

# U.S. Hydrogen Hubs

The Utility's Role

By Guidehouse's  
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here has been tremendous interest in hydrogen in recent years, with the added support from the U.S. Department of Energy, along with public and private sector decarbonization targets. The Hydrogen Shot initiative targets an eighty percent reduction from today’s cost of clean hydrogen, ultimately aspiring for one dollar per kilogram.

The recent Inflation Reduction Act incentives, such as production tax credits and increased Section 45Q credits for carbon sequestration – including direct pay credits for five years and a twelve-year credit duration – will help to bridge the cost gap and make clean hydrogen more cost-competitive.

A key commercial liftoff is the Bipartisan Infrastructure Law, which provides eight billion dollars in support for U.S. regional hydrogen hubs (H2Hubs). The U.S. DOE received seventy-nine concept papers from H2Hub developers, issuing thirty-three encouraged responses to submit formal applications by April 7, 2023.

Six to ten of those are expected to be awarded up to one and a quarter billion each to support a network of companies and other organizations, working together along the full hydrogen value chain (hydrogen production, offtake, and infrastructure such as pipelines and fueling stations).

Here, we outline a vision for how hydrogen might benefit utility companies and discuss some of the challenges that could be encountered when participating in the H2Hubs. Select utility representatives from several of the regional hubs were interviewed to get their perspectives on the value and challenges of the H2Hubs.

### The Value of Utility Participation in H2Hubs

The U.S. has a goal to achieve a clean electric power grid by 2030 and net-zero emissions by 2050, but achieving decarbonization will require multiple use case approaches. These are likely to include oil refineries, steel and cement manufacturing, ammonia production, heavy-duty transport, and energy-intensive activities at any location where significant expansion of power grid infrastructure would be difficult.

As demand for electricity increases, utility companies will benefit from blending hydrogen to replace natural gas in gas turbine power plants to meet their emission reduction goals, in combination with renewables, energy efficiency, demand response, energy storage, and other distributed generation technologies.

Some gas turbines on the market today can handle blends of up to fifty to sixty percent hydrogen by volume. The challenge of using clean hydrogen in electric power generation, though, is its high-cost relative to natural gas. As noted in a recent Guidehouse

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Insights report, “Even at the current aspirational price of a dollar per kilogram for green H2, natural gas would need to be around \$7.50/MMBtu for hydrogen to be competitive.”

Another potential role of hydrogen is as a medium for providing power grid support, as hydrogen can be stored and then used to meet peak loads. Unfortunately, many U.S. locations where H2Hubs are likely to be established lack the types of geology required for large-scale underground caverns likely to be suitable for long-term hydrogen storage.

Although not directly a mandate for utility companies, H2Hubs are required to have a significant focus on Environmental Justice and Justice40 guidelines, where forty percent of all benefits from the H2Hubs must accrue to disadvantaged communities.

Economic development, workforce training, job creation, and other activities will be enhanced through the H2Hubs, which will likely result in increased utility company engagement with local stakeholders to ensure equity and environmental justice, as the U.S. continues to power grids and provide customers with reliable and clean power.

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**The U.S. DOE received 79 concept papers from H2Hub developers, issuing 33 encouraged responses to submit formal applications. Six to ten are expected to be awarded up to \$1.25 billion each to support a network of companies and organizations, working together along the full hydrogen value chain (hydrogen production, offtake, and infrastructure such as pipelines and fueling stations).**

Participating in H2Hubs can provide utilities the opportunity to work with companies across the value chain to create markets for hydrogen that will drive down costs and support global decarbonization targets. The U.S. Department of Energy noted in a recent report that hydrogen can play a role in decarbonizing up to twenty-five percent of global energy-related carbon dioxide emissions, particularly in industrial/chemical uses and heavy-duty transportation sectors.

These themes are often echoed by utility companies. For example, “Southern Company believes there is a compelling opportunity for hydrogen technology to help deliver an energy system that is abundant, reliable, and resilient in a net-zero future,” said Mark Berry, Southern Company SVP of Research and Development.

“With our customer-centric focus, Southern Company’s electric and gas utilities are uniquely suited to advance hydrogen

as part of a diverse energy mix and as a new catalyst for robust economic development and growth in our states and regions. Southern Company is involved in two applications to secure funding to develop regional clean hydrogen hubs in our footprint,” continued Berry.

“Nicor Gas, a participant in the Midwest Alliance for Clean Hydrogen, and Southern Company are among the five major utilities proposing a Southeast Hydrogen Hub spanning six states. Leading innovation in H2 positions us to holistically serve the energy needs of customers as they seek to achieve their own decarbonization goals.”

Sacramento Municipal Utility District’s Director of Power Generation, Joel Ledesma, commented that, “With the most ambitious carbon reduction goal of any large utility in the United States, SMUD supports technologies, partnerships, and efforts that accelerate the transition to a clean energy economy. Hydrogen hubs support this transition by catalyzing regional collaboration to

help transform hydrogen into an accessible clean and economical fuel source that’s available at scale.”

