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RE: Air Products' Comments Related to SB 1075 Joint Agency Workshop

Dear Ms. Sahota & Joint Agencies:

Thank you for the opportunity to comment on the material presented during the SB 1075 joint agency kick-off workshop. Hydrogen will play a critical role in the clean energy transition – particularly in the transportation, power and industrial sectors. We look forward to working with CARB and the Joint Agencies as you develop this important work, setting a proactive, future path for hydrogen in California.

Background & Introduction

Air Products is a global company with substantial experience in producing, storing, and deploying hydrogen in a safe and environmentally conscious manner. Worldwide, nationally and in California, Air Products is the largest hydrogen producer, with over 10,000 metric tons per day of production capacity. Within California, for more than 40 years, Air Products has safely operated hydrogen systems, including 10 hydrogen-production facilities and 30 miles of hydrogen pipelines. Air Products supplies a network of light-duty and heavy-duty hydrogen fueling stations, facilitating the transition to zero emissions transportation. We are a global leader and expert on the production, storage, transport, and use of hydrogen, and have substantial new lower carbon hydrogen investments under development today. In fact, Air Products announced[1] that it will spend $15 billion dollars by 2027 in clean energy investments including both green and blue hydrogen projects with over $11 billion of that already committed.

California is home to one of the nation's largest, well-established competitive hydrogen markets, and the state leads the global hydrogen economy with policies and programs that support economy-wide applications and create demand and incentives for new production and hydrogen deployment. The SB 1075 framework is an important process, which can result in expanding the existing, successful, and competitive hydrogen market in the state in an environmentally and

[1] Air Products, Air Products Announces Additional "Third by '30" CO_2 Emissions Reduction Goal, Commitment to Net Zero by 2050, and Increase in New Capital for Energy Transition to $15 Billion (July 25, 2022)

economically efficient manner. Along with the market framework analysis work at GO-Biz, the SB 1075 framework is a key component to enabling near- and long-term viable, competitive hydrogen markets that will deliver key environmental and economic benefits.

Leveraging California's historic, successful, and robust hydrogen systems – production capacity, delivery, dispensing, and storage systems by proven providers – will add to the toolbox of clean energy resources to enable the state's environmental goals. In addition to greenhouse gas emission reductions, benefits from increased hydrogen end-use applications include dramatically improved air quality, reduced negative health impacts by eliminating diesel and bunker fuels in front-line communities (especially near ports), new zero-carbon drop in fuels supplies for critical electric assets needed for grid reliability or for resources adequacy, and new green jobs to replace some which may be lost in the energy transition as we move away from refined fossil fuels.

Hydrogen deployments should be focused in the economic sectors that are not easily decarbonized by electrification, and the SB 1075 study process should focus on the most effective sector targets. These targets include creating demand for hydrogen (and its derivatives like ammonia and methanol) in long-haul, heavy-duty transportation, heavy industry (metals, cement), clean aviation fuel, shipping fuel, ZEV cargo handling equipment at the ports, and zero emission fuels (ZEF) for critical electric resources.

As California writes the next chapter for its established hydrogen economy, guiding principles that shaped other clean energy programs, like the electricity Renewable Portfolio Standard (RPS) and the Low Carbon Fuel Standard (LCFS), can serve as template policy frameworks.

Guiding Principles to Expand Hydrogen Market:

- Preserving competitive markets are key to accelerated project development, lower costs, wider-scale emissions reductions, and long-term success.
- Set clear market rules that create certainty:
    - Avoid new rules or market regulations that dramatically shift or disrupt the existing, functional hydrogen market.
    - Create tangible long-term market rules to incentivize supply for hydrogen and its use.
    - Create new long-term visible market rules to enable private sector investments in lower carbon hydrogen production and delivery infrastructure including demand side offtake rules over long periods of times (15-20 years).
    - Align any new hydrogen market rules with established climate policies like the 2022 Scoping Plan Update.
- Prioritize support for new lower carbon hydrogen production facilities with verifiable emission reductions.
- Use energy diversity, resiliency, and energy independence as metrics, and avoid over-reliance on one energy source, like electricity.
- Provide a technology-agnostic approach for incentives and market rules for lowering the carbon intensity of hydrogen.
- Use carbon intensity metrics to measure lower carbon hydrogen.
- Recognize the role that hydrogen derivatives will play and give consideration when setting policy.
- Recognize that California's energy system extends beyond its borders and leverage regional collaboration to drive down costs and increase lower carbon hydrogen supply, reliability and availability.

