ENERGY

Gas Utilities Are Promoting Hydrogen, But It Could Be A Dead End For Consumers And The Climate

Energy Innovation: Policy and Technology Contributor
We are a nonpartisan climate policy think tank helping policymakers make informed energy policy choices and accelerate clean energy by supporting the policies that most effectively reduce greenhouse gas emissions.

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Natural gas utilities are increasingly promoting hydrogen—which emits no greenhouse gases (GHG) emissions when burned—as a promising path to preserve their business model while meeting demands to cut emissions. This trend is accelerating, with at least 26 projects proposed across more than a dozen states since 2020.

The utility vision seems clear: Blend hydrogen with natural gas using existing pipeline networks, eventually switching entirely to hydrogen or blending it with other low- or zero-carbon fuels.

But it's not that simple. New Energy Innovation research finds using hydrogen in homes and buildings is fraught with economic, logistical, and safety challenges, capable of reducing GHG

emissions less than 7% before encountering potentially insurmountable roadblocks.

Natural gas meters are fixed to the outside of residential townhouses and apartments at a building ... [+] GETTY IMAGES

Gas utilities may view hydrogen as an attractive path to continue business-as-usual and a lifeline to maintain their market share. While utilities generally pass fuel costs on to their customers, they profit by investing in infrastructure—needed to entice private investors to lend utilities their capital. A decarbonization strategy centered around maintaining, retrofitting, and building new pipelines to increase hydrogen use thus makes these companies more valuable.

However, these hydrogen-centric plans are a bad bet for consumers and the climate. Regulators approving new utility hydrogen projects could forestall the electrification of buildings—a far more cost-effective and safer pathway to reducing GHG emissions that necessarily sees gas utilities' role, and profits, shrink over time.

State utility regulators should thus be highly skeptical of ratepayer-funded gas utility proposals to advance hydrogen as a primary strategy to cut emissions from buildings. Separately, policymakers should consider carefully how hydrogen fits in with carbon reduction goals to avoid supporting dead-end pathways, instead advancing more viable options such as a managed transition to all-electric buildings.

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Hydrogen may be a myopic path with little to gain

Gas utilities and their regulators should seek cost-effective GHG emissions reductions using measures that enhance—or at least don't compromise—public health and safety, reliability, and service quality. Even where states have less-ambitious climate targets than a zero-emissions gas system, regulators should consider pathways that wouldn't require utilities to dramatically change course if the latter becomes law.

Utilities can produce zero-carbon "green" hydrogen from renewable electricity and water, a process called electrolysis which emits oxygen as its only byproduct. By blending green hydrogen with natural gas, utilities can reduce the carbon intensity of their delivered fuel. However, research suggests utilities can only safely blend up to 20% hydrogen with natural gas using today's pipelines and appliances, even after extensive testing and targeted pipeline retrofits.

Because burning hydrogen releases less energy than methane—the primary component in natural gas—a 20% blend only reduces GHG emissions 6%-7%, and green hydrogen's higher production costs today would raise the price of this blended fuel two to four times above standard natural gas.

Utilities aware of hydrogen blending's bad value proposition are favoring a more expansive strategy. Some are exploring "blue" hydrogen, which strips hydrogen from methane and attempts to capture most of the carbon dioxide emissions for storage underground. Many are also pursuing chemically identical sources of methane, whether synthetically produced or derived from sources like landfills and pig farms.

However, blue hydrogen faces the same blending limits as green hydrogen without the same depth of emissions reductions. Other "clean fuels" can directly substitute for natural gas but suffer from methane leaks throughout the pipeline network. They are also either expensive or can't scale—for example, waste-derived biogas in the United States can only supply 1.5% of national consumption.

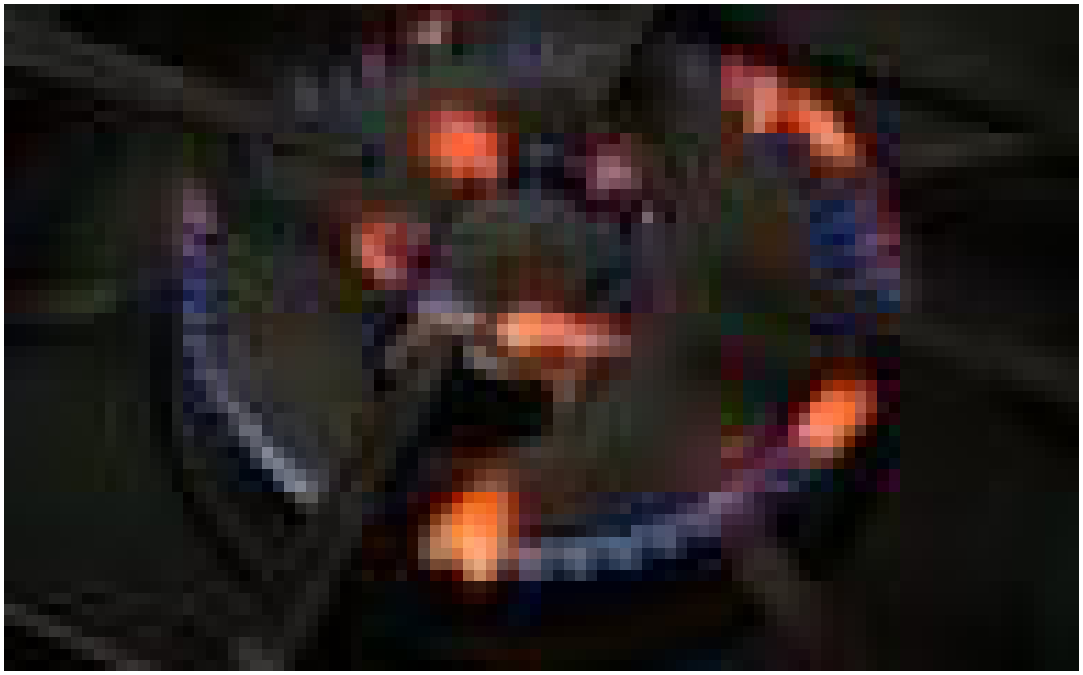
Fuel inputs of hydrogen production. S&P GLOBAL MARKET INTELLIGENCE