Salt River Project’s Innovation and Development Manager, Chico Hunter, noted that, “Hydrogen can play a key role in decarbonizing hard-to-decarbonize applications such as heavy trucks, mining vehicles, buses, and other portions of the economy and provides economic development through helping companies reduce their carbon footprint.”

Entergy’s VP, Federal Infrastructure Policy, Jason Reynolds, confirmed, “Regional hydrogen hubs help minimize the risk of early infrastructure investment to forward-thinking electric utilities like Entergy who are involved in the HALO hub. They set a foundation for economies of scale to drive down the delivered cost of low-carbon hydrogen applications, which benefits all of Entergy’s stakeholders – customers, communities, and shareholders.”



Roger Kranenburg, VP Energy Strategy and Policy at Eversource, stated that, “The value the hubs provide is to develop a hydrogen ecosystem that closely matches the region’s unique needs and aligns with its policies.

For example, New England has significant decarbonization objectives, as well as a cold climate and distinct economic structure relative to the rest of the country. The region’s economy is less dependent on heavy industry with very high value-add activities, such as biotechnology, pharma, higher education, medical, finance, venture capital driving innovation, and high-end defense manufacturing, along with commercial goods and services for its high population density. Energy reliability and resiliency are paramount for these economic activities and essential to the health and well-being of its citizens living in a cold climate with cold snaps.”

### **Barriers to be Addressed**

Permitting, both for pipeline development and onshore or offshore wind development, remains a significant barrier to overcome in many parts of the country and around the world. Many countries have complex permitting processes that are slowing down development timelines, the interconnection queue, and overall energy transition.

For example, the need for shortened permitting and planning procedures was identified as a critical need to scale-up the production of renewable gases in Europe in the Action Plan for Implementing REPowerEU, a report for the European Commission, which Guidehouse supported and can be found at [www.gasforclimate.2050.eu](http://www.gasforclimate.2050.eu). We expect that this will need to be addressed by participating companies in U.S. H2Hubs, as well.

Achieving a competitive dispensed price for hydrogen fuel is a challenge – even with IRA support – due to the complex supply chain involved in getting hydrogen fuel to the pump. The aggregated cost of fueling infrastructure, hydrogen production, liquefaction, shipping, and taxes leaves a narrow – and in some cases non-existent – margin to achieving a dispensed



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fuel price (of five to six dollars per kilogram of H<sub>2</sub>) competitive with diesel fuel.

Given these constraints, blue hydrogen (derived from natural gas) will be the most cost-competitive supply source in the near term for transportation fuel, until green hydrogen costs come down and scale can be achieved through the H2Hubs.

Some groups are suggesting imposing additionality constraints on clean energy to maximize its use for power applications. This would have a significant negative impact on clean hydrogen production during these early market-forming years.

The EU's recent Delegated Acts on Renewable Hydrogen gradually implement such constraints over the next fifteen years. With the U.S. being several years behind Europe in clean hydrogen, it is critical for domestic policy to establish a runway to market lift-off by similarly allowing generation resources to participate – and new resources to enter the market until 2030 or 2035 with minimal constraints.

Safety will also be a critical factor to address, including potential leakage of hydrogen in its handling, transport, storage, and end use. The H2Hubs will help to address this through their required stringent Safety Plans. Note that there are many applications that have already been using hydrogen safely for many years. Sharing of safety knowledge and technology within H2Hubs will make it easier for new entrants in the hydrogen space to handle the material appropriately.

H2Hubs need to address the balance between supply and demand, especially at the outset, when certain hydrogen markets are new and growing. Securing long-term offtake agreements will be key; hopefully, many utility companies will be able to engage in long-term contracts to reliably and cost-effectively procure hydrogen for power plant fuel blending.

To support utility companies with renewable energy integration and managing supply-demand balance, hydrogen storage can play a key role by reducing curtailment of renewables and helping with peak demand. As mentioned, limited salt cavern geology in North America reduces the ability to co-locate power plants with hydrogen production facilities.

In addition, the economics of capital investment, equipment utilization, and other related factors will make this application less widespread than desired. As Hunter from SRP noted, “The H2Hubs will begin to develop infrastructure and commercial-scale applications of hydrogen for broader use in other sectors of the economy. In particular, the hubs will help to develop safe and commercial-scale underground storage and transportation of hydrogen that is necessary for use in utility-scale electricity generation.”

Reynolds from Entergy also commented that, “One hurdle that stands to be overcome by participating in a hydrogen hub is ensuring that the reliability and flexibility of fuel supply that’s necessary for consistent electrical power generation are in place.

The significant infrastructure investments in the region enabled by the hub will enhance the reliability and flexibility of hydrogen fuel supply, allowing hydrogen power to be adopted faster and with reduced financial risk.

Firing a power generation turbine completely on hydrogen requires a huge amount of fuel, and the manufacturers of the turbines are aggressively working to get to a hundred percent hydrogen capability for us to be able to produce sufficient supply. The hub will also facilitate the necessary components of a reliable

and flexible fuel supply, such as diverse production facilities, underground cavern storage, and a robust network of pipelines.”

