Testimony of Andy Marsh

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before the

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Good afternoon. Thank you to Chairman Manchin, Ranking Member Barrasso, and members of the Committee for inviting me to testify before you today regarding the federal regulatory framework governing the development of interstate hydrogen pipelines, storage, import, and export facilities. I am glad to discuss Plug Power's (Plug) experience with hydrogen infrastructure development and share my perspectives on the need for, and regulation of, a national hydrogen system.

Background and Introduction

My name is Andy Marsh. Since 2008, I have had the privilege of being the President and CEO of Plug, a leading innovator in the renewable energy field. Plug pioneered the first commercially viable market for hydrogen fuel cell technology in material handling and goods movement. Today, Plug is creating a full-circle green hydrogen ecosystem where we produce, transport, store, and deliver green hydrogen to customers around the world. Previously, I was a co-founder of Valere Power, where I served as CEO and board member, from its inception in 2001 through its sale to Eltek ASA in 2007. Prior to founding Valere, I spent almost 18 years with Lucent Bell Laboratories in a variety of sales and technical management positions.

I am excited about the recent attention to hydrogen and fuel cells and the role each can play in our nation's energy future. I thank the Committee for its continued leadership.

About Plug

Founded 25 years ago in Latham, New York with the goal of powering the world using renewable energy, Plug has grown into the leading provider of turnkey green hydrogen solutions, with the largest hydrogen fueling station footprint in the world.

Following our creation of the first commercially viable market for hydrogen fuel cells, customers turned to Plug to develop easy to deploy hydrogen solutions that could address every step of their operations. Putting our customer's needs first, Plug has built an end-to-end ecosystem with more than 100 products, 60,000 operational fuel cell systems, and more than 165 hydrogen fueling stations across the Unites States and world.

Plug currently supports more than 100 logistics and manufacturing companies around the world. During the height of the pandemic, Plug's products were responsible for moving approximately 30% of America's retail food and groceries to support the needs of customers such as Walmart, Amazon, Kroger, SuperValu, Wegmans, and Aryzta.

To further support our customers' needs to both improve their operations and meet sustainability goals, Plug is building the world's first Green Hydrogen Highway, with plans to produce 500 tons of liquid green hydrogen per day by 2025, and 1,000 tons per day by 2028. Green hydrogen, made through electrolysis powered by renewable energy, is the only form of hydrogen that is emission-free, with experts estimating that it could power up to 25% of the world by 2050. We are committed to developing effective and reliable end-to-end green hydrogen solutions that allow customers in transportation and industry to decarbonize and, thus, create a more sustainable planet.

As of July 2022, Plug's workforce includes 2,870 regular employees from around the world. The Company has seen a workforce increase of almost 200% since 2020, when Plug employed 985 regular employees. We are growing rapidly, with 400 current job openings.

Industry Leadership

My team and I are involved in several industry associations committed to the safe adoption of hydrogen energy and fuel cells. I am currently the chairman of the Fuel Cell and Hydrogen Energy Association, which represents leading companies and organizations that are advancing innovative, clean, safe, and reliable hydrogen energy and fuel cell technologies. Plug also participates in the Hydrogen Council, the California Hydrogen Business Council, the National Fuel Cell Research Center, the Ohio Fuel Cell Coalition, and more.

Plug's Green Hydrogen Ecosystem

Plug is building an end-to-end green hydrogen ecosystem, from production, storage, and delivery to energy generation. Our capabilities cover all aspects of the full hydrogen value chain. This turnkey approach is important to our customers – both in their efforts to improve efficiency and implement decarbonization strategies. As an electrolyzer manufacturer, our leading technology can deliver at gigawatt-scale. Plug is building a global network of electrolytic hydrogen generation facilities, with plans to produce 1000 tons per day by 2028. Our capabilities also cover liquefaction, transport, delivery, and refueling for our customers. And, Plug's stationary and mobility fuel cell applications provide a unique combination of productivity, flexibility, and environmental benefits. This full ecosystem approach is necessary, and in many ways, is representative of how well-designed policy must approach the hydrogen economy.

Our products and services include:

Hydrogen Production: Plug is building green hydrogen production plants to produce at least 500 tons of liquid green hydrogen daily by 2025 and 1000 tons daily by 2028 – enough to ensure fuel supply to our customers, and a clear signal to early adopters that a resilient and robust supply of green hydrogen will be available, should they select the technology.

Electrolyzers: Plug has been a leader in PEM (proton exchange membrane) electrolysis technology for nearly 50 years, with experience in a variety of mission-critical naval and aerospace applications and was recently named the number one hydrogen electrolyzer company by Guidehouse Insights. Our electrolyzers can be paired with renewable energy resources such as solar, wind, and hydro-electric power to produce green hydrogen from water and can be delivered at gigawatt-scale. Plug has developed electrolyzers that have high current densities, high-pressure output, and rapid load following capabilities.

