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Chairman Carper, Ranking Member Capito, and Members of the Committee, on behalf of Air Liquide's more than 20,000 employees in the United States, thank you for the opportunity to testify today on the *Future of Low Carbon Transportation Fuels and Considerations for a National Clean Fuels Program*. My name is Mike Graff, and I am the Chairman and CEO of American Air Liquide Holdings, Incorporated. Air Liquide is a world leader in sustainable technologies and solutions that can help decarbonize the planet and advance the transition to a clean energy economy while creating high paying careers in the sector. Our portfolio of sustainable solutions includes clean hydrogen energy, carbon capture technologies, biogas production, advanced membrane technologies and more.

Air Liquide recently had the honor of hosting Chairman Carper, Energy Secretary Jennifer Granholm, Labor Secretary Marty Walsh, and White House National Climate Advisor Ali Zaidi at our Delaware Research and Development facility. It was evident that we share a core belief: clean energy is not about lowering emissions at the expense of economic growth; it's about lowering emissions and *growing our economy*.

My testimony today will focus on achieving these twin goals as they relate to the role of clean hydrogen energy in the decarbonization of the transportation sector and the need for flexibility, certainty, and technological neutrality in doing so. These characteristics are critical to promoting private sector investment, creating jobs, and minimizing burdens on the American consumer.

The timing of this hearing is very important. As a nation, we have reached a critical point in the Clean Energy Transition: emissions reductions remain paramount; domestic energy security is

essential; and the passage of the *Inflation Reduction Act* and the *Bipartisan Infrastructure Law* illustrate the importance of the private sector and the federal government investing and working together. As we capitalize on this moment, the U.S. workforce and economy are poised to benefit from immense growth. At Air Liquide, we are not awaiting the Clean Energy Transition; we are advancing it.

My testimony today will explain hydrogen's role in the Clean Energy Transition and share important lessons learned from Air Liquide's experiences with the California Low Carbon Fuel Standard (CA LCFS) and the nation's Renewable Fuels Standard (RFS):

I. **Hydrogen: Necessary to Advance the Clean Energy Transition**

II. **Hydrogen Hubs: The Connection to Low Carbon Fuel Standards**

III. **Certainty, Flexibility & Technological Neutrality: Essential Principles for Low Carbon Fuels Programs**

IV. **Lessons Learned: CA LCFS**

V. **Lessons Learned: RFS Pathways Approvals Need Certainty and Timeliness to Advance the Nation's Clean Energy Transition Goals**

I. Hydrogen: Necessary to Advance the Clean Energy Transition

It's estimated that hydrogen, over the next 30 years, could grow to account for over 20 percent of the world's total energy demand. This would reduce annual CO2 emissions by roughly 7 gigatons compared to today's levels, and contribute roughly 20 percent of the abatement required to limit global warming to two degrees Celsius, according to the Hydrogen Council's *Hydrogen for Net-Zero* study. According to the "Road Map to a U.S. Hydrogen Economy" produced by the Fuel Cell and Hydrogen Energy Association, by 2030, the hydrogen economy in the U.S. alone could generate an estimated $140 billion per year in revenue and support 700,000 total jobs across the hydrogen value chain. In the U.S., hydrogen is projected to be even more robust by 2050 accounting for at least $750 billion in revenue and 3.4 million jobs.

Air Liquide has a long history of leadership in establishing the markets of the future. As a pioneer in the hydrogen market, we have over 60 years of experience along the hydrogen value chain and in this time we have focused on hydrogen as a key molecule for investment, research and technology development. At Air Liquide, we are not just talking about the potential of hydrogen, we are investing in its future. In fact, we have committed to investing nearly $10 billion in low-carbon hydrogen by 2035 as part of a plan to more than triple sales of hydrogen and help substantially curb emissions. With nearly 1,400 locations across every state in the United States, Air Liquide knows that these investments are more than facilities, they're the creation of clean energy careers in our communities.

Hydrogen alone will not drive the clean energy transition, but the clean energy transition will not happen without hydrogen.

II. Hydrogen Hubs: The Connection to Low Carbon Fuels Standards

According to the EPA, transportation accounted for nearly one-third of the greenhouse gas emissions of the United States in 2020, which means that the decarbonization of this market is essential to reaching the country's goal of achieving net-zero emissions economy-wide by no later than 2050. Policy mechanisms intended to address the GHG impact of transportation fuels include the federal Renewable Fuel Standard and the low-carbon fuel standards active in states like California. The utilization of hydrogen in programs such as these, coupled with the creation of regional hydrogen hubs, can magnify its decarbonization impact.