Kranenburg from Eversource also noted, “The primary barrier is to build an entire ecosystem to support this development from essentially nothing. The hydrogen market that does exist today in this region is for forklifts used for indoor material handling. However, this market predominantly uses grey hydrogen with a high greenhouse gas footprint.

Building this ecosystem initially requires advancing cost and performance, as well as manufacturing and ensuring that the workforce has the necessary skills, as with any other new market. This is then followed by the challenges to scale the ecosystem to an industrial scale while meeting low cost, reliability, and resiliency needs.”

**H2Hubs will be vital to accelerating this new, clean fuel source needed to achieve decarbonization targets. Utility companies are important stakeholders in the process of securing long-term demand for hydrogen, which will allow private sector capital to flow into further hydrogen development in a sustainable, virtuous cycle.**

### **Potential Challenges in H2Hub Participation**

Fuel blending is just one of many applications for clean hydrogen in H2Hubs. The first priority (and best early adoption opportunity) in some of the H2Hubs is likely to be reducing the carbon intensity of existing hydrogen production facilities, such as for ammonia production and/or oil refining.

Later, clean hydrogen used for heavy duty transport, aviation, and maritime applications will become more prominent and more economically attractive. For example, the willingness to pay for hydrogen for ammonia production, steel manufacturing, and chemicals is roughly between one to two dollars per kilogram; for heavy duty transport it is four to five dollars per kilogram; and for aviation and maritime uses it is seventy cents to three dollars per kilogram.

In comparison, natural gas blending willingness to pay is estimated to be much lower, at forty to fifty cents per kilogram. Blue hydrogen today can be produced for roughly one to two dollars per kilogram and green hydrogen at four to seven dollars per kilogram (including the IRA's production tax credit), so economies of scale will be needed to drive down the hydrogen cost further for viability in power sector applications.

One of the main challenges for H2Hubs is the need for strong confidentiality among the project participants. Within H2Hubs there are competitors working together to support the regional vision. However, often their company-specific strategies can't be shared with other H2Hub project participants. This can be a challenge when trying to evaluate the regional economics and broader viability of the H2Hub vision.

Reynolds from Entergy noted that, "One key challenge utilities face through the development of the hydrogen hub is a misconception about the use case of hydrogen for power generation in a utility, as opposed to other hydrogen off-takers.

The use case for a utility is distinct – whereas most hydrogen users may be looking to displace their natural gas use with hydrogen, a utility may have several use cases, including long duration energy storage.

All proponents of hydrogen as a power generation fuel will need to work together to inform stakeholders and potential opponents about the unique operational complexities and benefits associated with use by utilities to allow our communities and investors to make informed decisions about their support of hydrogen fueled power.

This is an opportunity for Entergy to continue to lead in the low-carbon hydrogen future while providing reliable and affordable energy to our customers and communities." Kranenburg from Eversource also noted that, "The challenges will be to match the long-term view of what could be with the reality of starting from where we are.

It will involve matching supply and demand, scaling hydrogen storage and transportation, ensuring reliability, resiliency, and safety. Ultimately, it will require aligning perspectives of a wide variety of stakeholders and policymakers with consumer needs, and then executing on a plan that balances those perspectives."

## Conclusion

It takes many years to adopt a new fuel source. Coal, nuclear, oil, and natural gas needed more than thirty years of support to achieve ten of the national fuel mix and forty to eighty years to get to twenty percent, as David Crane, Director of the U.S.

DOE's Office of Clean Energy Demonstrations, noted in a recent hydrogen webinar.

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## President Biden's Administration recently announced a proposed rule to limit greenhouse gas in power plants, in which all coal and natural gas power plants would need to cut or capture almost all carbon dioxide emissions by 2040. Hydrogen could be one of the solutions.

ing long-term demand for hydrogen, which will allow private sector capital to flow into further hydrogen development in a sustainable, virtuous cycle.

Every end-use for hydrogen will be needed to help balance supply and demand and to secure the volume of supply needed to drive down key elements of hydrogen cost, such as electrolyzers, fueling infrastructure, storage, and updated power and transport equipment that can handle this new, clean fuel source.

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to limit greenhouse gas in power plants, in which all coal and natural gas power plants would need to cut or capture almost all their carbon dioxide emissions by 2040. Hydrogen could be one of the solutions to help utility companies achieve these strong emission reduction targets.

As aptly stated by Kranenburg, "The utility model is founded on investing and operating regulated assets in the public interest. Hence programs and incentives should be aligned to allow utilities to finance these investments through a regulated business model. The federal funding is key in getting these investments off the ground from where we are today to offset the uncertainties inherent in new markets." **PUF**



Public Utilities Fortnightly was there at the Bipartisan Policy Center on May 10 when the Senior Advisor to the President of the United States for Clean Energy Innovation and Implementation, John Podesta, made news about the Administration's position on passing bipartisan permitting reform. To the left is Xan Fishman, Director of Energy Policy and Carbon Management at the Bipartisan Policy Center.