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Air Products' comments to September 8th IEPR Hydrogen Workshop

Air Products appreciates this opportunity to comment. Please find our comments attached.

Additional submitted attachment is included below.

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October 5, 2023

Commissioner Patty Monahan
California Energy Commission
715 P Street
Sacramento, California 95814

RE: Air Products' Comments Related to September 8, 2023, Hydrogen Workshop – 23-IEPR-06

Dear Commissioner Monahan:

Thank you for the opportunity to comment on the material presented during the September 8, 2023, hydrogen workshop for the development of the 2023 Integrated Energy Policy Report (IEPR). Hydrogen will play a critical role in the clean energy transition – particularly in the transportation, maritime, heavy industry, and certain aspects of the power sectors. As was noted in the workshop, hydrogen is receiving strong support this year and the opportunity to expand hydrogen as part of the mid-century decarbonization strategy is supported by state and federal agencies. Hydrogen will continue to complement other low and zero emission energy sources, adding to energy diversity and resiliency.

The Joint Agency work, the Governor's directive to develop the Hydrogen Market Development Strategy, Senate Bill 1075 (Skinner) process and future work on SB 100 and SB 423 implementation, coupled with the federal Inflation Reduction Act and potential U.S. DOE hydrogen hub award, creates more momentum than ever in the state to expand our robust hydrogen economy. While we collectively are looking for new, innovative end-uses, like power sector and maritime applications, it's important to recognize that California has a well-established and well-regulated hydrogen market, with in-state production capacity, and existing hydrogen storage and delivery systems in place. Leveraging and building on these existing functioning markets and systems will be a key differentiator for the region and will enable faster, safe, and more cost-effective expansion of hydrogen.

As the California Energy Commission (CEC) continues the IEPR studies, a broad view of emission reduction opportunities, community benefits including jobs and air quality improvements for frontline communities, industrial complex decarbonization and driving down long-term costs, energy diversity, safety and reliability should be our collective priorities. As the largest hydrogen producer in the state, the United States, and the world, with vast operational expertise as owners and operators of in-state dedicated hydrogen pipelines and storage, Air Products looks forward to working closely with the CEC on this portion of the IEPR, as well as the larger SB 1075 process and the Governor's market development strategy.

Background & Introduction

Air Products is a global company with substantial experience producing, storing, and deploying hydrogen in a safe and environmentally conscious manner. Worldwide 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, and we have already committed over $11 billion of that amount. By bringing to bear the financial, technical and execution resources of our existing business, along with others experienced in the hydrogen industry, to focus on future growth and sustainability, we will be able to deploy the levels of capital investment needed to scale the production and distribution of hydrogen, thereby transforming heavy-duty and off-road transportation and heavy industry. Importantly, our model also shows that this clean energy transition can happen within the context of a private competitive market and meet the demands of this segment of the energy transformation while achieving the lowest cost for the consumer.

California is home to one of the nation's largest, well-established competitive hydrogen markets. Much of the hydrogen deployed in California and across the Unites States serving heavy industry and transportation already. California leads the global hydrogen economy with policies and programs that support economy-wide hydrogen applications and creates demand and incentives for new production and hydrogen deployment in traditional (industry) and non-traditional (zero emission vehicle (ZEV), maritime, power) economic sectors.

Guiding Principles to Expand Hydrogen Market

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 for policy frameworks. In particular, CEC and other state agencies should work to develop a hydrogen market that aligns with the following principles:

- The preservation and expansion of **competitive markets** is 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 markets.
    - Create new **long-term visible market rules** to enable private sector investments in hydrogen production and delivery infrastructure including demand side offtake rules that match investment life cycles (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**. For electrolytic hydrogen, this would include robust time-matching, deliverability, and additionality requirements.
- Use energy **diversity, resiliency, and energy independence** as metrics, while avoiding over-reliance on one energy source, like electricity.

[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)

- Provide a **technology-agnostic** approach for incentives and market rules for lowering the carbon intensity of hydrogen.
- Use **carbon intensity metrics** to measure lifecycle emissions from lower carbon hydrogen.
- Recognize the role that **hydrogen derivatives** will play and give them consideration when setting policy.
- Recognize that California's energy system extends beyond its borders and leverage regional collaboration to drive down costs and increase hydrogen supply, reliability, and availability.
- Prioritize **front-line communities** and design programs that deliver meaningful environmental and economic benefits for these communities.
- **Don't pick winners and losers,** and allow for innovation and accommodation of new, lower carbon hydrogen technologies as they develop.
- Support continued **workforce training** and enable skilled job growth.

A Broad Analysis Will Benefit Future Hydrogen Market Effectiveness

The CEC's update to the IEPR as directed by SB 1075 is critical analytical work and key to informing a broader roadmap and an inflection point for the state energy economy. The guidance from this process will inform programs and market rules with significant impacts to the future of the state's hydrogen market, at key agencies like the CPUC and CARB.

