



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update June 2021: United States

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

- On January 20, the Biden-Harris Administration took office and set specific priorities around tackling the climate crisis, reducing carbon emissions, investing in clean energy technologies, ensuring environmental justice and lifting up disadvantaged communities. Examples of new programs and goals around these topics include:
 - Achieving [100% clean electricity grid by 2035 and net-zero emissions by 2050](#)
 - Creating a government-wide [Justice40 Initiative](#) with the goal of delivering 40 percent of the overall benefits of relevant federal investments to disadvantaged communities
 - Launching the [American Jobs Plan](#) to invest in infrastructure activities and spur job creation, including investment in 15 hydrogen demonstration projects in disadvantaged communities.
- On June 7, U.S. Energy Secretary Jennifer Granholm [announced](#) U.S. Department of Energy's (DOE) Energy Earthshots Initiative, to accelerate breakthroughs of more abundant, affordable, and reliable clean energy solutions within the decade. The first Energy Earthshot—Hydrogen Shot—seeks to reduce the cost of clean hydrogen by 80% to \$1 per kilogram in one decade.
- Programs and activities at the state level have increased with a growing number of regional coalitions and partnerships focused on hydrogen deployment. Examples of recent and state-level policy and initiatives include:
 - Houston joined the H2 Ports initiative as part of Hydrogen Clean Energy Ministerial
 - Washington State signed two legislations that establish a [clean fuel standard](#) covering hydrogen, and [sales and use tax exemption program](#) for hydrogen fuel cell vehicles.
 - Oregon signed a [law](#) requiring Oregon DOE to conduct a study to evaluate the benefits and barriers to renewable hydrogen production in Oregon
 - California is finalizing a [major study](#) to quantify state support and timing required for hydrogen stations to achieve self-sufficiency.
 - Several other states and regions are ramping up activities and legislation. Examples include New Jersey, New York, Texas, Hawaii, Massachusetts, and others.



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

2. Hydrogen and Fuel Cell R&D Update

- DOE [presented](#) new fuel cell and hydrogen R&D targets during the DOE Hydrogen Program Annual Merit Review plenary to reflect increased focus on heavy duty transportation for fuel cells and alignment with the new DOE Hydrogen Shot. The 2030 cost target for heavy duty fuel cell system is \$80/kW and the cost target for hydrogen production is \$1/kg.
- DOE released fuel cell R&D program records documenting the [fuel cell bus durability](#) as 17,000 hours, and the [projected cost](#) of an 80-kW PEM fuel cell system as \$76/kW (assuming a 10,000 units/yr. volume).
- DOE continues to expand its efforts across offices that include not only renewables but also fossil fuels with CCS, nuclear, and basic science, strengthening coordination through the Under Secretary's Science and Energy Tech Team on hydrogen.

3. Demonstration, Deployments, and Workforce Developments Update

- As of June 2021, PEM electrolyzer installations in the US (including firm announcements and those under construction) totaled approximately [172 MW](#). This capacity includes those units of 120 kW or greater per site and do not include smaller units such as those used for laboratory research.
- DOE [announced](#) two collaborative workforce development efforts with Los Alamos National Laboratory and with Oakridge National Laboratory/University of Tennessee to support the transition of students, post-docs and civilians, particularly encouraging minorities, to careers in hydrogen and fuel cells .

4. Events and Solicitations

- DOE issued a [Request for Information](#) (RFI) in support of the Hydrogen Shot to solicit feedback from stakeholders on viable hydrogen demonstrations, including specific locations, that can help lower the cost of hydrogen, reduce carbon emissions and local air pollution, create good-paying jobs, and provide benefits to disadvantaged communities.
- The 2021 DOE Hydrogen Program Annual Merit Review and Peer Evaluation Meeting (AMR) took place the week of June 7 and had nearly 2,000 attendees. Energy Secretary Granholm [kicked off](#) the event announcing the Hydrogen Shot. AMR presentations will be available on the [AMR website](#) by June 28. DOE has over \$90 million in solicitations across offices in fiscal year 2021 for hydrogen as well as fuel cells, turbines and related technologies.

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

- DOE activities in hydrogen include several offices and a total of approximately \$400 million in the President's Fiscal Year (FY) 2022 [Budget Request](#). This compares to approximately \$285 million related to hydrogen in FY 2021.



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

- DOE issued the [“Supertruck 3” funding opportunity](#) covering \$100 million in funding over four years (subject to appropriations), to pioneer electrified medium- and heavy-duty truck concepts, including hydrogen fuel cell technologies, with significant improvements in efficiency and potential for deep emission reduction.
- DOE issued a [request for proposals](#) covering up to \$12 million (over multiple years) to support the H2@Scale vision and the National Renewable Energy Laboratory's (NREL's) Advanced Research on Integrated Energy Systems (ARIES) research goals.
- DOE issued a [funding opportunity](#) covering \$33 million to support innovative hydrogen and fuel cell research & development (R&D), infrastructure supply chain development and validation, and cost analysis activities. Announcement for project selections is planned for summer 2021.
- DOE issued a [funding opportunity](#) covering up to \$20 million to demonstrate nuclear powered H2 production for end uses
- DOE issued a [funding opportunity](#) covering nearly \$28 million to advance fossil-based hydrogen with carbon capture.

6. Regulations, Codes & Standards, and Safety Update

- DOE Sandia National Laboratories released a [“regulatory map”](#) highlighting US federal regulations that apply to hydrogen, including those that may indirectly cover hydrogen as an energy carrier participating in a sustainable, zero-emission global energy system. A DOE [H2IQ hour webinar](#) explaining the regulatory map is available online.
- Version 3.1 of the Hydrogen Risk Assessment Model (HyRAM) tool was [released](#) alongside a HyRAM Validation Report providing a comparative assessment of model changes from Version 2.0 to version 3.0/3.1.



Summary Country Update June 2021: United States

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fuel Cell Vehicles ¹	1,000,000 by 2030 in CA	>10,000	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.)
FC Bus	No target	>60	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 June 2021, 5 of 10 Toyota/Kenworth Class trucks have been deployed out of the Port of LA	CTE, FedEx Express, UPS, CEC, SCAQMD, Nikola	ZEV MOU and taskforce 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 support the deployment of medium- and heavy-duty ZEVs
Forklifts	No target	>40,000	Early market applications strategy	

¹ Includes Fuel Cell Electric Vehicles with Range Extenders

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



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

H ₂ Refueling Stations	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
70 MPa On-Site Production	1,000 by 2030 in CA	>47 open retail stations	State and private sector partnerships	California - \$2.5 billion to build ZEV charging/refueling stations including 200 hydrogen stations (includes O&M grants) ZEV mandate
70 MPa Delivered	12-20 in Northeast			
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
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

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

⁴ <5 kW (e.g., Residential Use)



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

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
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	~172 MW PEM electrolyzer capacity installed/underway	Continued government funding/cost share	State/regional (e.g., 33% renewables in CA)

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)

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)



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

		\$5-\$6/kg for low volume		
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		
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.

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

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)