

HYDROGEN ENERGY & FUEL CELLS

Climate & Emissions Benefits

Hydrogen is an important piece of the solution to achieve carbon neutrality by 2050.

Achieving carbon neutrality by 2050 will require a dramatic transformation of the way we produce and consume energy, including an urgent need for solutions to reduce emissions from the most difficult-to-decarbonize sectors of the economy. We cannot reach this low-carbon future without hydrogen energy and fuel cell technologies.

New innovations are unlocking the singular potential of hydrogen energy to generate the high-heat required to replace fossil fuels in difficult-to-decarbonize industrial processes, and hydrogen fuel cells are already replacing carbon-intensive fuels in the transportation and power sectors. Hydrogen is a clear pathway to meeting the climate challenge, both today and in the future.

CURRENT CLIMATE BENEFITS

Hydrogen fuel cell energy is reducing transportation and electricity emissions.

Hydrogen fuel cells are playing a transformative role in the transportation sector, which accounts for more than a third of all U.S. carbon emissions. Hydrogen fuel cells provide a lower-emissions alternative to gasoline and diesel-powered internal combustion engines in trucks, passenger vehicles, and forklifts, thanks to their quick fueling times, long distance range, and low vehicle weight.

Climate and public health benefits: By 2050, greater fuel cell deployment could reduce carbon emissions in the U.S. transportation sector by **30%** and lower NO_x emissions by **36%**.

Hydrogen energy is also decarbonizing distributed power generation by replacing traditional diesel generators. In data centers, telecommunication towers, and microgrids across the country, fuel cells provide backup and off-grid power with fewer emissions, less air and noise pollution, and increased reliability.

By 2050, hydrogen energy and fuel cell technologies can eliminate...

30% of transportation CO₂ emissions

36% of harmful NO_x emissions

16% of all U.S. CO₂ emissions

...helping the country achieve carbon neutrality.

Hydrogen can unlock even more efficient use of renewable energy sources.



Renewable-produced hydrogen is a complement to the investments the country has made in building out renewable electricity generation. Clean hydrogen can provide energy storage for intermittent renewable generation and a reliable source of dispatchable power to help support a decarbonized grid.

FUTURE CLIMATE BENEFITS

A low-carbon hydrogen future can help solve the problem of difficult-to-decarbonize sectors.

Low-carbon hydrogen — produced using renewable energy, or by capturing and storing emissions from hydrogen production — holds immense potential as an alternative low-carbon fuel and industrial feedstock for difficult-to-decarbonize sectors.

A rapid scale-up of low-carbon hydrogen production and use could **directly reduce U.S. carbon emissions 16% by 2050**. In the coming decades, low-carbon hydrogen can:

- **Create a pathway toward global decarbonization targets** in the shipping and aviation sectors.
- **Provide a low-carbon alternative to coal and natural gas** as a feedstock in steel, cement, and chemicals production.

CASE STUDY: Harnessing Clean Hydrogen for Sustainable Agriculture



Real-world projects to harness the climate benefits of renewable hydrogen are underway. The University of Minnesota is developing the capability to use zero-carbon electrolytic hydrogen to convert wind energy into ammonia for use as a nitrogen fertilizer in local agriculture. Ammonia produced using renewable electrolytic hydrogen can significantly reduce emissions from agriculture — a notoriously difficult-to-decarbonize sector of the economy — compared to current fossil fuel-based methods of fertilizer production. Ongoing R&D efforts could soon deliver low-carbon ammonia at costs that are competitive with fossil fuel-derived ammonia.

POLICY SUPPORT

Policy support can drive the deployment of lower emissions hydrogen energy and accelerate the development of low-carbon hydrogen.

The hydrogen industry is actively working to innovate lower-emissions and clean hydrogen technologies and deploy them at commercial scale. Policymakers can support these efforts by:

- Facilitating hydrogen fuel and fuel cell deployment at-scale with smart regulation and rulemaking.
- Ensuring that IRA and IIJA funding administered by federal agencies is deployed quickly and managed responsibly.
- Investing in the systems needed to support hydrogen deployment at scale, including fueling infrastructure.
- Making systemic changes to support a hydrogen economy, including permitting reform and updating and harmonizing technical codes and safety standards.
- Including hydrogen-based options in government procurement.