

HYDROGEN FORWARD

Clean Hydrogen: Zero-Carbon Fuel for Heat Decarbonization

Energy for heating and cooling, or thermal energy, [accounts for 39% of energy-related CO2 emissions globally](#). In the United States, heating and cooling comprise 25% of total energy use for the residential, commercial, and industrial sectors at a cost of \$270 billion each year. To achieve net-zero economy-wide, the U.S. will need to deploy cleaner heating solutions, including clean hydrogen. Clean hydrogen can either be combusted or used in a fuel cell to generate power and heat for residential, commercial, and industrial applications, including process or space heat. Hydrogen emits no greenhouse gases (GHG) when it is used to generate energy, which is why it is considered a key solution to achieving net-zero across the economy. Let's take a closer look at clean hydrogen's potential as a decarbonized heating solution.

Industrial Process Heat

Industrial process heat is used in nearly every sector of the economy to produce many of the goods and products that we interact with on a day-to-day basis. Most of the process heat today is produced using fossil gases, including natural gas and liquid petroleum gas (LPG).

[According to IEA Bioenergy](#), hydrogen can be used as a key solution for process heat, offering a "relatively smooth integration into, or replacement of, process heat systems based on fossil gases." When combusted, hydrogen can provide the high temperatures manufacturers need to produce the goods our society depends on. To become a

viable option for industrial process heat, the cost of clean hydrogen will [need to be reduced to \\$1 per kg](#) by expanding production capacity and distribution infrastructure to achieve economies of scale. The [U.S. Department of Energy Hydrogen Earthshots Initiative](#) was launched to help achieve that price point within the next decade.

Residential and Commercial Space Heating

Clean hydrogen can be used in the same way that natural gas is currently used to heat space and water in homes and businesses across the country but without emitting GHGs. Clean hydrogen can be blended and distributed in existing gas pipeline infrastructure as a short-term solution to decarbonize the gas system. Several gas utilities throughout the U.S. are studying hydrogen blending and beginning to [test the application through pilot and demonstration projects](#). Using existing gas infrastructure can lower overall costs of the energy transition, avoid stranded assets, and provide a long-term pathway to retain union jobs in the gas industry.

DID YOU KNOW? The University of California, Riverside and the California Public Utilities Commission found that blends of up to 5% hydrogen in the natural gas stream is generally safe? In fact, end-use appliances, like stoves and water heaters, could accept up to 5% blends without any modifications required.

Process heat is used to manufacture nearly everything around us, including:

Steel	Jewelry	Plastics
Automotive Parts	Ceramics	Cement
Glass	Textiles	Cosmetics
Appliances	Defense Equipment	Electronics
Chemicals	Pipes & Tubes	Weapons & Armaments
Paint	Beverages	Farm & Heavy Equipment
Ores and Minerals	Machinery	Aerospace Components
Food	Asphalt Paving	Paper Products
Computer Chips	Composite Materials	Medical Products
Rubber		

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As the hydrogen blending percentage exceeds 5%, some modifications to appliances and infrastructure will likely be required to accommodate the increase in hydrogen supply. To prepare, appliance manufacturers could make [new gas boilers, stoves and water heaters “hydrogen-ready”](#) to accept varying levels of natural gas-hydrogen blends.

Here are a few of the hydrogen heating projects underway:

[HyGrid Project](#): National Grid and the Town of Hempstead have announced a joint project to build one of the first and largest clean hydrogen projects in the U.S. The HyGrid Project, located on Long Island, will aid in decarbonizing networks by blending renewable hydrogen into the existing distribution system and is expected to heat approximately 800 homes and fuel 10 municipal vehicles.

[\[H2\] Innovation Experience](#): SoCalGas has developed a clean hydrogen-powered microgrid and home to demonstrate how carbon-free gas made from renewable electricity can be used to fuel clean energy systems and communities of the future. The system will demonstrate clean solutions for power generation and heating.

[H21 Project](#): Northern Gas Networks is leading a suite of projects to convert the U.K.’s existing natural gas network to transport pure hydrogen. Over a third of the UK’s carbon emissions are generated by the 83% of domestic homes currently using natural gas for heating and cooking.

[Combined Heat and Power Plant](#): Chesapeake Utilities Corporation successfully blended hydrogen with natural gas to power the Company’s Eight Flags Energy Combined Heat and Power plant in Nassau County, Florida.

[Chesapeake Utilities is looking ahead](#) to injecting hydrogen into its distribution systems in its Florida and Mid-Atlantic territories

Fuel Cells: A Combined Heat and Power Solution

In addition to generating electricity, hydrogen fuel cells also produce heat that can be captured and used to improve overall system efficiency. The heat recovered from fuel cells can be used to produce hot water, low-pressure steam (<30 psig), and chilled water with an absorption chiller. There are 126 fuel cell systems across the U.S. configured for combined heat and power operations, which have an average capacity of 532 kW and a combined capacity of 67 MW. For fuel cells used in vehicles, heat can be recovered to provide space heat to the cabin area.

DID YOU KNOW? Solid-oxide fuel cells can be fuel agnostic to accept both renewable fuels, like hydrogen or biomethane, and conventional fuels, like natural gas. This fuel flexibility provides certainty for fuel cell installations and investment throughout the energy transition.

The Bottom Line

Hydrogen can be used as a clean solution to decarbonize industrial, commercial, and residential heat. Existing gas pipeline infrastructure can be used to distribute hydrogen to end-users at scale. In addition to generating electricity, fuel cells also produce heat that can be captured and used, which improves overall fuel cell system efficiency. Appliance manufacturers and pipeline operators can prepare by making new appliances and pipelines “hydrogen-ready” to accept varying levels of natural gas-hydrogen blends.

About Hydrogen Forward

Hydrogen Forward is a joint initiative of companies committed to advancing hydrogen for a cleaner, stronger U.S. economy. The coalition works in concert with allies across industries and sectors to educate decisionmakers and other stakeholders on the value hydrogen delivers today and the important role that it should play in our future. To learn more about the initiative and its member companies, visit www.HydrogenFwd.org.