



## ***Advancing toward a clean energy and industrial future***

The U.S. Department of Energy (DOE) is supporting a whole-of-government approach to addressing climate change while protecting public health and creating good-paying jobs. The Biden Administration's [Investing in America agenda](#) has accelerated the adoption of technologies and tools that will help the United States achieve a zero-carbon American power sector by 2035 and net-zero greenhouse emissions by 2050.

DOE's [Office of Fossil Energy and Carbon Management \(FECM\)](#) is coordinating with multiple offices across the Department and other federal agencies to accelerate the production of clean hydrogen in support of moving toward a clean energy and industrial future. FECM's Hydrogen with Carbon Management Program invests in research, development, and demonstration to evaluate carbon-based clean hydrogen production coupled to [carbon capture and storage](#).

The program also supports the development of technologies to use clean hydrogen from any source. It plays an integral role in one of DOE's Energy Earthshot Initiatives, the [Hydrogen Shot](#), which seeks to reduce the cost of clean hydrogen production by 80% to \$1 per 1 kilogram in one decade to expand new, clean hydrogen pathways in the United States.

### **Overview**

Hydrogen, a clean fuel, is the most abundant element in the universe. It occurs naturally on the earth in compound form, and it can be used in a fuel cell or a gas turbine to create electricity with only water and heat as byproducts. Clean hydrogen can be produced from zero-emissions electricity generated by wind, solar, geothermal, and nuclear energy. It can also be produced through the conversion of leak-tight natural gas, wastes such as municipal solid waste and plastics, and sustainably sourced biomass, while capturing and permanently storing geologically the carbon dioxide created during the conversion process.

However, currently more than 95% of the roughly 10 million metric tons of hydrogen produced in the United States comes from natural gas without the capture and geologic storage of carbon dioxide, which results in significant greenhouse gas emissions. This is why advancing clean hydrogen production is important to helping the nation speed its trajectory toward a net-zero future.

As outlined in the [U.S. National Clean Hydrogen Strategy and Roadmap](#), achieving commercial-scale hydrogen deployment is critical to building a strong clean energy economy in the United States. Estimates indicate that America's growing hydrogen economy has the potential to add 100,000 net new direct and indirect jobs by 2030.

### **New investments will spur innovation and implementation in technologies to advance clean hydrogen with carbon management**

The production, processing, delivery, storage, and end-use of clean hydrogen, including innovative uses in the industrial sector, are crucial to DOE's strategy for achieving the Administration's climate goals.

On October 13, 2023, DOE announced [\\$7 billion to launch seven regional clean hydrogen hubs](#) across the nation and accelerate the commercial-scale deployment of low-cost, clean hydrogen. The hydrogen hubs are expected to collectively produce three million metric tons of hydrogen annually, reaching nearly a third of the 2030 U.S. production target and lowering emissions from hard-to-decarbonize industrial sectors that represent 30 percent of total U.S. carbon emissions.

In addition to supporting DOE's hydrogen portfolio and providing technical assistance on any carbon management equities, FECM has announced investment opportunities of over \$128 million in approximately 78 projects since January 2021 that advance the research, development, and demonstration of clean hydrogen with carbon management (*as of October 10, 2023*).

FECM is leveraging innovative approaches to produce clean hydrogen at lower costs from materials that include municipal solid waste, legacy coal waste, waste plastics, and biomass with carbon capture and storage. FECM is also developing gas turbine combustion systems to accommodate hydrogen and hydrogen-natural gas fuel blends while minimizing nitrogen oxide emissions and maintaining efficiency.

Included below are a few of the most recent announcements. View all of FECM's announcements [here](#).

- On **September 12, 2023**, FECM announced [\\$19 million](#) for research that will develop cutting-edge technology solutions to make clean hydrogen a more available and affordable fuel for electricity generation, industrial decarbonization, and transportation.

- On **September 7, 2023**, FECM announced [\\$6.4 million for university-based research and development projects](#) that will develop advanced materials and components to improve the performance of hydrogen-fueled turbines.
- On **August 17, 2023**, FECM announced the award of [\\$34 million to 19 industry- and university-led research projects](#) that will advance cutting-edge technology solutions to make clean hydrogen a more available and affordable fuel for electricity generation, industrial decarbonization, and transportation.
- On **September 13, 2022**, FECM announced [\\$4.7 million for six projects](#) to advance the development of ceramic-based materials to improve the efficiency of hydrogen-fueled turbines that may one day be used in clean power plants.
- On **August 26, 2022**, FECM announced [\\$28.9 million to 15 industry- and university-led projects](#) that will support clean hydrogen uses for a more available and affordable fuel for electricity generation, industrial decarbonization, and transportation fuel.
- On **May 19, 2022**, FECM announced [\\$24.9 million for six research and development projects](#) to support the advancement of clean hydrogen for electricity generation.

In addition, FECM is collaborating with offices across DOE, including the Office of Clean Energy Demonstrations, the Loan Program Office, and the Office of Technology Transitions, to advance hydrogen with carbon management and ultimately achieve the Administration's climate goals. These investments and partnerships will, over time, result in the elimination of hundreds of millions of tons of carbon dioxide emissions every year. These efforts will also benefit communities across the nation by improving air quality, protecting existing industrial jobs, and creating new ones.

### Commitment to meaningful engagement

FECM is committed to meaningful engagement with communities, tribes, and other stakeholders that enables them to contribute to and be active participants in local projects. Projects funded by FECM are required to develop [community benefit plans](#) that address [societal considerations and impacts](#) and ensure continuous stakeholder engagement throughout the lifecycle of the project.

FECM is also partnering with communities and regions across the country to help drive economic development, technological innovation, and high-wage jobs as the United States works toward building a clean energy and industrial economy. In August 2023, FECM announced its intent to launch a "[Responsible Carbon Management Initiative](#)" to encourage all project developers and others in the industry to pursue the highest levels of safety, environmental stewardship, accountability, community engagement, and societal benefits in carbon management projects.

### Five key things to remember:

1. Carbon management currently offers the lowest cost way to produce low-carbon hydrogen at scale, which will be essential for achieving a zero-carbon emissions American power sector by 2035 and net-zero greenhouse gas emissions by 2050.
2. Every hydrogen hub with carbon management has the potential to grow into broader industrial decarbonization hubs, including the buildout of shared carbon transport and storage and clean electricity infrastructure that enables industry to decarbonize more rapidly.
3. DOE clean hydrogen investments help enable additional pathways for existing infrastructure to decarbonize in the near-term.
4. DOE is supporting the development of methane mitigation and carbon management technologies and the application of measurement, monitoring, reporting, and verification of greenhouse gas emissions across the natural gas value chain to help ensure that future hydrogen production from natural gas results in near-zero methane emissions and is as fully decarbonized as possible.
5. Hydrogen hubs will help communities build technical capacity and retain and develop their local skilled workforces.

Learn more about FECM's hydrogen with carbon management portfolio and investments by signing up for [FECM news alerts](#) and visiting the [FECM website](#) to read all of the latest announcements.