



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update October 2023: United States

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Covered Period	April 2023 to September 2023

1. New Initiatives, Programs, and Policies on Hydrogen and Fuel Cells

- The US government (USG) released a national clean hydrogen strategy and roadmap with goals to achieve hydrogen production in the US of 10 million metric tons (MMT) per year by 2030, 20 MMT per year by 2040, and 50 MMT per year by 2050.
- In August, the USG the Hydrogen Interagency Task Force (HIT) – a whole-of-government approach to collaborate across federal agencies to execute the national strategy.
- The US Environmental Protection Agency (EPA) and Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration announced various proposed and final rules covering areas with applicability to hydrogen including a requiring maintenance measure on pipeline safety, addressing leakage, and controlling air pollution and emissions from heavy duty engines and fossil power plants.

2. Hydrogen and Fuel Cell R&D Update

- DOE updated technical targets PEM and high-t electrolyzers at the stack and system level. Targets cover key areas such as performance, efficiency, PGM content, cost, lifetime, among others.
- DOE released a fuel cell R&D program record documenting the projected cost of a 275-kW PEM fuel cell system for a Class 8 heavy-duty truck as \$179/kW, assuming a 50,000 units/year volume.

3. Demonstration, Deployments, and Workforce Developments Update

- In July, DOE announced a \$1 billion demand-side initiative to support the Regional Clean Hydrogen Hubs (H2Hubs). The initiative aims to ensure that during initial years of production, both producers and end users in the H2Hubs have needed market certainty to unlock private investment and realize the full potential of clean hydrogen.
- DOE released a program record documenting a five-fold increase in electrolyzer (PEM, SOEC and Alkaline) installations (planned and operational) since 2022. As of May 2023, there are approximately 3.7 gigawatts of planned and/or operational electrolyzers capacity installed in the US.



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- In July, DOE HFTO, in collaboration with the Clean Energy Ministerial (CEM) Clean Hydrogen Initiative, launched H2 Twin Cities 2023. H2 Twin Cities 2023 will focus on pairing Mentor and Mentee cities with significantly different levels of hydrogen experience and expertise to collaborate, share ideas, and learn from each other as they deploy clean-hydrogen solutions.
- The H2Rescue, a fuel cell truck for disaster and relief response, completed road testing of 180 miles and showcased the ability to support neighbouring communities in the event of an emergency.

4. Events and Solicitations

- The 2023 DOE Hydrogen Program Annual Merit Review and Peer Evaluation Meeting (AMR) was held in a hybrid format from June 5 to 8, 2023 with over 2,500 attendees. Program and project presentations, as well as all project posters are available on the AMR website.
- DOE held various H2IQ hours webinars, including one in August focused on the US National Clean Hydrogen Strategy and Roadmap and one in July focused on the Hydrogen Emergency Relief Vehicle, H2Rescue.
- Since April, DOE announced over \$70 million in funding to enable RD&D progress in multiple crosscutting areas with applicability to hydrogen:
 - Up to \$35 million in funding to support a new program to enable zero-process-emission ironmaking and ultra-low life cycle emissions steelmaking. Steelmaking has been identified as an emerging high-priority application for clean hydrogen.
 - \$32 million in funding for projects that will help build facilities that produce rare earth elements and other critical minerals. These essential materials are key to manufacturing domestic clean energy products, including electrolyzers and fuel cells.
 - \$6.4 million in funding for university-based research and development projects that will develop advanced materials and components to improve the performance of hydrogen-fueled turbines.

5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

- Since April 2023, DOE announced over \$150 million announced to support over 100 projects to advance hydrogen RDD&D such as electrolyzers, industrial decarbonization, infrastructure components, end-use tech. incl. fuel cells. Announcements include:
 - \$48 million in funding for 16 projects across 13 states to reduce hydrogen technology costs, enhance infrastructure and improve the performance of fuel cells.
 - \$34 million in funding for 19 industry- and university-led research projects that will advance cutting-edge technology solutions to make clean hydrogen a more available and affordable fuel for electricity generation, industrial decarbonization, and transportation.
 - \$42 million in funding for 22 projects in 14 US states to advance critical technologies needed to produce, store, and deploy clean hydrogen
 - \$18 million to establish a new North American university research consortium to help states and tribal communities improve grid resiliency and achieve decarbonization goals.
 - \$8.6 million in small business research and development grants for 43 hydrogen and fuel cell projects across 16 US states.



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6. Regulations, Codes & Standards, and Safety Update

- The Hydrogen Safety Panel celebrated its 20th year this year and was recognized by the DOE with a Hydrogen Program Special Recognition award for its contributions to the safe deployment of hydrogen and fuel cell technologies and RD&D activities.
- The ASME Boiler and Pressure Vessel Code (BPVC) Committee for Section VIII (Rules for Construction of Pressure Vessels) has approved a revised code case which addresses cell stack assemblies. In this revised code case, electrolyzer cell stack assemblies are included but fuel cells are not considered part of the scope. A task group on this subject area is being formed.



