INTRODUCTION AND BACKGROUND

The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy’s Fuel Cell Technologies Office leads efforts to enable the widespread commercialization of fuel cells across several application areas. In order to strengthen our nation’s energy security and improve our stewardship of the environment, the Program engages in research, development and demonstration of critical improvements in the technologies, as well as activities to overcome commercialization obstacles. The Program addresses the full range of barriers facing the development and deployment of fuel cell technologies by integrating basic and applied research, technology development and demonstration and other supporting activities. The progress in hydrogen and fuel cells discussed below is from the 2014 Annual Report of The Hydrogen and Fuel Cell Technical Advisory Committee.1

UPDATE ON MEMBER’S ENERGY FRAMEWORK

UPDATE ON RELEVANT POLICIES

After years in the shadows, hydrogen and fuel cells regained some visibility in 2014 as contributors to sustainable energy systems, whether functioning as an energy carrier; balancing intermittent solar or wind generation; or providing low or zero-emission power for homes, businesses, factories or vehicles. Relevant policy changes from the U.S. include:

• The U.S. federal tax credit for fuel cell power systems is scheduled to expire in 2016. The federal tax credit for FCEVs expired at year-end 2014.
• California extended its Self-Generation Initiative Program, arguably the most important state-level incentive for fuel cells in the United States. Utilities will contribute $83 million per year through 2019, with 75% available for fuel cells and energy storage in 2015. There is a 20% bonus for California manufacturers.
• In May, California joined many of its ZEV partners, including Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island and Vermont, in a Multi-State ZEV Action Plan to achieve 3.3 million ZEVs on the road by 2025.
Electricity Production
(Units in TWh)
Total Production: 4093

Coal: 1586 - 39% of total
Natural Gas: 1121 - 27% of total
Nuclear: 797 – 19% of total
Renewables: 533 – 13% of total
Other: 56 – 1% of total

UPDATE OVERVIEW ON RELEVANT PROGRAMS AND PROJECTS

Funding

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<th>Key Activity</th>
<th>FY 2013</th>
<th>FY 2014</th>
<th>FY 2015</th>
<th>FY 2016</th>
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Total FY15 Budget: ~$180M

Figure 1. DOE funding for hydrogen and fuel cells R&D.

Highlights of Progress

- The U.S. Department of Transportation made funds available for low or zero-emission buses, and in early 2015 it awarded $18.6 million: 6 for 10 fuel cell buses—five each for transit agencies in California and Ohio.

- DOE is funding demonstrations in small numbers of terminal tractors, medium-duty delivery vans, a bucket truck, cargo tuggers (Fig. 3), and power units for refrigerated trailers. Budget for these market transformation programs was about $3 million in 2014.

- In California, more than 50 stations were open or in progress at year-end, after the California Energy Commission awarded $46.6 million in May for 28 stations and a mobile refueler. A start-up, FirstElement Fuel, won financing for 19, with support from Toyota (at least $7.2 million) and Honda ($13.8 million).

- In November, Toyota and Air Liquide announced plans to build 12 stations in the Northeast, in states that have adopted California’s Zero Emission Vehicle (ZEV) program.

Figure 2. The Dominion Bridgeport fuel cell park, consisting of five FuelCell Energy power plants. Image courtesy of FuelCellEnergy, Inc.
HYDROGEN R, D&D SPECIFICS

PROGRAMS, PROJECTS, INITIATIVES IN BRIEF

Status and Accomplishments

Significant progress in DOE-funded research in 2014 includes the following:

• Two national laboratories reported development of a new catalyst structure called a nanoframe that offers potential for more than 30x improvement in catalyst activity (Fig. 3). DOE estimates that catalyst costs represent nearly half of stack costs. DOE invested nearly $13 million in fuel-cell-catalyst-related R&D in FY 2014.

• Improvements allowed one membrane electrode assembly (MEA) to achieve DOE’s 2014 target for specific power levels, though not the durability target. (Other MEAs had met the durability target but not the specific power target.)

• DOE reported a new fueling strategy to improve station capacities during peak hours. The technique reduces on-site compression requirements, yielding a 14% cost reduction for tube trailer hydrogen delivery.

• DOE also reported a continued improvement in carbon fiber tensile strength, which is important for high-pressure storage vessels.

• In hydrogen production, DOE reported improvements in electrolyzer drying techniques, in stability of photoelectrochemical devices, in reactor design for biological production and in solar thermochemical materials and concepts.

• The number of fuel-cell-related patents remained strong in 2014, with 658 patents granted through three quarters, an increase of 36 year-over-year. Toyota, Honda, and General Motors led the way.

• The cumulative number of patents resulting from DOE research exceeded 500.

Figure 3. Platinum-nickel alloy nanoframe covered by a thin platinum skin, a new catalyst structure developed by researchers at Argonne National Laboratory and Lawrence Berkeley National Laboratory. Printed in Science (343: 6177), 2014; pp.1339-1343.
Status of Market Introduction of Hydrogen and Fuel Cells

The current status of Fuel Cell Research and DOE targets are shown in Figure 4.

ENDNOTES


2. Source: [http://www.eia.doe.gov](http://www.eia.doe.gov)

REFERENCES

Member Website


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