>Deployment: Bellevue, WA</th>
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<tr>
<td>Puget Sound Energy working with Mitsubishi Power to collaborate on green hydrogen storage assets</td>
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**Research: Benton County, WA**

| Pacific Northwest National Laboratory: Materials Challenges for Cryogenic Hydrogen Storage Technologies |
| Pacific Northwest National Laboratory: ElectroCat: Highly Active and Durable Platinum-GroupMetal-Free Oxygen Reduction Reaction Electrocatalysts through the Synergy of Active Sites |
| Pacific Northwest National Laboratory: Lab Call FY19: Solid Phase Processing for Reduced Cost and Improved Efficiency of Bipolar Plates |
| Pacific Northwest National Laboratory: Magnetocaloric Hydrogen Liquefaction |
| Pacific Northwest National Laboratory: Hydrogen Safety Panel, Safety Knowledge Tools, and First Responder Training Resources |
| Pacific Northwest National Laboratory: H-Mat Overview: Polymers |

**Deployment: Douglas County, WA**
Global technology and power solutions leader Cummins Inc. (NYSE: CMI) will provide its 5-megawatt PEM electrolyzer to enable renewable energy for the Douglas County Public Utility District.

**DEPLOYMENT: Lewis County, WA**

Hydrogen fueling station planned as part of US hydrogen highway network, scheduled to open in 2022.

**OPPORTUNITY: Lewis County, WA**

Lewis County Has Potential to Be First Hydrogen Valley in Pacific Northwest.

**DEPLOYMENT: Moses Lake, WA**

Universal Hydrogen is working to modify a small regional turboprop aircraft to fly on hydrogen fuel, test and certify them to carry passengers, and demonstrate that hydrogen aviation is economically viable.

**RESEARCH: Quincy, WA**

A project funded by the US Department of Energy’s H2@Scale Initiative will explore the use of large-format hydrogen fuel cells to produce sustainable backup power for Microsoft data centres at a facility in Quincy.

**DEPLOYMENT: Seattle, WA**

Alaska Airlines signs agreement for use of hydrogen and solid waste as bio fuel. Additionally, Anglo American is developing the world’s largest zero-emission hydrogen-powered fuel cell mining truck in partnership with First Mode that will be used at its global mining sites.

**RESEARCH: Seattle, WA**

The Port of Seattle and Seattle City Light, assisted by Pacific Northwest National Laboratory and Sandia National Laboratories, will take a deeper look at using hydrogen fuels to reduce greenhouse gas emissions in two studies funded by $2.12 million in Energy Department grants.
DEPLOYMENT: Snohomish County, WA
ZeroAvia was awarded a $350,000 Washington State grant for setting up new offices and R&D space at the Paine Field airport near Seattle, in Snohomish County
READ MORE »

DEPLOYMENT: Sumner, WA
Global technology and power solutions leader Cummins Inc will provide its 5-megawatt PEM electrolyzer to enable renewable energy
READ MORE »

OPPORTUNITY
Renewable hydrogen could play a key role in Washington’s clean-energy future
READ MORE »

West Virginia

RESEARCH: Morgantown, WV
West Virginia University: HydroGEN Seedling: Intermediate Temperature Proton-Conducting Solid Oxide Electrolysis Cells with Improved Performance and Delivery
READ MORE »

OPPORTUNITY

U.S. Senators Joe Manchin, D-W.Va., Shelley Moore Capito, R-W.Va. and Gov. Jim Justice launched the WV Hydrogen Hub Working Group on February 15 “to collaborate and support a strong West Virginia candidate to be chosen to develop a hydrogen hub.”

EQT Corporation, Equinor, GE Gas Power, Marathon Petroleum (including its affiliate MPLX), Mitsubishi Power, Shell Polymers and U. S. Steel have formed a new alliance to work with stakeholders on a shared vision for a low-carbon and hydrogen industrial hub in Ohio, Pennsylvania and West Virginia that can be a national model for sustainable energy and production systems
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Wisconsin

OPPORTUNITY
## Wisconsin Hydrogen Breakthrough May Be Steps Toward Cleaner Energy

**Wyoming**

**DEPLOYMENT: Cheyenne, WY**

Bill Gates funding coal and hydrogen production facility

The Wyoming Energy Authority and Energy Resources Council approved funding for the Tallgrass Energy, “Eastern Wyoming Sequestration Hub” to study the potential to sequester CO2 in the Wyoming Denver-Julesburg Basin in support of developing a commercial scale sequestration hub in Eastern Wyoming

**DEPLOYMENT: Douglas, WY**

Nordex USA is hoping to break ground on a privately-funded $2.2 billion clean hydrogen extraction/fuel plant located in Niobrara and Converse counties by late 2025 or early 2026

**DEPLOYMENT: Evanston, WY**

The Wyoming Energy Authority and Energy Resources Council approved funding for North Shore Energy and Starwood Energy Group’s “Project Phoenix,” joint exploration in the development of an ammonia complex with on-site carbon capture and sequestration capabilities at existing depleted hydrocarbon reservoirs and processing facilities

The Wyoming Energy Authority and Energy Resources Council approved funding for 8 Rivers’ study “The 8RH2 Process for Producing Clean Hydrogen with Autothermal Reforming and Carbon Capture” to conduct a Pre-Front-End Engineering Design (Pre-FEED) study for a new-build hydrogen plant

**RESEARCH: Laramie, WY**

University of Wyoming’s School of Energy Resources partnered with The Williams Cos. Inc. on the Wyoming Hydrogen Pilot Project researching hydrogen production from renewable energy sources

The U.S. Department of Energy’s (DOE) Office of Fossil Energy and Carbon Management (FECM) announced up to $644,000 in funding for the University of Wyoming School of Energy Resources to assess the economic impacts of fossil...
energy production in Wyoming and evaluate opportunities and research needs to deploy clean hydrogen technologies

**OPPORTUNITY**

- The future of hydrogen energy in Wyoming: A conversation with the head of the Wyoming Energy Authority
- All Green Hydrogen Roads Lead to ... Wyoming
- Wyoming Energy Authority announced funding for three hydrogen production/use projects
- Colorado, New Mexico, Utah and Wyoming will jointly apply for federal money to create a regional hydrogen hub and compete for $8 billion set aside for such projects in the 2021 Infrastructure Investment and Jobs Act