

# 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<sub>x</sub> 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 CO<sub>2</sub> emissions

**36%** of harmful NO<sub>x</sub> emissions

**16%** of all U.S. CO<sub>2</sub> 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, 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.