- Prioritize front-line communities and design programs that deliver meaningful environmental and economic benefits for these communities.
- Accommodate new lower carbon hydrogen technologies as they are developed; don't pick technology winners and losers.
- Support continued workforce training and enable skilled job growth.

Air Products is Committed to California's Energy Transition and Invested in Positioning the State as a Global Leader in Lower CarbonHydrogen

We are Deploying Capital Across the Hydrogen Value Chain to Enable California's Energy Transition

I. **California's dedicated hydrogen pipeline system**: Approximately 1,600 miles of dedicated hydrogen pipelines are operated in the United States[2], including about 30 miles in California serving industrial customers. Air Products owns and operates the only dedicated hydrogen pipeline system in the state. We recently expanded our pipeline system to enable clean fuels production, converting a refinery property into the largest sustainable aviation fuels production facility in North America.

Air Products' California pipeline has safely and cost-effectively operated in Southern California for more than 25 years. All dedicated hydrogen pipelines in the United States are regulated by Department of Transportation and Pipeline and Hazardous Materials Safety Administration (PHMSA). Today, PHMSA is updating and expanding their hydrogen safety protocols, working with global hydrogen industry leaders, including Air Products. Dedicated hydrogen pipelines are part of a well-established private network of industrial gas pipelines in the U.S. and California, which are engineered, designed and constructed to carry that particular molecule for the dedicated end users.

As the Joint Agencies consider hydrogen delivery infrastructure and potential expansion, we urge you to carefully consider the existing successful, safe, and competitive market guidelines in place today. **A clear and effective regulatory framework already exists for hydrogen and provides strong oversight for the safe operation of hydrogen operations.**

Typically, hydrogen pipelines are developed to serve large, industrial end-users. The capital expense to fund private pipelines can only be justified by a demonstrated demand at the delivery point, not speculative potential future demand. Additionally, these pipelines are purpose-built to specifications for hydrogen, with rigorous engineering and monitoring to prevent leakage and ensure safety. We encourage you to explore the historic protocols developed by DOT/PHMSA along-side the hydrogen pipeline operators. We also request that you carefully evaluate market impacts of any alternative regulatory proposal for hydrogen, ammonia, and other industrial pipelines, storage or handling infrastructure expansions for hydrogen derivatives. Industrial pipelines in California and the U.S. do not fall under the Natural Gas Act and thus the related market or commodity regulation does not apply. Industrial gases, like hydrogen, which serve large industrial users (not residential and small businesses) are competitively produced and sold, facilitating an efficient and cost-effective market.

[2] Hydrogen Pipelines | Department of Energy

II. **Multi-modal, reliable hydrogen fueling stations and ZEV solutions:** Hydrogen and its derivates are an important zero emission transportation fuel solution for heavy-duty, long-haul highway transportation, port complex cargo handlers, maritime or shipping fuel, rail, and long-distance aviation fuel. These transportation subsectors are also among the hardest to abate end-uses which will most benefit from available, reliable hydrogen supply and fueling infrastructure. CARB and the Joint Agencies should look at all transportation needs, the benefits from deploying zero-emission vehicles like drayage, fuel cell electric vehicle (FCEV) Class 8 trucks, hydrogen-capable aircraft, and ammonia (hydrogen derivative) fueled ships to determine how to provide supply incentives and appropriate multi-modal fueling infrastructure to deliver a reliable, cost-effective hydrogen and ammonia system.

III. **Focus on decarbonizing port complexes and benefits for nearby front-line communities should be a priority:** Targeting ports, and goods movement, will focus hydrogen systems solutions on heavily impacted front-line communities which experience some of the worst air quality due to goods movement in and near port complexes. Providing specific recommendations, incentives and enabling solutions to reduce or eliminate diesel and bunker fuels related to goods imports and movements will immediately and dramatically improve air quality, preserve and expand skilled jobs in the area, and enable scaling of hydrogen to bring overall costs down. Additionally, a focus on these transportation needs (long-haul trucking, rail, ships, drayage, aviation) will position the state, via its ports, as a global ZEV fuel partner and enable existing international agreements between California and Port Authorities to provide hydrogen, ammonia and other ZEFs for international shipping needs.