In 2022, Air Liquide opened its largest liquid hydrogen production facility in the world in North Las Vegas, Nevada. This $250 million investment utilizes a steam methane reformer which, with biogas feedstocks and renewable power for liquefaction, provides low-carbon and renewable hydrogen to the mobility market in California. At full capacity, this facility can provide enough fuel to keep more than 40,000 hydrogen fuel cell electric vehicles on the road, significantly improving the supply to this critical market. With the investments made at this project, Air Liquide also developed the infrastructure necessary to attract other companies to move into the area, creating additional jobs and new revenue in a previously underdeveloped area.

In addition to the Nevada investment, Air Liquide is involved in a variety of hydrogen hub proposals, which reflect the local investments and versatility that hydrogen provides. The concept of hydrogen hubs, created by the *Bipartisan Infrastructure Law*, is intended to leverage a regional approach to building a network of interconnected hydrogen energy centers. The hubs concept is built on the utilization of local resources to generate hydrogen and to then deploy it across sectors. As the hub proposals develop, we can see this regional emphasis evolving:

- Chairman Carper and Senator Fetterman, in the midAtlantic, a regional hydrogen hub could unite the east coast transportation system with the necessary renewable fuel and refueling infrastructure. This region is of great importance to Air Liquide. Newark, Delaware is home to Air Liquide's Innovation Campus, which is continually advancing hydrogen research in the study and optimization of electrolysis; development of safety protocols for hydrogen refueling of boats and vehicles, in partnership with the DOE's Hydrogen-at-Scale Maritime project; as well as the development of a membrane technology capable of both upgrading biogas for renewable hydrogen production and for capturing carbon. Pennsylvania is home to almost 1,400 Air Liquide employees; and Radnor is the headquarters of Airgas, an Air Liquide company, with extensive history in the state including the operation of a nationwide high school welding program, including schools in Pennsylvania.

- Ranking Member Capito and Senator Cardin, an Appalachia hub could leverage the region's abundant supply of natural gas. Using carbon capture, we can produce low-carbon hydrogen from that supply and dramatically reduce transportation emissions compared to traditional transportation fuels.

- Senator Merkley and Senator Padilla, in the Northwest and in California, a hydrogen hub could support the region's ambition to adopt a 100% clean electricity standard. This renewable electricity could be used to produce renewable hydrogen through electrolysis.

- Senator Sanders, Senator Whitehouse, and Senator Markey, in the Northeast, the region's abundant wind and hydropower can also be used to create low-carbon hydrogen via electrolysis. Air Liquide is at the forefront of this technology as it operates the world's largest Proton Exchange Membrane electrolyzer currently in operation, utilizing hydropower from Niagara Falls to produce and supply the Northeast U.S. with low-carbon, renewable hydrogen.

- Senator Stabenow, in the Midwest, a hydrogen hub can serve to transform heavy duty transportation in the heart of the nation's mobility networks while leveraging the existing nuclear generating fleet.

- Senator Kelly, a regional hydrogen hub in the Southwest could utilize the region's vast solar and land resources to produce clean hydrogen, and has the ideal conditions for the storage of large volumes of hydrogen through salt caverns, for the benefit of Southwestern states and tribal organizations.

- In the Gulf Coast, hydrogen can serve as a decarbonization vector to reduce the carbon footprint of energy intensive industries such as the chemical sector. The Gulf Coast is home to the largest hydrogen production basin in the world, and boasts the infrastructure necessary to produce, transport and store hydrogen - including the world's largest hydrogen storage cavern, which we own and operate.

Investments in clean hydrogen, and its deployment into an LCFS or clean fuels program, regionally or nationally, can help ensure that the United States reaches its emissions reductions goals and remains the energy superpower of the future.

III. Certainty, Flexibility & Technological Neutrality: Essential Principles for Clean Fuels Programs

To support the expansion of clean energy and drive investments, policies should be certain, flexible, and technology neutral. Policies that frequently change make it difficult for a business to plan for large scale investments. Policies that are too onerous or prescriptive can unintentionally hinder the expansion of clean energy production and use. And to promote competition to drive innovation, policies should set a clear incentive structure and allow technologies to compete fairly. When considering a National Clean Fuels Program, the Committee should keep these goals in mind.

