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Updated March 21, 2024

# DOE Appropriations for Its Hydrogen Program: 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 projects 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 (HFTO) within the DOE Office of Energy Efficiency and Renewable Energy (EERE) with participation by other DOE offices.

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. 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 (EPAct, P.L. 109-58) and its amendments, including the Infrastructure Investment and Jobs Act (IIJA, P.L. 117-58), further defined the DOE program's scope and purpose.

### The DOE Program

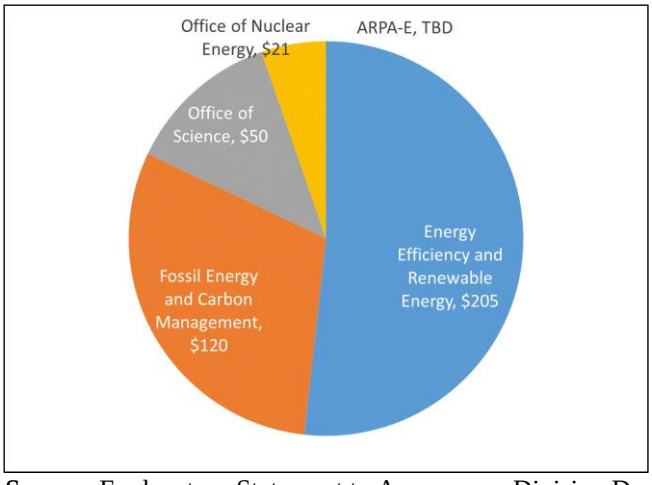
Participants in the DOE Hydrogen Program include several offices with responsibility for supporting hydrogen work based on different sources of energy (e.g., renewable, fossil, nuclear) and types of end-use (e.g., vehicles, portable power, thermal comfort). DOE's June 2023 *National Clean Hydrogen Strategy and Roadmap* envisages 10 million metric tons of new production of hydrogen per year 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 (IIJA §40314). DOE's "Hydrogen Shot" goal for the cost of hydrogen is $1/kg 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 Budget Authority

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 the Office of Science received smaller percentages. In FY2023, the DOE total budget authority for hydrogen was $437.5 million, including $20.0 million announced by ARPA-E (Advanced Research Projects Agency-Energy) in September 2023.

For FY2024, the President's budget request for the DOE hydrogen program was $381.6 million. In the joint explanatory statement accompanying the Consolidated Appropriations Act, 2024 (P.L. 118-42), Congress directed $396.0 million (**Figure 1**) for the crosscutting initiative on hydrogen. In addition to FY2024 annual appropriations, DOE received all hydrogen-related appropriations from

**Figure 1. FY2024 Appropriation for the DOE Hydrogen Program, by Office ($million)**




**Source:** Explanatory Statement to Accompany Division D of the Consolidated Appropriations Act, 2024, P.L. 118-42. 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.

the IIJA for FY2022 through FY2024. These include funds for two programs—Clean Hydrogen Manufacturing and Recycling Research, Development, and Demonstration; and Clean Hydrogen Electrolysis—which together received $300 million for each of FY2022 through FY2024. In July 2023, DOE accepted applications for the first $750 million in funding for these two programs and has not announced awards to date. The IIJA also appropriated $8 billion for Regional Clean Hydrogen Hubs, awards for which are in negotiations.

In the joint explanatory statement accompanying the Consolidated Appropriations Act, 2024, (P.L. 118-42) Congress directed $170.0 million for HFTO, nearly $7 million above the President's request. The funding for HFTO makes up the majority of the pie slice for EERE in **Figure 1** (as well as the majority of prior-year appropriations). As incorporated by reference in the joint explanatory statement, H.Rept. 118-126 directed that $10.0 million in the Vehicle Technologies control point be used to research 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 over 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 forklifts 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). The Department of the Treasury published a notice of proposed rulemaking (NPRM) and notice of public hearing on December 26, 2023, for implementing 45V. In S.Rept. 118-72, the Senate Appropriations Committee instructed DOE to support updates to Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET), the model the IRA requires to be used to determine whether the "well-to-gate" greenhouse gas (GHG) emissions meet the threshold for eligibility for the tax credit and at what dollar-level. Further information is available in CRS In Focus IF12602, *The Clean Hydrogen Production Credit: How the Incentives are Structured*, by Nicholas E. Buffie and Martin C. Offutt. The NPRM raised the possibility that GREET could be updated one or more times per year.

## Recent Developments

On February 9, 2024, ARPA-E announced the awarding of $20.0 million of FY2023 funds for geologic hydrogen for 16 projects. One-half the amount of the awards went to universities and roughly one-quarter each to the private sector and DOE national laboratories. The projects collectively would address two areas. In one area, projects would consider management of reservoirs of naturally-occurring hydrogen—roughly two-thirds of funds. In a second area, projects would focus on the subsurface production of hydrogen through stimulated mineralogical processes—roughly one-third of funds. ARPA-E also announced the awarding of funds to Argonne National Laboratory to develop GREET further to include additional pathways for manufacturing hydrogen.

On October 13, 2023, DOE announced it was entering award negotiations with seven finalists for the Regional Clean Hydrogen Hubs (IIJA §40314) for a total award value of $7 billion. On January 17, 2024, DOE announced that it had selected a consortium to receive $1 billion for a Demand-side Support Initiative as part of the Regional Clean Hydrogen Hubs. The Hubs received $1.6 billion in appropriated funds in each of FY2022 through FY2024.

## Congressional Considerations

H.Rept. 118-126 and S.Rept. 118-72 directed that DOE coordinate hydrogen and fuel cell programs across DOE offices. S.Rept. 118-72 noted the number of coordination mechanisms, including crosscuts and "Earthshots," such as the Hydrogen Shot discussed above, and directed DOE to simplify and consolidate these into one function.

The 45V tax credit, and how much of it taxpayers will be able to claim in the Regional Clean Hydrogen Hubs, may be of interest to Congress. The development and updating of the GREET model could inform adjustments to which projects are eligible for the 45V credit and at what dollar-level; this may be of continued interest to Congress. The IIJA required that DOE consider a number of goals (e.g., long-term employment, geographic diversity) 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.

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