



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update April 2017: United States

Name	Sunita Satyapal/Mike Mills
Contact Information	sunita.satyapal@ee.doe.gov , 202 586-2336 michael.mills@ee.doe.gov
Covered Period	Nov 2016 to April 2017

1. New Policy Initiatives on Hydrogen and Fuel Cell

Policy Decisions since last meeting:

- Administration changes:
 - Donald Trump was sworn in as President on January 20
- Organizational changes:
 - Former Governor of Texas Rick Perry was sworn in as the Energy Secretary on March 2.
- Proposed budget:
 - The President's 'skinny budget' proposed that EERE will focus on "early-stage applied energy research and development activities where the Federal role is stronger".

New Publications since last meeting:

- DOE publishes approximately 100 publications, including newsletters, success stories, news alerts, and blogs every year
- **State of the States: Fuel Cells in America 2016** was released in November 2016. The seventh in a series, the report provides a comprehensive analysis of state activities supporting fuel cell and hydrogen technology, profiles of leading states, and a catalogue of recent installations, policies, funding, and deployments around the country. <https://energy.gov/eere/fuelcells/downloads/state-states-fuel-cells-america-2016>
- **Hydrogen Fuel Quality Specifications for Polymer Electrolyte Fuel Cells in Road Vehicles:** released in November 2016. This report to the Safety, Codes, and Standards Program addresses hydrogen fuel quality specifications for PEM fuel cells in road vehicles. https://energy.gov/sites/prod/files/2017/01/f34/fcto_h2_fuel_quality_specs_pem_fc_road_vehicles.pdf



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- 5 Common Fuel Cell Myths in an example of a brief article published on the DOE website. It dispels myths about fuel cells in an effort to educate and assure the public. <https://energy.gov/eere/articles/5-common-fuel-cell-myths>

2. Hydrogen and Fuel Cell R&D Update

- Buses have achieved up to 23,000 hr durability for fuel cell power plant, exceeding 2016 target
- Fuel cell buses have surpassed 15 million passengers
- FCEVs have achieved 3,900 hr (117,000 mi) durability (4-fold increase since 2006)
- The U.S. Army will test the Colorado ZH2 in extreme field conditions next year to determine the viability of hydrogen-powered vehicles on military missions.
- Stationary Power: Improved mean electrical efficiency for fuel cells with >100 kW exceeding 2015 target
- Fuel cell forklifts have surpassed 5 million hydrogen refuelings
- Developed an 875 bar stationary pressure vessel design, which received approval by the American Society of Mechanical Engineers
- Achieved a world record of 16% efficiency in direct photovoltaic hydrogen conversion using III-V semiconductor tandem devices

3. Demonstration and Deployments Update

- Progress continues towards 100 stations in California. By March, 26 retail stations and 5 non-retail stations had opened in California and an additional 15 are in process. 12-25 retail stations are planned for the Northeast U.S. Over 1,600 miles of hydrogen pipeline are in place.
- Demand for FCEVs has increased exponentially. Through March over 1,600 FCEVs had been purchased or leased. (In July, 2016 there were 331 fuel cell vehicles registered in California.)
- H2USA: Surpassed 50 partners in H2USA and supported H2USA with National Lab experts, creating station rollout scenarios and tools to enable infrastructure plans.

4. Events and Solicitations

- **U.S. Department of Energy Hydrogen and Fuel Cells Program 2017 Annual Merit Review and Peer Evaluation Meeting:** Hydrogen and fuel cell projects funded by DOE will be presented and reviewed for their merit from June 5-9, 2017. <http://www.annualmeritreview.energy.gov/>



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- **Hydrogen and Fuel Cell Technical Advisory Committee (HTAC):** Upcoming biannual meeting will take place on May 4-5, 2017 in Washington, D.C.
https://www.hydrogen.energy.gov/htac_meeting_may17.html

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

- In January of 2017, DOE announced SimpleFuel as the winner of the \$1 million H2 Refuel H-Prize Competition. The H2 Refuel H-Prize Competition challenged America's innovators to deploy an on-site hydrogen generation system, using electricity or natural gas, to fuel hydrogen vehicles, that can be used in homes, community centers, small businesses, or similar locations. SimpleFuel's home scale refueling appliance can provide a 1-kilogram fill to vehicles in 15 minutes or less at 700 bar using hydrogen produced via electrolysis, with a cost-effective design that minimizes setback distances and reduces the physical footprint of the system.