In addition to evaluating the transportation and power sector, mandated by SB 1075, we encourage you to look at synergistic relationships, both economically and geographically, with these two sectors along with the ports, aviation, maritime and heavy industry. Hydrogen is a well-established market with a commodity that can be deployed across the economy. Complementing electrification strategies with expanded hydrogen production, cost-effective storage and delivery will drive a balanced, future competitive clean energy market. We encourage the IEPR and related SB 1075 analyses and frameworks to include a broad analysis of the regional market relationships for hydrogen and other clean energy supplies and subsector market off-takers.

California's Robust Hydrogen Private Sector Providers and Existing Infrastructure Can and Should Serve as the Foundation for New End-Uses

Leveraging California's historic, successful, and robust hydrogen systems – production capacity, delivery, dispensing, and storage systems by experienced and safe providers – will add to the toolbox of clean energy resources to enable the state to meet its 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 through the elimination of diesel and bunker fuels in front-line communities (especially near ports), new zero-carbon drop-in fuels for critical electric assets needed for grid reliability or for resource adequacy, and new green jobs to replace some which may be lost in the energy transition as we move away from refined fossil fuels. Leveraging the experience and momentum from existing, proven hydrogen solution providers will enable the state to act with speed and efficiency to delivery on its energy transition goals.

Strategically Target the Expansion of Hydrogen: Prioritize Sectors Not Addressed by Electrification and Employ Strategies that Benefit Front-line Communities and Goods Movement Corridors

Hydrogen deployments should be focused in the economic sectors that are not easily decarbonized by electrification. We support the IEPR focus on transportation and power sector opportunities in this report cycle but ask that you continue to consider their geographic connection to industrial complexes, ports, aviation and maritime, as well. Sector targets should include creating demand for hydrogen (and its derivatives like ammonia and methanol) in long-haul, heavy-duty transportation, clean aviation fuel, shipping fuel, ZEV cargo handling equipment at the ports, and zero emission fuels (ZEF) for critical electric resources. Moreover, industrial clusters that include several end-uses and are located in front-line communities and/or goods movement corridors should be prioritized as the CEC analyzes technology, systems, and policies for future hydrogen expansion. For the transportation sector, the workshop focused primarily on heavy-duty truck transportation, but based on the 2022 Scoping Plan Update, the hydrogen market for aviation, marine, and other non-road equipment should also be considered in this IEPR report, as well.

The CEC and Other Agencies Should Identify and Prioritize the Most Beneficial Uses for Low Carbon Hydrogen and its Derivatives

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, rail, aviation), and heavy industry (chemicals, cement, power, steel, aluminum, and iron). When used as a fuel or energy carrier in these sectors, it produces very low or no direct emissions, significantly improving local air quality. In a complement to renewable electricity, hydrogen also provides important grid reliability, resilience and energy storage characteristics that will support the continued growth of renewable generation.

Focus on Decarbonizing Port Complexes and Prioritize Benefits for Nearby Front-Line Communities

Targeting ports, and goods movement more generally, will focus hydrogen systems solutions on heavily impacted front-line communities that experience some of the worst air quality due to goods movement in and near port complexes. Providing port-specific recommendations, incentives, and enabling solutions to reduce or eliminate diesel and bunker fuels related to goods movement will immediately and dramatically improve air quality, preserve and expand regional skilled jobs, 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 zero emission fuel provider and enable existing international agreements between California Port Authorities and International Ports to provide hydrogen, ammonia and other ZEFs for international shipping needs.

Experienced Hydrogen Producers Are Already Investing in New Hydrogen Production, Storage, Delivery and Fueling Infrastructure to Serve California; Recommendations for Future Regulation Should Support and Leverage This Private Sector Investment

Air Products is among the private sector leaders deploying significant capital across the hydrogen value chain to enable California's energy transition. It owns and operates **California's existing, dedicated hydrogen pipeline system**, and much of the **a**pproximately 1,600 miles of dedicated hydrogen pipelines already operating in the United States.[2] California's dedicated hydrogen pipeline networks comprises about 30 miles in Southern California, serving large industrial customers. Air Products recently expanded our pipeline system to enable clean fuels production,

[2] Hydrogen Pipelines | Department of Energy

converting a 60+ acre refinery property in Los Angeles 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, to develop the high pipeline safety standards for hydrogen. 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 dedicated end users.

Safety and Leak Prevention Are Top Priorities

It is also important to note that these same engineering standards that ensure safe operation also minimize hydrogen leakage, which is an issue raised by Environmental Defense Fund (EDF). This concern is taken seriously by the industry. Air Products and other hydrogen pipeline owners and operators take substantial measures to mitigate leakage.

Air Products designs and operates its production and pipeline systems to minimize hydrogen losses in accordance with international, national, and industry standards and best practices. Potential fugitive emissions are minimized through the equipment and techniques Air Products uses, such as leak-tight valves, welded connections, operational measures to detect leaks, and system maintenance and repairs—all of which are also important safety measures. Most of Air Products' hydrogen is transported by pipelines, which greatly minimizes potential emissions. When hydrogen is transported by truck, Air Products takes steps to mitigate venting, which is done to pressure balance for safety, by improving distribution and planning design options to recover vented hydrogen.