Hydrogen Liquefaction: By cooling hydrogen to temperatures below -400 °F, Plug liquefaction systems significantly increase the amount of hydrogen that can be transported in tankers over the road versus compressed gas trailers, and stored at our customer's facilities.

Transport Hydrogen: Plug's fleet of hydrogen tankers provides our customers with liquid and gaseous green hydrogen anywhere in the country, around the clock, every day of the year.

Store and Dispense Hydrogen: Plug offers on-site storage and dispensing systems designed for each customer's individual requirements, whether serving material handling warehouses, hydrogen fueling stations, large data centers, or industrial processes. Plug has more than 300 hydrogen refueling dispensers at more than 165 sites across the United States.

Fuel Cell Applications: We are a leading manufacturer of PEM fuel cells for electric forklifts and electric industrial vehicles at multi-shift high volume manufacturing and high throughput distribution facilities. Our products offer significant productivity gains and generate no emissions at the point of use. Plug also has a rapidly expanding footprint in on road medium- and heavy-duty vehicles and specialty vehicles that service ports and airports. Additionally, we manufacture and sell fuel cell products to replace batteries and diesel generators in stationary backup and continuous power applications for telecommunications, data centers, and utility customers. Plug supports these fuel cell customers with an ecosystem of integrated products that make, transport, handle, and dispense hydrogen for any given application.

Plug's Strategy for Hydrogen Adoption

While Plug's core market is North America, we are also targeting Asia, Australia, Europe, and the Middle East for expansion in adoption. Our operating strategy objectives include decreasing product and service costs and expanding overall system reliability. We also believe that continued investment in research and development is critical to the enhancement of innovative products, technologies, and services.

Plug has recently made the following investments to expand its green hydrogen offerings:

Plug is currently investing billions of dollars into building green hydrogen infrastructure in the United States. Since announcing our national network of 500 tons per day of green hydrogen production in 2020, Plug has made significant progress. In 2021, Plug announced four new hydrogen plants in New York, Georgia, Texas, and California, and broke ground on the plants in New York and Georgia. In the first half of 2022, Plug announced a partnership with Olin Corporation to produce hydrogen at a jointly owned plant in Louisiana. We will begin producing green hydrogen from our first plants in 2022 and break ground on at least two other projects by

the end of the year. Several other projects around the nation are in the early stages of development.

In 2021, Plug opened its 155,000 square foot gigafactory manufacturing facility in Rochester, New York, and in 2022, will begin operations in its newly constructed 300,000 square foot manufacturing facility at the Vista Technology Campus in Albany County, New York. Plug also announced plans for gigafactories in South Korea, with SK E&S Co., Ltd. (SK E&S) and in Australia with Fortescue Future Industries Pty Ltd. (FFI).

Scaling Plug's electrolyzer program to provide comprehensive and economical solutions starting with our 1MW, 5MW and 10MW offerings, and is using these building blocks to reach into the gigawatt-scale electrolyzer market.

Plug is expanding into new mobility markets, including on-road vehicles (delivery vans, cargo vans, Class 6 to Class 8 trucks and buses) and aviation (serving drones and airplanes).

Expanding into large-scale stationary power fields for critical operations, data centers, and microgrids.

Plug is expanding into new regions including in Europe, Asia, and Australia through its joint ventures with companies such as Renault SAS (Renault) in France, Acciona Generación Renovable, S.A. (Acciona) in Spain, and agreements with SK E&S in South Korea Fortescue and Future Industries in Australia.

In 2021, Plug acquired: (i) the Frames Holding B.V. in the Netherlands to add engineering, process, and systems integration to Plug's portfolio; and (ii) Applied Cryo Technologies in Houston Texas for its expertise in storage and delivery of liquid hydrogen.

In 2022, Plug acquired Joule Processing LLC in Houston, Texas to commercialize cryogenic process technology and reduce the cost of hydrogen liquefaction. This was followed by a collaboration agreement between Plug, Atlas Copco Mafi-Trench Company LLC and Fives, as world leading key technology and manufacturing partners to jointly develop hydrogen liquefaction plants.

The Benefits of a Hydrogen Economy

A robust green hydrogen economy is vital to any comprehensive clean energy and climate strategy. In its 2020 report, "Road Map to a US Hydrogen Economy," McKinsey found that hydrogen is a key driver of economic growth and significant decarbonization. It is estimated that by 2030 the U.S. hydrogen economy could generate $140 billion per year in revenue and support 700,000 jobs across the hydrogen value chain. By 2050, this number has the potential to raise to $750 billion per year in revenue and a cumulative 3.4 million jobs. At the same time, hydrogen has the potential to meet 14 percent of U.S. energy demand by 2050. Through this vision, carbon emissions would be lowered by 16 percent, and harmful tailpipe particulates (nitrogen oxides and sulfur oxides) from transportation eliminated through the transition to hydrogen fuel cell and battery electric vehicles. Hydrogen may be the only viable pathway to reduce emissions for

difficult-to-decarbonize sectors, such as rail and long-haul truck transportation, marine vessels, steel, cement, and ammonia.