Fortunately, as mentioned, there are policies currently that drive clean production, like the California Low Carbon Fuel Standard (CA LCFS) and the Renewable Fuel Standard (RFS), that we can use as a model for enhancement and improvement.

Every hydrogen molecule sold from Air Liquide's facilities into the California transportation market falls under the CA LCFS, making Air Liquide a significant low carbon fuel provider. Additionally, Air Liquide's industrial operations supply the refinery industry, which also must comply with the CA LCFS. Finally, our biogas business provides renewable natural gas (RNG) into the LCFS markets and it generates renewable identification numbers (RINs) under the RFS. This broad view of the LCFS and RFS provides Air Liquide with unique expertise and insights into the programs and their effects on our markets.

IV. Lessons Learned: CA LCFS

A. Successful CA LCFS Elements: Emissions Reductions, Technological Neutrality, Energy Producer Flexibility

Air Liquide's experience in the CA LCFS program has given us a unique perspective on the model's flexibility, promotion of innovation and private investment, and its benefits to various parties.

1) CA LCFS: CO2 Emissions Reductions: By stimulating innovation and the market for low carbon alternative fuels, California's program has enabled the state's hydrogen market to quickly decarbonize and, with the introduction of infrastructure incentives (which subsidize the construction of fueling facilities), it has helped address the issue of consumers' limited access to stations. To be effective, a National Clean Fuels Program should provide consumers with a low cost renewable fuel option that can help meaningfully reduce CO2 emissions.

   The growth of clean hydrogen is not only good for the market but it is greatly beneficial to communities. Environmental justice communities often are more disproportionately impacted by transportation-related emissions. The opportunity to transition buses and other heavy-duty vehicles to renewable fuels, including zero emission hydrogen fuel cell electric vehicles, has the benefit of decreasing conventional pollutants in these communities.

2) CA LCFS: Energy Technology Agnostic Pathway Evaluations Are Effective: Important to the effectiveness of the CA LCFS program is that it is based on a performance-based "carbon intensity" target and a methodology for the fair evaluation of fuels on an equal basis. It is not based on labels such as "renewable" or "green," which can mask large differences in the emissions associated with various fuels. The pathway evaluations are appropriately based on emissions from well to wheels with explicit, stable rules for accounting for direct and indirect emissions. Importantly, because the CA LCFS is based on the calculated carbon intensity of each fuel, it is agnostic about technologies and

feedstocks. It does not favor or disfavor any particular feedstock that goes into the making of a fuel, nor does it favor or disfavor any particular technology for producing a fuel. For example, a fuel produced from petroleum feedstocks, with capture and sequestration of the emissions resulting from the production process, may have a carbon intensity that is as low or lower than a "renewable" fuel that is produced with waste material or solar energy. This flexibility allows fuel suppliers to optimize their available feedstocks and best meet the low cost, low carbon solutions required by their customers.

3) CA LCFS: Flexibility for Clean Energy Producers Underpins the Program's Success: The CA LCFS allows the use of Renewable Electricity Credits (RECs) and biogas Environmental Attributes (EAs) to lower carbon intensity of feedstocks. Under the LCFS, this is known as "book-and-claim accounting." Additionally, the CA LCFS also allows fuel producers to obtain credits for avoided emissions for some feedstocks.

Policies that enable the use of RECs and EAs enable investments that best use available resources, infrastructure, and technologies to meet targets. RECs and EAs allow for solution providers to invest in expansion of both the electric grid and the natural gas network while providing real carbon reductions. The use of RECs and EAs allows hydrogen to leverage the unique resources of different geographic regions. States in energy poor regions can utilize renewable or low carbon energy created in energy abundant regions. This allows for fuels, such as hydrogen to be produced where it is needed without being constrained by colocation of feedstock development and production.

When considering decarbonization objectives, flexibility is important. For example, a fuel producer that captures methane from a dairy manure digester can obtain LCFS credits for the avoided methane emissions that would have resulted if the methane had been allowed to escape to the atmosphere. Methane has a high global warming potential, so there is significant value in capturing methane emissions. In many instances, capturing methane emissions results in the production of a fuel with a negative carbon intensity; that is, the production and use of the fuel results in a reduction of GHG emissions. Furthermore, this allows for the increased supply of renewable hydrogen which reduces fuel prices, spurring the expansion of clean energy investments and jobs.