IV. **Transition Air Products heavy-duty truck fleet to ZEV FCEVs:** Air Products has a global fleet of 2,000 heavy-duty, Class 8 trucks that deliver industrial gas to smaller consumers. We are committed to turning over our fleet to zero emission hydrogen FCEV trucks. Working with our partner Cummins, we are moving forward with this transition to further demonstrate our commitment to becoming net-zero by 2050 and to inspire other fleet operators to shift their fleets to zero-emission technologies, as well. We encourage the Joint Agencies to evaluate policies and new market rules to support similar fleet transitions in the heavy-duty transportation sector, including ongoing FCEV truck purchase incentives and more funding for multi-modal fueling stations.

V. **Expand workforce and skilled training opportunities**: As we look toward expanding California-based hydrogen production, handling, delivery and fueling infrastructure, we see an opportunity to grow the green economy and increase the availability of skilled jobs in California's already vibrant hydrogen industry. Together with labor leadership, we look forward to increasing worker training programs and creating a robust pipeline of trained workers across the trades to build generational careers.

VI. **Build-out real projects with verifiable greenhouse gas emission reductions, jobs and air quality improvements**. Increase clean fuel supply and production capacity locally, regionally and globally, including hydrogen, its derivatives and sustainable aviation fuel.

VII. **Air Products has committed ~$15 billion to expand the supply of new clean fuels by 2027, which include the following investments:**

- **Sustainable Aviation Fuel in Los Angeles County:** Air Products invested in a $2.5 billion expansion project with World Energy to develop North America's largest sustainable aviation fuel (SAF) production facility in Paramount, California. The project transitions a legacy oil refinery to a total SAF capacity of 340 million gallons annually. This included an expansion of Air Products' existing hydrogen pipeline network in Southern California.

- **An Air Products green hydrogen** facility based in Casa Grande, Arizona, just outside Phoenix, will be onstream in 2023 and will produce zero-carbon liquid hydrogen for the transportation market.

- **An Air Products green hydrogen** investment of about $500 million in a large-scale facility to produce zero-carbon hydrogen at a greenfield site in Massena, New York. The facility will be powered by 94 MW of low-cost St. Lawrence River hydroelectric power.

- **A green hydrogen facility developed jointly** by Air Products and The AES Corporation of approximately $4 billion to build, own and operate a green hydrogen production facility in Wilbarger County, Texas. This proposed mega-scale renewable power to hydrogen project includes approximately 1.4 gigawatts of wind and solar power generation, along with electrolyzer capacity capable of producing over 200 tonnes per day of green hydrogen, making it the largest green hydrogen facility in the United States.

- **An Air Products $4.5 billion blue hydrogen clean energy complex** in Louisiana, which represents the company's largest investment ever in the United States and will permanently sequester more than five million tons of carbon dioxide (CO_2) per year. This project will capture 95% of the facility's CO_2 emissions and produces blue hydrogen with near-zero-carbon emissions.

- **An innovative net-zero-carbon hydrogen Air Products** production complex in Alberta, Canada, totaling $1.6 billion, which achieves net-zero emissions through the combination of advanced hydrogen reforming technology, carbon capture and storage, and hydrogen-fueled electricity generation.

- **The world's largest green hydrogen project developed by Air Products** with regional partners will utilize more electrolyzer capacity than has been deployed throughout the world to date. This multi-billion-dollar project in Neom will unilaterally serve to scale global electrolyzer production capacity and manufacturing, helping to bring down the costs of this important technology.

The SB 1075 Report Recommendations Should Promote a Diverse Set of Hydrogen Production Technologies and Resources

As discussed above, Air Products is fully committed to California's climate policies and supporting efforts that lead to lower carbon hydrogen market lift-off with global implications, particularly new hydrogen policies. Because hydrogen has the potential to deliver zero emission solutions for hard-to-abate sectors, which typically use fossil crude or fossil feedstocks, building out the supply chain and market rules to enable this global transition is critical.