The hydrogen economy can help ensure that disadvantaged communities are prioritized in the clean energy transition. Environmental justice is a fundamental tenet within Plug's overall strategy. For too long, disadvantaged communities have faced disproportionate environmental injustices, suffered the brunt of climate change, toxic pollution, adverse health effects, and endured underinvestment in critical infrastructure and services.

Hydrogen fuel cell technologies and green hydrogen offer distinct and focused benefits for these communities. In many cases, green hydrogen and fuel cell technologies are the best replacement for diesel. Hydrogen fuel cells are a commercially available, zero emission solution to reduce diesel particulate matter. Replacement of diesel trucking fleets and generators with hydrogen fuel cell alternatives can ensure focused-environmental benefits for disadvantaged communities that suffer disproportionate health effects from diesel emissions (such as high asthma rates). Relatedly, the green hydrogen economy will benefit disadvantaged communities through job creation, regional infrastructure improvements such as investment into renewable wind and solar infrastructure, and community-driven programs implementing green hydrogen solutions. Looking forward, we see an enormous opportunity to develop and increase awareness, training, and apprenticeship programs in hydrogen career paths, with targeted outreach programs in disadvantaged communities.

Furthermore, the holistic approach Plug is undertaking as a leader in the green hydrogen ecosystem, both domestically and abroad, is integral to ensuring the long-term energy security of the United States and our international allies. Our own decarbonization strategy must also ensure energy security and resiliency, and the green hydrogen economy can be instrumental in achieving those goals. At scale, green hydrogen can serve a crucial link between the electric grid and the broader energy sector by adding long duration energy storage capacity, better utilization of electric transmission infrastructure, and seasonal storage of renewable energy by large scale storage or hydrogen blending into natural gas grids.

The hydrogen economy is growing rapidly but is in its early stages of development, in comparison to our natural gas infrastructure. Plug believes the federal government can accelerate the clean energy transition through frameworks such as a Clean Hydrogen Production tax credit and the Investment Tax Credit, as shown by the success of these incentives in other markets. These frameworks will accelerate demand and expand end uses of hydrogen, through economies of scale that drive cost reduction of both production and transportation.

Moving and Storing Hydrogen

Plug Power is building a green hydrogen generation network across the United States, with near-term delivery via on-road transport to our customer base. Like many members of this Committee, we are bullish on the continued growth of hydrogen generation and its ability to serve a variety of end uses. We commend the Committee for funding the Regional Clean Hydrogen Hubs program pursuant to the Infrastructure Improvement and Jobs Act, Public Law 117-58 (IIJA). This keystone enactment has the potential to accelerate the formation of a self-

sustaining national clean hydrogen economy. Among other things, the IIJA specifies that the creation of a "national clean hydrogen network" is a central objective of the hydrogen hub program. A nationwide system for moving and storing hydrogen is a necessary step in reaching this statutory objective.

However, large-scale hydrogen transportation infrastructure is in its nascent stages. Currently, there are only 1,600 miles of closed-network dedicated hydrogen pipeline in the U.S., located in the Gulf Coast, Texas, and the greater Los Angeles area in California. The existing hydrogen pipelines are closed networks, based on bilateral agreements between a small number of participants. Ultimately, a vastly more expansive system is needed – akin to that of the more than 2 million miles of natural gas pipeline in the United States. Transitioning to an open-access business model will enable hydrogen pipelines to expand their customer base and de-risk revenue sources to better attract investment capital. In addition, pricing transparency of open-access pipelines can lower costs and benefit all system users. Open access frameworks have provided the United States with the most developed and commercially vibrant pipeline network in the world. Going forward, we believe that the ability to use existing pipeline rights of way will be vital to building a nationwide network of hydrogen pipelines.

