HYDROGEN ENERGY & FUEL CELLS

Technology & Innovation

America leads the world in developing innovative solutions to tough challenges. It's time to turn our attention to hydrogen.

The challenge of reaching net carbon neutrality by 2050 cannot be achieved with today's energy mix alone. It will require dramatic transformations of the way our nation produces and consumes energy and the wide-scale deployment of game-changing technologies. Hydrogen energy is a key component of this strategy.

Hydrogen offers a unique solution to drive deep emissions reductions in energy-intensive, hard-to-decarbonize sectors of the economy, including shipping, aviation, and industrial applications like steel manufacturing. Hydrogen energy and fuel cell technologies are already playing a critical role in decarbonizing the transportation, power generation, and industrial sectors as well as improving energy grid reliability. As the industry continues to mature, the U.S. has an opportunity to establish itself as a leader in advanced global decarbonization—but concentrated investment and policy support will be crucial to unlocking this potential.

HYDROGEN TECHNOLOGY EXPLAINED

HYDROGEN ENERGY

Pure hydrogen is an energy-dense fuel source that is uniquely well-suited to replace fossil fuels as a fuel or feedstock in applications where renewable energy cannot meet high heat requirements. Hydrogen energy can be delivered using existing pipeline infrastructure, reducing the need for new construction to unlock its benefits.

Current Applications: Limited pilot testing as a fuel feedstock for industry and chemical production; limited demonstration of blending with natural gas for residential and commercial heating needs.

Transformative Potential: Widespread use as a fuel and feedstock for industry and as an alternative fuel in shipping and aviation; full replacement of fossil fuels for residential and commercial heating.

FUEL CELLS

Fuel cells convert hydrogen and ambient oxygen into efficient, low-carbon electricity using a wide range of fuels, including pure hydrogen and other hydrocarbons (e.g., biogas, methanol, etc.). Fuels cells can be combined to provide a scalable, flexible power source across a wide range of applications.

Current Applications: Expanding deployment in material handling equipment and passenger vehicles; expanding deployment as a source of distributed power.

Transformative Potential: Broader deployment in heavy duty and passenger vehicles to complement battery electric vehicles; broader deployment in in grid-scale energy storage to fully decarbonize the transportation sector and electricity grid.

Hydrogen + Carbon Capture: Complementary Pathways to Carbon Neutrality

Hydrogen energy produced using natural gas plus carbon capture, storage and utilization (CCUS) technology offers an innovative, advanced decarbonization solution—leveraging plentiful domestic energy resources to produce the low-carbon hydrogen needed to fuel emissions reductions across a wide range of hard-to-decarbonize industries.

FCHEA
Fuel Cell & Hydrogen Energy Association

For more information, please visit https://www.fchea.org/hydrogenbonds

ACHIEVING CARBON NEUTRALITY

Hydrogen energy and fuel cells offer a singular opportunity to achieve deep emissions reductions in difficult-to-decarbonize sectors of the economy.

Hydrogen energy is the best option to:

Replace fossil fuels in high-heat industrial processes like steel and cement production.

Decarbonize residential energy use as a low-carbon natural gas and heating oil replacement.

Develop low-carbon aviation and shipping fuels, either as a fuel or feedstock for fuel production.

Fuel cells are the best option to:

Replace long-haul trucking and passenger vehicles with zero-emissions, quick refueling fuel cell vehicles (FCVs), which provide an important complement to battery electric vehicles for long-haul trucks and for drivers without the ability to recharge at home.

Support a decarbonized electricity grid and enable increased renewable generation by providing seasonal storage and dispatchable power during periods of surge demand or low renewable generation.

CASE STUDY: Decarbonizing Steel Production with Hydrogen Energy

Pilot projects are already demonstrating the potential of hydrogen to decarbonize the U.S. iron and steel industry. Midrex Technologies is installing Direct Reduced Iron (DRI) plants that can use up to 30% supplemental hydrogen energy as a feedstock, while the University of Utah is a developing a flash-iron DRI-process pilot plant that can meet 100% of its heat requirements with hydrogen energy. As legacy steel plants reach the end of their service life, replacing them with hydrogen-powered alternatives represents one of few options to decarbonize the steel industry—and remove up to 40 MMT of CO_2 per year.

POLICY SUPPORT

Policy support can drive the deployment of lower emissions hydrogen energy and accelerate the development of no-carbon hydrogen as a decarbonization solution.

The hydrogen industry is actively working to innovate, test, commercialize, and deploy lower-emissions and clean hydrogen technology. Policymakers can support these efforts by:

- Supporting hydrogen fuel and fuel cell technology development with tax incentives.
- Supporting hydrogen fueling infrastructure deployment.
- Funding and engaging in public-private partnerships (e.g., DOE Hydrogen Program) to support research, development, demonstration, and deployment of clean hydrogen energy.
- Including hydrogen-based options in government procurement.

Data and assumptions discussed in this fact sheet are based on McKinsey & Co.'s Roadmap to a U.S. Hydrogen Economy report. For more information and full citations, please visit https://www.fchea.org/hydrogenbonds