B. CA LCFS Areas for Improvement: Streamline Pathways Approvals, Support Market Growth & Innovation, Create Certainty

1) CA LCFS: Streamlining Pathway Approvals Would Improve Efficiency and Consistency: The CA LCFS requires fuel supply pathways to be validated and approved. When considering a National Clean Fuels Program processes of establishing pathway approvals need to be streamlined and efficient. Ensuring consistency in the use of book-and-claim accounting across all feedstocks and process energy, as well as consistency in avoided

emissions rules, would make the program more efficient. For example, the CA LCFS recognizes reduced emissions from swine and dairy manure operations, but not from all manure operations. A flexible system should ensure equal treatment for all fuels and feedstocks, prioritizing low-carbon outcomes and not mandating specific pathways.

Pathways can also include the efficiency of the end user, encouraging high efficiency applications such as fuel cells over combustion systems - the Energy Economy Ratio featured in the CA LCFS is one method of incorporating vehicle efficiency. Additionally, consistent and equal application of the program to all value chain participants is important. Today in California, different parties (producer/dispenser/user) generate the LCFS credits depending on the fuel involved and how it is used.

2) CA LCFS: Design for Market Expansion and Growth: The objective of any program aimed at supporting new and more sustainable markets should be to encourage open market dynamics that drive innovation, investment, and sustainable growth. To achieve this, a National Clean Fuels Program should be built flexibly so that the system can react to market changes that may dilute the value of the program without having to completely rewrite the program. Another important feature that would support this aim is to have a system that enables credit/deficit reporting to be averaged over reasonable time periods (quarters) and across supply regions to allow suppliers to best balance regional supply/demand without jeopardizing energy resiliency.

   As the energy transition continues to evolve, and new technologies and applications are developed, any potential National Clean Fuels Program should consider renewable fuels for transportation. This could include aircraft and sustainable aviation fuels, in addition to the maritime and rail sectors.

3) CA LCFS: Avoid Stranded Costs that Are Inherent in the CA LCFS System: While one of the strengths of the CA LCFS is that it is based on the carbon intensity of specific fuels, this also means that when a fuel-producing facility starts up, there may be insufficient data to determine the carbon intensity of the fuel for a long period of time. The LCFS requires 90 days of operational data in order to determine the carbon-intensity of the fuel and obtain a certification, and the LCFS does not allow a fuel producer to claim credits for a fuel before the calendar quarter in which a fuel's carbon intensity is certified. This can result in some stranded costs during facility startup and could potentially slow investments in clean energy projects. Regulations with a streamlined approach and the opportunity for retroactive credit earnings would be helpful.

V. Lessons Learned: RFS Pathway Approvals Need Certainty and Timeliness to Advance the Nation's Clean Energy Transition Goals

The RFS requires fuel supply pathways to be validated and approved, which can cause some clean energy sources to be unfairly treated. As an example, biogas which is captured and sold as renewable natural gas (RNG) to be used in a natural gas vehicle, is eligible to generate RINs under the RFS. If you were to use that same RNG to produce renewable hydrogen for use in a fuel cell vehicle, it would not generate RINs.

Air Liquide has three pending RFS pathway petitions pending to allow hydrogen from RNG to qualify, the first of which was submitted in 2016. Air Liquide, and other companies, have met with the Environmental Protection Agency (EPA) multiple times through multiple Presidential Administrations to discuss the petitions, but they have not advanced, and there is no clarity as to when, if ever, these petitions will be finalized.

This lack of movement and transparency could be remedied by a program with a simple methodology with clear boundaries on emissions from well-to-wheel along a production pathway. Such pathways should allow for the flexible use of RECs and EAs to promote entire energy markets and allow for full usage of our existing natural gas and electricity infrastructure. Regional, temporal, or "additionality" limits can artificially bias pathways and inhibit regional energy investments. It is also important to include and treat equally all energy and emission sources in the pathway evaluations including feedstock development and supply, production and process energy, distribution and supply, and end use including carbon abatement, if deployed.

Conclusion

In conclusion, at Air Liquide, we believe that decarbonizing the transportation sector is a mission that can only be achieved through collaboration - among industry, government and communities. We have the technologies and expertise needed to advance the energy transition through the use of renewable fuels. With supportive governmental policy and programs that provide certainty and are technologically neutral and flexible, we can ensure that the market and the U.S. consumer benefit from a clean energy system that is affordable.

Chairman Carper, Ranking Member Capito, and Members of the Committee, thank you for your time today. I look forward to answering your questions.