Today, California imports 75% of its crude oil, more than 90% of its natural gas, and over two-thirds of all energy, including electricity. Replacing these fossil fuels and energy sources will require scaling state, regional, national and international hydrogen and hydrogen derivatives supply chains. CARB and the Joint Agencies should recognize the global energy economy, analyze the role for hydrogen, and recommend market frameworks to ensure that there is a robust, reliable supply as hydrogen end uses expand to replace oil and gas. Additionally, the analysis should have a broad view of hydrogen derivatives – including but not limited to ammonia, methanol, and synthetic e-fuels such as renewable methane or sustainable aviation fuels – in advancing the State's climate goals and examining the replacement of oil and gas. In addition to existing private hydrogen pipeline and production, the U.S. and California have infrastructure in place for hydrogen derivatives, such as ammonia. California is home to a significant ammonia import terminal which serves the agricultural industry and can serve as infrastructure and feedstock for expanded hydrogen deployment in the transportation sector.

CARB and the Joint Agencies Should Identify and Prioritize the Most Beneficial Uses for Low Carbon Hydrogen and its Derivatives.

Air Products believes that hydrogen is the most viable energy source that can decarbonize a significant portion of the economy such as heavy-duty transportation (i.e., transit buses, trucks, shipping, aviation), chemicals, cement, power, and metals (steel, aluminum, and iron) production. When used as a fuel or energy carrier in these sectors, it produces very low or no direct emissions, improving local air quality and in contrast to some of the other fuels used today. In a complement to renewable electricity, hydrogen also provides important grid reliability, resilience and energy storage characteristics that will support the growth of renewable generation.

As was mentioned by some of the workshop attendees, we urge caution related to blending hydrogen into natural gas pipelines or using pure hydrogen in any legacy commercial or residential heating systems. Any application of hydrogen in these sectors needs to be carefully reviewed to ensure safety, continued system reliability, and that the blend of hydrogen in small quantities into natural gas is an effective emission reduction approach. As identified by the University of California, Riverside report to the CPUC (footnote)[3], limitations to blending exist in terms of pipeline materials, component materials and function (i.e., meters) and impacts on end user equipment and appliances (different flame patterns, flame temperature with associated NOx increases, heat transfer requirements, etc.). Additionally, because of the lower energy density of hydrogen, more volume is needed which may create constraints in the system that require expensive retrofits to pipelines designed to deliver natural gas, with little emission reduction benefit. In fact, a 5% blend by volume only displaces about 2%[4] of the energy that the natural gas provides which dilutes the emission reduction potential. Use of low carbon hydrogen in the residential and commercial sectors should be the lowest priority especially while commercial hydrogen volumes are low.

Balance California's zero-carbon electricity goals and the need for new lower carbon hydrogen infrastructure. While the state has some world-class renewable energy resources, according to the 2021 Joint Agency SB 100 Report, the state will need to sustain "record breaking" clean energy build rates for 25 years, just to achieve its SB 100 goals. At the workshop, CARB estimated that by 2045, the state will need twice as much electricity and four times more wind and solar capacity relative to 2022. Crucially, this forecast does not include the power needed for

[3] CPUC Issues Independent Study on Injecting Hydrogen Into Natural Gas Systems (ca.gov)
[4] P. 14, Hydrogen Blending into Natural Gas Pipeline Infrastructure: Review of the State of Technology (nrel.gov)

renewable electrolytic hydrogen (estimated at 10 gigawatts) or direct air capture, which were assumed to be off grid.

California will very likely have to continue relying on imported electrons to meet its clean energy goals for electricity and other sectors – even in a clean energy future. It is important that the SB 1075 Report identify use cases and policies that can deploy conventional hydrogen to advance air quality benefits, and strategies to lower the carbon intensity of that hydrogen.

The SB 1075 Report Findings and Recommendations Should Include Continued Direction for Rapid Private Sector Investment in Lower Carbon Hydrogen Solutions

Air Products, and the hydrogen industry more broadly, are rapidly moving to build out hydrogen infrastructure. California has a well-established hydrogen market and can leverage it to expand lower carbon hydrogen products and solutions. The Legislature created ARCHES in 2022 to establish the state's hydrogen entity and create a green hydrogen hub. ARCHES is pursuing U.S. Department of Energy designation and financial awards for a green hydrogen hub. Since its recent creation, ARCHES now has more than 400 participating hydrogen entities and robust private sector participation. California can best support the rapid development of additional projects by:

  - Avoiding defining or classifying hydrogen based on technologies or geography, and instead make any eligibility or other criteria for hydrogen based on carbon intensity. For example, Air Products supports the broad definition of green hydrogen referenced in the 2022 Scoping Plan Update, which includes biomass and other renewable hydrogen options, alongside electrolysis. We further note that blue hydrogen can be made with a similar carbon intensity as green hydrogen and should be incentivized accordingly.