When climate policy requires utilities to make deeper emissions reductions for a net-zero economy, hydrogen blends and “clean fuels” will eventually reach their limits. But in that time, utilities could spend many years investing in a system only capable of handling 20% hydrogen at great consumer expense and with little upside. Continuing down this path toward a 100% green hydrogen-capable distribution system, replete with compliant consumer appliances, promises high utility profits but sidelines the more effective electrification strategy.

The expensive, logistical nightmare of a hydrogen transition

Hydrogen is a smaller and much more flammable molecule than methane, and itself is a climate-warming compound (though less so than methane). This means it can leak more easily through pipes and embrittle them, accumulating either in the atmosphere or in enclosures—including homes—which can cause explosions. This means any gas utility aiming for 100% hydrogen would need to upgrade its distribution system depending on each pipe’s age, size, material, and operating pressure.

Household appliances pose an even bigger hurdle, because they’re optimized for natural gas and are generally incapable of safely handling more than a 5%-20% hydrogen blend. Manufacturers would need to develop furnaces, water heaters, stoves, dryers, and industrial equipment capable of handling pure hydrogen, pure natural gas, *and* any blend in between. Utilities would then need to coordinate replacing *every single appliance* in their service area before increasing their blend beyond 5%-20% as any missed appliances would cause an explosion.



A photo illustration shows gas burning stove. (Photo by Paul ELLIS / AFP) (Photo by PAUL ELLIS/AFP ... [+] AFP VIA GETTY IMAGES

If manufacturers can't find a way to design these hybrid appliances and can only build appliances capable of burning 100% hydrogen, this switchover would be impossible without long and severe gaps in gas service. Utilities would have to keep hydrogen blending levels low so long as any old appliances remained on its system; however, consumers wouldn't be able to operate any new hydrogen-only appliances until utilities switched to a 100% hydrogen fuel system.

By contrast, a quarter of U.S. homes are already all-electric, and about half of single-family homes are already wired for all-electric appliances. Switching from gas to electric equipment can happen incrementally with existing infrastructure, and electrified buildings connect directly to an increasingly clean electricity grid, thus supporting decarbonization. Some homes would need new electrical panels or wiring, and utilities might need to upgrade distribution system equipment, but these investments also support the ongoing transition to electric vehicles while boosting grid reliability.

Now we're cooking with electricity

Energy-efficient electric appliances would bring lower energy bills compared to hydrogen-burning counterparts—and already do on average relative to today's natural gas-burning appliances. These lower costs result from two inherent advantages: using more efficient processes than combustion, and avoiding the energy lost from electrolysis to produce green hydrogen.

Today's electric heat pumps, which heat *and* cool air, would use electricity three to six times more efficiently than hydrogen-compatible heating equipment. This has serious implications for how much renewable generation the U.S. will need to build to support the decarbonization of our buildings. For example, one estimate shows heating a home with green hydrogen would require five times more renewable electricity than doing so with an efficient electric heat pump.

Even in cold climates when heat pumps perform at their lowest efficiency, they still operate more efficiently than gas alternatives. These thermodynamics won't change, with 15 independent studies finding hydrogen is too costly and inefficient to consider as a means to heat buildings.

Heat pump mini split system next to home with painted brick wall and space for text copy GETTY

Induction stoves are also highly efficient, with about 90% of the electrical energy transferred to directly heat pots and pans. Hydrogen stoves would be around 30% efficient after losing energy from electrolysis and again by indirectly heating food when much of the combustion heat escapes. Induction stoves also perform far better than today's gas and electric resistance stoves, with impeccable temperature control and the ability to boil water in minutes.

Public health is another important consideration. We know natural gas stoves leak methane indoors even when turned off and release harmful toxins like nitrous oxides (NOx) and formaldehyde when burned. These emissions harm health and climate alike, with one study finding children in homes with gas stoves have a 42% increased risk of developing asthma symptoms. Hydrogen emits even more NOx than natural gas when burned, which would likely exacerbate this problem if utilities blend or switch to hydrogen. Induction and electric stoves avoid combustion altogether, improving family health.

Getting it right the first time

Regulators should be highly skeptical of utilities seeking ratepayer funds to blend hydrogen into gas distribution systems as part of a decarbonization strategy—especially with proven ways of slashing near-term emissions, like reducing methane leaks from pipelines or funding building efficiency and electrification.

State policymakers should look to reduce gas demand via building electrification. For example, the Colorado legislature recently passed a "Clean Heat Standard" directing the state's regulated gas

utilities to file emissions reduction plans with state regulators, and permitting gas utilities to use “non-pipes alternatives,” such as replacing gas with electric equipment. However, regulatory oversight is needed to prevent utilities from promoting pathways that do not meaningfully reduce emissions, protect public safety, or ensure consumers don’t get left with the bill for stranded assets.

State policymakers should also advance electrification by adopting all-electric building codes for new construction, funding rebates for efficient electric appliances and heating equipment, and providing additional assistance to low-income customers. Together, these policies can kickstart an intentional transition, driving down electric equipment costs and capitalizing on their higher performance.

Green hydrogen may have an important role in the clean energy economy, but we need not force its use in buildings. Electrification can decarbonize our buildings today while delivering affordable, safe, reliable, and higher-quality services. Let’s not waste our time and money looking elsewhere.

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