Studies and experience show that pipelines move large amounts of energy over long distances at approximately 50% less cost than electric transmission lines. Open-access, dedicated interstate pipelines are particularly important for delivering substantial amounts of clean energy into population centers and regions where it is most needed from regions where it is cost-effectively produced. We believe such pipelines will serve a key role in transporting renewable power, in the form of green hydrogen, from areas with ample wind and solar resources to areas that demand cleaner energy sources. Connecting supply with demand will achieve tremendous benefits for the entire country and its energy economy. As a large supplier and transporter of liquid hydrogen to our customers, Plug has analyzed and compared the costs of delivering green hydrogen via tanker versus pipelines. While interstate pipelines require substantial scale to justify investment, the potential cost benefits with pipelines are profound. Applying a typical natural gas, interstate pipeline tariff rate and after adjusting hydrogen's lower energy density, it costs 15 times more to deliver hydrogen 500 miles by tanker than it would under a similarly structured tariff applied to hydrogen. Delivery to customers by pipeline would reduce our delivered product costs up to 30%.

The volume of product contained within pipeline networks, themselves, also serve as an important energy storage buffer, and ensure resiliency within our national energy systems. Pipelines can absorb and store hydrogen at times when renewable generation capacity is low cost or would otherwise be curtailed. Hydrogen, as an energy carrier, provides the ability to cost-effectively store large amounts of renewable energy for the long-term, which will be a necessary complement to increased electrification and integration of low-cost renewable energy resources.

Recommendations for Interstate Hydrogen Pipeline and Storage Regulations

While the regulatory regime for interstate pipelines and storage has not been Plug's traditional focus, we do concur that a national regulatory regime will be necessary, as the scale and scope of

our industry grows. The Federal Energy Regulatory Commission's (FERC) current authority extends to interstate natural gas pipelines, interstate electricity transmission, and the participation in wholesale power markets. The hydrogen economy intersects all three areas, and will increasingly so, as the United States transitions to a fully green energy system. In the past, FERC has provided clarity that enabled the development and rapid growth of new markets such as energy storage. We also know that transitioning hydrogen pipelines from closed-network to open access, and the transparency that entails, will be crucial to the buildout of large scale hydrogen pipelines that can best serve users. FERC's involvement in hydrogen pipelines could provide regulatory consistency, clarity, and a template for states policymakers within intrastate hydrogen networks. That said, we have unanswered questions on how suitable permitting rules designed for hydrocarbons are for hydrogen pipelines, and how the open season rules should apply to hydrogen lines, which at this stage will be of much smaller capacity and reach.

Regulatory certainty could facilitate an efficient and timely build out of the pipeline infrastructure needed to create a self-sustaining, national hydrogen economy. The absence of a well-devised federal regulatory framework could stall crucial investments that would otherwise be subject to a patchwork of state regulations. Among other things, policymakers must consider common rules and standards for blending hydrogen into existing natural gas pipelines. This will incent the buildout of hydrogen generation to feed such infrastructure and enable large energy users to lower their carbon emissions. The conversion of natural gas pipelines to accept hydrogen is another important policy consideration to extend the economic value of this significant infrastructure in a lower carbon world. Further, policymakers should also consider purity level requirements (i.e., fuel cell grade) for dedicated hydrogen pipelines, which is pertinent to direct use by transportation and some chemical process applications.

Additional Recommendations

To ensure efficient siting of dedicated hydrogen pipelines, we urge the use of existing right of ways from both transmission lines and natural gas pipelines. The use of existing rights of way will minimize potential permitting barriers that currently exist for natural gas pipelines and transmission lines, including regional and local landowner concerns. At Plug, we believe the need for dedicated pipelines will be a near-term reality, part due to the IIJA Regional Clean Hydrogen Hubs program.

The utilization of large volumes of hydrogen will also require consideration of federal safety standards for hydrogen pipelines. There are technical issues to work through to maintain safety, reliability, and asset integrity prior to development and widespread deployment. We urge policymakers to leverage industry's significant experience in hydrogen safety, operations, and leak detection, rather than *de novo,* which will unnecessarily delay pipeline buildout.

Lastly, we suggest FERC consider the benefits that fast-responding PEM electrolyzers can bring to the transmission grid through fuller participation and access to wholesale power markets. PEM electrolyzers can serve as flexible load to make use of otherwise curtailed renewable power at points of transmission congestion, and their active power systems can provide other ancillary services, such as frequency and voltage regulation. Providing electrolyzers broader access to

wholesale power markets directly supports deeper electrification of industry and transportation, as the United States transitions to cleaner and more diverse energy sources.

Conclusion

I am hopeful that this Committee's continued leadership on hydrogen-related policies and oversight of regulatory activities will support the development of end-to-end green hydrogen solutions that foster a more sustainable and robust domestic economy. Plug appreciates your commitment to seeking solutions that would provide industry with added certainty as we build a green hydrogen ecosystem across the United States.

Again, I would like to thank Chairman Manchin, Ranking Member Barrasso, and the members of the Committee for giving attention to the issues revolving around a federal regulatory framework governing the development of interstate hydrogen pipelines, storage, import, and export facilities. Plug stands ready to continue working in partnership with you to develop and expand the national hydrogen ecosystem.