- Implementing policies to substantially increase demand, including:

  - Strengthening the LCFS through 2030 and beyond, to continue driving investments in low carbon fuels and adopt Hydrogen Refueling Infrastructure (HRI) crediting for heavy-duty vehicles under the LCFS. This program has been successful in fostering private sector investment in larger, more reliable hydrogen fueling stations for light-duty vehicles and can help to rapidly scale infrastructure for heavy-duty ZEVs, as well.

  - Providing long-term visibility into the availability of incentives for heavy-duty fuel cell vehicles, including exempting fuel cell vehicles from the large-fleet cap proposed under the HVIP program.

  - Targeting roles for hydrogen solutions in power sector resource mix including clean resource adequacy options, long-term storage solutions, grid resiliency or distributed generation capacity, and drop-in zero-carbon fuel for critical thermal assets with local reliability constraints.

  - Leveraging the State's climate change programs – including the LCFS, Cap-and-Trade and new policies that may be developed pursuant to Senate Bill 596 (Becker, statutes of 2022 – net-zero emissions in the cement sector) or otherwise

for new decarbonized hydrogen market opportunities in the refining sector, cement and other industrial applications.

The Agencies Should Take a Technology-Neutral Approach to Hydrogen and Other Emerging Topics

We are confident that a full and fair evaluation of the complete array of hydrogen technologies, throughout the supply chain, will lead to the conclusion that we can more deeply and quickly decarbonize many sectors of California's economy than we currently assume. An incomplete evaluation, however, including one that only looks at limited solutions, such as electrolysis or pipeline transport of hydrogen, is more likely to lead to suboptimal outcomes, higher costs, and longer timeframes for achieving California's climate goals.

We urge you to take a technology-neutral and performance-based approach in your evaluation of hydrogen, including an evaluation of:

- Current hydrogen supplies and how they can be deployed to support California's clean air and energy goals, including feedstock replacement for additional decarbonization.

- End use applications for hydrogen and its derivatives, including methanol, ammonia, and alternative fuels such as renewable methane or sustainable aviation fuel.

- Maintaining a technologically-neutral approach also aligns with federal incentives including the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA) – neither of which dictate a specific production technology.

Most of all, as referenced above, we strongly urge you to avoid creating any arbitrary and limiting definitions or exclusions for hydrogen based on production technology, feedstock, or other categorizations that don't necessarily influence emissions outcomes or air quality improvements. This would only serve to limit opportunities to reduce emissions in the State. A comparison and evaluation of decarbonization strategies, including for hydrogen, should be based on lifecycle carbon intensity.

Conclusion

California is a global leader in the green economy with renewable and low carbon electric and fuel markets that drive state, national and international policies. These state programs provide important market incentives that drive private sector investments. As California moves toward the next phase of economy-wide decarbonization and expands the existing robust hydrogen systems to a wider end-user base and more clean fuels supply, Air Products urges you to consider driving principles that will deliver meaningful environmental benefits, prioritize frontline communities, expand green job opportunities, deliver real projects with verifiable emission reductions and preserve the existing competitive hydrogen market. Future market rules and incentives for hydrogen that flow from this process and other important agencies initiatives should support the broad range of hydrogen infrastructure investments happening now by the private sector, and deliver a robust hydrogen supply quickly, safely and cost-competitively. Future market rules and incentives for hydrogen that flow from this process, as well as other important agency initiatives, should support and leverage the broad range of private sector investments currently being made in hydrogen infrastructure, with an eye toward delivering a robust hydrogen supply in a quick, safe, and cost-competitive manner.

Thank you again for the opportunity to comment. Air Products looks forward to working with you and the Joint Agencies throughout the development of the SB 1075 Report to help the state realize its carbon reduction goals. If you have any questions, please feel free to contact me or Miles Heller (hellermt@airproducts.com).

Respectfully,

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Vice President
H2fM and Clean Hydrogen