



October 19, 2023

DOE Appropriations for Hydrogen and Fuel Cell Activities: FY2024

The U.S. Department of Energy (DOE) Hydrogen Program addresses the development of applications that use hydrogen in place of today’s fuels to provide modern energy services. The program also considers hydrogen as an established industrial chemical, for example, in petroleum refining. The DOE program includes over 400 projects involving research and development (R&D), systems integration, and demonstration and deployment activities—collectively performed by universities, national laboratories, and industry. These activities cover the energy value chain starting with producing hydrogen from diverse feedstocks; transporting and storing it; and finally using it in various applications. The program is led by the Hydrogen and Fuel Cell Technologies Office (HFCTO) within the DOE Office of Energy Efficiency and Renewable Energy (EERE).

A future “hydrogen economy” using hydrogen as an energy carrier and fuel could offer an alternative to today’s economy with its prevalent combustion of fossil fuels. Initially thought of as a new technology for personal mobility services (e.g., cars) and high-value applications such as provision of electric power during space flight, hydrogen now is receiving attention for industrial processes, heavy vehicles, forklifts, portable power, and buffering and balancing of electric power. In addition to annual appropriations on hydrogen, legislation enacted in the 117th Congress funded hydrogen programs and provided incentives for production of hydrogen that meets certain criteria. For more information, see CRS Report R47487, *The Hydrogen Economy: Putting the Pieces Together*, by Martin C. Offutt.

Federal Hydrogen Programs

Authorizing Legislation

The Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976 (P.L. 94-413) authorized a federal hydrogen program, initially at the National Science Foundation. Congress transferred overall management responsibility of the hydrogen program to DOE with the Spark M. Matsunaga Hydrogen Research, Development, and Demonstration Program Act of 1990 (P.L. 101-566). The Energy Policy Act of 2005 (EPA, P.L. 109-58) and its amendments, including the Infrastructure Investment and Jobs Act (IIJA, P.L. 117-58), further defined the program’s scope and purpose.

The DOE Program

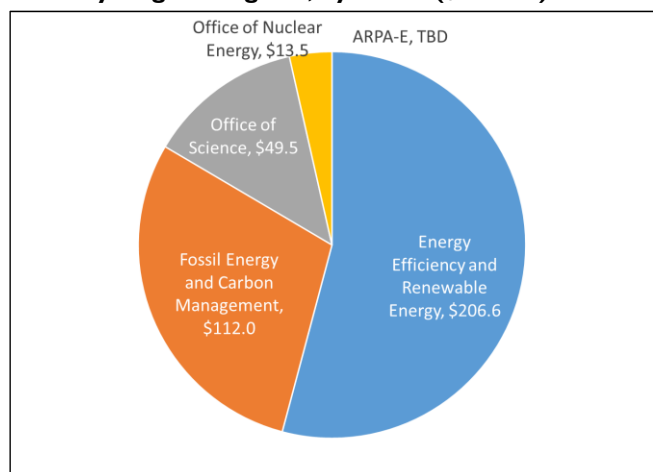
The DOE Hydrogen Program includes several offices with responsibility for supporting hydrogen work based on different sources of energy (e.g., renewable, fossil, nuclear) and types of end-use (e.g., vehicles, portable power,

thermal comfort). DOE’s June 2023 *National Clean Hydrogen Strategy and Roadmap* envisages 10 million metric tons of new production of hydrogen by 2030, further stipulated to be clean hydrogen as defined in statute and DOE regulation. The *Strategy and Roadmap* has three focal points: increasing the use of industrial applications, including heavy-duty transportation and energy storage; reducing the cost of clean hydrogen; and developing regional networks through the Regional Clean Hydrogen Hubs (\$40314 of IIJA). DOE’s “Hydrogen Shot” goal for the cost of hydrogen is \$1 per kilogram by 2031, not including delivery and dispensing, for production using electrolyzers that split water to make the hydrogen. Currently the cost of hydrogen made with electrolyzers is roughly \$5/kg.

DOE Spending

Within DOE, two offices—EERE and the Office of Fossil Energy and Carbon Management—were responsible for executing over 80% of DOE’s budget authority on hydrogen and fuel cells from the FY2023 annual appropriation. The Office of Nuclear Energy and Office of Science received smaller amounts. The DOE-wide total was \$437.5 million in FY2023, including \$20.0 million announced by ARPA-E (Advanced Research Projects Agency-Energy) in September 2023.

Figure 1. FY2024 President’s Budget Request for the DOE Hydrogen Program, by Office (\$million)



Source: Department of Energy FY2024 Congressional Justification: Vol. 2: Crosscutting Activities, March 2023. ARPA-E funding for hydrogen is determined annually based on programs developed through office and stakeholder priorities and defined, in part, by the proposals it receives and awards.

For FY2024, the President’s budget request included \$381.6 million (see **Figure 1**). The House Appropriations

Committee reported H.R. 4394, the Energy and Water Development and Related Agencies Appropriations Act, 2024, on June 30, 2023. The bill text and accompanying report (H.Rept. 118-126) did not specify a DOE-wide total for hydrogen programs. On July 20, 2023, the Senate Appropriations Committee reported S. 2443, the Energy and Water Development and Related Agencies Appropriations Act, 2024, and recommended not less than \$390.0 million for the DOE-wide total (S.Rept. 118-72). In addition to annual appropriations, DOE received but has not yet obligated funds from the IIJA. These unexpended balances include funds for the seven Regional Clean Hydrogen Hubs (IIJA §40314) announced on October 13, 2023—a program which received \$1.6 billion in each of FY2022 through FY2024. Unexpended balances also include funds for two programs—Clean Hydrogen Manufacturing and Recycling Research, Development, and Demonstration; and Clean Hydrogen Electrolysis—which received \$300 million in each of FY2022 through FY2024. DOE began the procurement process in March 2023 for the first \$750 million of these latter two programs and anticipates award negotiations to occur in winter 2023/2024.