Summary Country Update October 2023: United States

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fuel Cell Vehicles ¹	1,000,000 by 2030 in CA	>17,000	Multiple state efforts and industry stakeholders	ZEV state mandate (currently implemented in CA, CT, MA, ME, MD, NJ, NY, OR, RI, and VT); state subsidies (rebates in CA, MA, CT etc.) Inflation Reduction Act (IRA) incentives: 30% credit for commercial fuel cell electric vehicles through 2032 and \$7,500 credit for new fuel cell electric vehicle purchases.
Fuel Cell Buses	No target	>80	Federal Transit Authority (Department of Transportation); CARB; CEC, and multiple states	
Fuel Cell Trucks ²	\$80/kW by 2030 (Interim) \$60 k/W (Ultimate)	As of September 2022, 10 Toyota/Kenworth Class 8 fuel cell trucks have been <u>deployed</u> out of the Port of Los Angeles	CTE, FedEx Express, UPS, CEC, SCAQMD, Nikola	ZEV MOU and action plan in place between California, Colorado, Connecticut, District of Columbia, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington to

¹ Includes Fuel Cell Electric Vehicles with Range Extenders

² https://www.hydrogen.energy.gov/pdfs/19006_hydrogen_class8_long_haul_truck_targets.pdf



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				support the deployment of medium- and heavy-duty ZEVs
Forklifts	No target	>60,000	Early market applications strategy	
H ₂ Refueling Stations	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
70 MPa On-Site Production	1,000 by 2030 in CA 12-20 in Northeast	>50 open retail stations	State and private sector partnerships	California - \$2.6 billion to build ZEV charging/refueling stations including 200 hydrogen stations (includes O&M grants) ZEV mandate Inflation Reduction Act (IRA) incentive: tax credit of 30% of the cost of alternative fuel refueling property placed in service before 2033.
70 MPa Delivered				
35 MPa On-Site Production	No target	N/A	2 stations for bus refuelling (California)	Solicitations from state and local agencies (e.g., South Coast Air Quality Management District, Air Quality Standards Attainment U.S. DOE in California)
35 MPa Delivered	No target			
Stationary	Target Number ³	Current Status	Partnerships, Strategic Approach	Support Mechanism

³ Targets can be units installed and/or total installed capacity in the size range indicated



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Small ⁴	\$1,000/kW for backup units running directly on hydrogen \$1,500/kW for combined heat and power units running on natural gas	Installed stationary power (including large, medium and small units) is over 500 MW.	Industry-led	State/regional
Medium ⁵	\$1,000/kW for combined heat and power units running on natural gas		Industry-led	State/regional
Large ⁶	No target	N/A	Industry-led	State/regional
District Grid ⁷	No target	N/A	Industry-led	State/regional
Regional Grid ⁸	No target	N/A	Industry-led	State/regional
Telecom backup	No target	N/A	Industry-led	State/regional

⁴ <5 kW (e.g., Residential Use)

⁵ 5kW – 400 kW (e.g., Distributed Residential Use)

⁶ 0.3MW – 10 MW (e.g., Industrial Use)

⁷ 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)

⁸ 30MW plus (e.g., Grid Storage and Systems Management)



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H ₂ Production	Target ⁹	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fossil Fuels ¹⁰	\$1/kg produced by 2030	\$1.5/kg		
Water Electrolysis ¹¹ (PEM, Alkaline, SOEC)	\$1/kg produced by 2030	<u>\$5-\$6/kg</u> for low volume 3.7 GW electrolyzer capacity installed/underway	Continued government funding/cost share	State/regional (e.g., 33% renewables in CA) Inflation Reduction Act (IRA) incentives: Clean Hydrogen Production Tax Credit of up to \$3.00/kg of H ₂ and up to 30% investment tax credit.
By-product H ₂	N/A	N/A		
Energy Storage from Renewables	Target ¹²	Current Status	Partnership, Strategic Approach	Support Mechanism
Power to Power ¹³ Capacity	N/A	N/A		

⁹ Target can be by quantity (Nm³, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target

¹⁰ Hydrogen produced by reforming processes

¹¹ Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)

¹² Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity

¹³ Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity



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Power to Gas ¹⁴ Capacity	N/A	Project in CA is injecting H ₂ into NG pipeline		California Low Carbon Fuel Standard creates credits for use of low-carbon fuels. Blends of H ₂ and natural gas could receive credits under this regulation.
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¹⁴ Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)