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Summary Country Update November 2016: U.S.

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
Fuel Cell Vehicles ¹	No target	As of 2/2017, 1500 (purchased or leased)	<ul style="list-style-type: none"> • 2015 vehicle roll-out in California • Partnering with California Air Resources Board (CARB) and California Energy Commission (CEC) • \$5,000 rebate for FCEVs https://cleanvehiclerebate.org/eng 	<ul style="list-style-type: none"> • ZEV state mandate (e.g. CA); state subsidies (rebates in CA, MA, CT etc.)
FC Bus	No target	~33 (in service) 20 funded for CA	Federal Transit Authority (Department of Transportation); CARB; CEC, State of CA	
Fuel Cell Trucks	No target	Prototype testing	TBD	<ul style="list-style-type: none"> • ZEV state mandate (e.g. CA)
Forklifts	No target	As of 10/2016, >10,000 (including on order, preliminary analysis)	Early market applications strategy	
H ₂ Refueling Stations	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
70 MPa On-Site Production	No Target		State partnerships	

¹ Includes Fuel Cell Electric Vehicles with Range Extenders



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70 MPa Delivered	No Target	~ 71 stations as of 4/17 (open, constructed, or planned) 26 public retail		<ul style="list-style-type: none"> California - \$100M to 2023 or until 100 stations are built (includes O&M grants) ZEV mandate
35 MPa On-Site Production	No Target	2 as of 5/2016 (bus only stations). 70 MPa stations include 35 MPa	2 stations for bus refuelling (California)	
35 MPa Delivered				
Stationary	Target Number ²	Current Status	Partnerships, Strategic Approach	Policy Support
Small ³	No Target	Negligible	-N/A	
Medium ⁴	No Target	As of 5/2016, system capacity installed ~555 kW	-Commercial (limited govt involvement beyond tax credit)	

² Targets can be units installed and/or total installed capacity in the size range indicated

³ <5 kW (e.g., Residential Use)

⁴ 5kW – <100 kW (e.g., Distributed Residential Use) By March, 26 retail stations and 5 non-retail stations had opened in California and an additional 15 are in process. 12-25 retail stations are planned for the Northeast U.S



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Large ⁵	No Target	As of 5/2016, system capacity installed ~170 MW	--Commercial (limited govt involvement beyond tax credit)	
District Grid ⁶	No Target	As of 5/2016, system capacity installed ~25 MW	--Commercial (limited govt involvement beyond tax credit)	
Regional Grid ⁷	No Target	As of 10/23/2015, system capacity installed 30 MW	-Limited govt involvement beyond tax credit)	
Telecom backup	No target	~7,800 (including on order, preliminary analysis)	-Commercial (limited govt involvement beyond tax credit)	
H ₂ Production	Target ⁸	Current Status	Partnerships, Strategic Approach	Policy Support
Fossil Fuels ⁹	\$4/kg (produced, delivered, dispensed)	~\$5/kg to \$7.5 (at high volume from distributed natural gas)	Limited govt partnerships (commercial/industry focused)	• Limited

⁵ 0.1MW – <10 MW (e.g., Industrial Use)

⁶ 10MW – <30 MW (e.g., Grid Stability, Ancillary Services)

⁷ 30MW plus (e.g., Grid Storage and Systems Management)

⁸ Target can be by quantity (Nm³, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target

⁹ Hydrogen produced by reforming processes



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		\$13-\$16/kg (low volume)		
Water Electrolysis ¹⁰ (PEM, Alkaline, SOEC)	44 kWh/kg	~50 to 55 kWh/kg	Continued govt funding/cost share	<ul style="list-style-type: none"> Limited (e.g. state dependent; e.g. 33% renewables in CA)
By-product H ₂	N/A			
Energy Storage from Renewables	Target¹¹	Current Status	Partnership, Strategic Approach	Policy Support
Power to Power ¹² Capacity	N/A		In process	
Power to Gas ¹³ Capacity	N/A		In process	

¹⁰ Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)

¹¹ Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity

¹² Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity

¹³ 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)