For FY2024, the House Appropriations Committee included \$138.0 million for HFTO, \$25.1 million below the President’s request, while the Senate Appropriations Committee included \$163.1, the same as the President’s request. The funding for HFTO makes up the majority of the pie slice for EERE in **Figure 1** and in prior-year appropriations. Within Vehicle Technologies, the House Appropriations Committee recommended \$10.0 million for novel, more efficient hydrogen combustion engines—a figure that was not in the President’s request.

Where DOE Spends the Money

DOE’s Hydrogen Program awards grants, contracts, and cooperative agreements to investigators at universities, industry, and national laboratories. This supports more than 400 projects. These include R&D focused on the hardware, such as the fuel cell, for a hydrogen economy. R&D is intended to reduce cost and improve performance of production and end-use technology and other parts of the hydrogen value chain. The projects also include work at higher levels of integration, such as to validate first-of-a-kind systems, reduce technological risk, and address the other aspects of a hydrogen economy (e.g., safety, codes and standards, and workforce development). In H.Rept. 118-126, the House Appropriations Committee encouraged DOE to examine the potential of hydrogen to provide power for electric vehicle charging in grid-constrained locations.

Hydrogen Programs at Non-DOE Federal Agencies

DOE’s HFTO has a coordinating role for hydrogen activities across the executive branch. Several other agencies—the Department of the Army, National Aeronautics and Space Administration, and Department of the Navy, among others—administer hydrogen programs. DOE estimates that, for FY2022 and FY2023 combined, projects funded by non-DOE hydrogen programs totaled over \$70.0 million, an increase of roughly \$30.0 million from combined FY2019 and FY2020. The projects range

from basic research on fuel cells to activities aimed at early deployment, including demonstrations of fuel cells in applications such as fork lifts and unmanned underwater and aerial vehicles.

P.L. 117-169, commonly known as the Inflation Reduction Act of 2022 (IRA), created the Clean Hydrogen Production Tax Credit in Internal Revenue Code Section 45V (IRC 45V, §13204). The Treasury Department issued Notice 2022-58 in November 2022 for comment on implementing the IRC 45V tax credit. As of mid-October 2023, the Treasury Department had not issued the guidance. The Senate Appropriations Committee (S.Rept. 118-72) instructed DOE to support updates to GREET, the model the IRA requires be used to determine if the well-to-gate emission of greenhouse gas emissions are below the threshold for eligibility for the tax credit.

Recent Developments

The IIJA authorized the Secretary of Energy to publish an initial standard for the “carbon intensity of clean hydrogen production” (CHP) and to review it at five-year intervals. DOE issued its guidance in June 2023 and arrived at a standard of 4 kilograms carbon dioxide equivalent (kg CO₂-equivalent) per kilogram hydrogen (kg H₂). Like the IRC 45V credit, this applies to the well-to-factory-gate CO₂ emissions and is the same regardless of the primary source of energy. The 4-kg-CO₂ level of the CHP standard is the same as the upper threshold of the IRC 45V tax credit, with the latter corresponding to \$0.60 per kg H₂ produced. The CHP standard applies to the Regional Clean Hydrogen Hubs (IIJA §40134) and other activities carried out under EAct Title VIII—Hydrogen.

DOE announced \$48 million in funding for projects on advanced clean hydrogen technologies on September 20, 2023. DOE envisages these investments as complementary to the IRC 45V tax credit and the Regional Clean Hydrogen Hubs in realizing the Hydrogen Shot goal of \$1 per kilogram of hydrogen produced by 2031.

Congressional Considerations

Both appropriations committees stated that DOE should coordinate hydrogen and fuel cell programs across DOE offices. The Senate committee also expressed concern about the number of coordination mechanisms, including crosscuts and Earthshots, such as the Hydrogen Shot discussed above, and would direct DOE to simplify and consolidate these into one function.

The IIJA required that DOE consider a number of goals (e.g., long-term employment) for the Regional Clean Hydrogen Hubs and established timetables for DOE’s implementation of these hubs. How and to what extent DOE implements these goals and how quickly it obligates IIJA funding may be of continued interest to Congress. The IIJA set a higher target for the cost of hydrogen than DOE’s Hydrogen Shot cost goal, each on different timescales. How these two goals align in practice may also be of interest to Congress.

Martin C. Offutt, Analyst in Energy Policy

Disclaimer

This document was prepared by the Congressional Research Service (CRS). CRS serves as nonpartisan shared staff to congressional committees and Members of Congress. It operates solely at the behest of and under the direction of Congress. Information in a CRS Report should not be relied upon for purposes other than public understanding of information that has been provided by CRS to Members of Congress in connection with CRS's institutional role. CRS Reports, as a work of the United States Government, are not subject to copyright protection in the United States. Any CRS Report may be reproduced and distributed in its entirety without permission from CRS. However, as a CRS Report may include copyrighted images or material from a third party, you may need to obtain the permission of the copyright holder if you wish to copy or otherwise use copyrighted material.