It is important to note that engineering standards mentioned above are specific to purpose-built hydrogen transport systems. Introducing hydrogen into legacy systems built for natural gas must be done only after careful study, and likely coupled with piping system upgrades. Utilizing existing natural gas pipelines for carrying hydrogen creates a different set of design considerations to address the leakage concerns than those raised at the workshop.

More Research is Needed to Better Understand Climate Impacts

In terms of impact on global warming, estimation methods are still in development and data collection and information related to detection, leak rates, emission inventory, and mitigation methods need to be studied and better characterized. The reports published to date on this topic contain various assumptions and results that indicate a high level of uncertainty. Further research on natural hydrogen sources and sinks, along with dispersion mechanisms, is also required to properly characterize the impact. We support state and federal research activities on this topic.

Also, any potential impacts from hydrogen emissions cannot be assessed in isolation. Because of the indirect interaction with other atmospheric emissions, like methane, which will be reduced over time based on both climate regulations targeting methane emissions and by displacement of fossil fuels like natural gas with hydrogen and electrification, any potential atmospheric impact from hydrogen will diminish. The positive impact of hydrogen displacing fossil fuels over time, and the associated methane and CO_2 reductions, must be incorporated into any assessment of

hydrogen's net climate impact. Not only will the impact from released hydrogen diminish over time as climate pollutant emissions decrease, but there is also an overall climate benefit from using hydrogen, relative to the petroleum-based alternatives in existing applications, such as heavy-duty transportation.

Hydrogen Production, Storage, Delivery and Fueling Systems Must Continue to be Carefully Planned and Economically Deployed

Historically, hydrogen pipelines, like many other industrial pipelines, are developed to serve large, industrial end-users. The capital expense to fund pipelines are justified by a demonstrated demand at the delivery point and are borne by the investor.

Moreover, hydrogen pipelines are purpose-built to specifications, with rigorous engineering, monitoring, and safety systems to prevent leakage. As you review new areas for hydrogen deployment and make recommendations for future infrastructure incentives, we encourage you to carefully evaluate safety and market impacts of any new alternative regulatory proposal for hydrogen, ammonia, and other industrial gas infrastructure – to avoid redundancy with other existing regulations, and to avoid undermining an existing competitive marketplace.

The State Should Be Deliberate When Contemplating Any Use of a Utility Rate-basing Model for a New Hydrogen Economy and Approach Changes to the Existing Private Competitive Market with Caution

As discussed above, the private hydrogen market has safely operated in California for decades. More recently, that same private competitive framework has gone on to drive significant investments from industry into new hydrogen technologies and end uses that meet state policy directives. If the state moves to authorize and implement a utility-based hydrogen model that is subsidized by ratepayers, it results in a chilling effect on the existing competitive market, sends a negative signal that deters continued private investment, and ultimately hamstrings multiple state policy objectives, ranging from reducing greenhouse gas emissions and meeting air quality goals to accelerating a broad range of skilled jobs in the new green economy.

The CPUC is actively considering several proposals from the state's natural gas utilities that would shift the hydrogen market to a rate-funded utility market. These proposals are spread across numerous CPUC venues, ranging from rate proceeding, policy rulemakings, and advice letter submissions.

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. Effectively creating a new hydrogen utility and introducing a utility-like, regulated market that was designed to serve millions of retail customers, made up mostly of homes and businesses, is unlikely to provide an appropriate framework to drive a strong hydrogen growth trajectory in California, particularly if future deployments are targeted to serve heavy industry and heavy-duty transportation, replacing, crude, diesel, oil, and gas. Moreover, expanding natural gas utilities' role to replace existing competitive hydrogen suppliers by leveraging natural gas customer rates will unfairly impact those ratepayers, drive up overall natural gas bills, and create an un-level playing field between natural gas utilities (acting as new ratepayer funded hydrogen utilities) and the private sector hydrogen market participants.

Currently, the CPUC has been presented with a multi-pronged effort by California natural gas utilities to shift the hydrogen market to a rate-funded utility market.[3] More specifically, upon application by natural gas utilities, the CPUC has recently considered, or has pending, various gas utility requests to utilize ratepayer funds to build hydrogen infrastructure across the value-chain, creating a vertically integrated hydrogen utility within the existing natural gas utilities, and fundamentally expanding their role to produce, store, dispense and deliver hydrogen. For example, the CPUC has been presented with the following requests and proposals:

- Build ***utility-owned hydrogen pipelines*** to deliver hydrogen, regardless of identified hydrogen supply source and confirmed industrial customer off-take[4]
- Build ***utility-owned hydrogen fueling stations*** to compete with privately financed stations[5] with non-competitive fuel pricing subsidized by ratepayers and ratepayers' LCFS credit revenue[6]

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[3] *See, e.g.*, A.22-02-007, *Application of Southern California Gas Company ("SoCalGas") for Authority to Establish a Memorandum Account for the Angeles Link Project* (in which natural gas utility sought Commission approval to track costs related to its development of seeking to track costs of hydrogen pipeline system for possible future cost recovery by ratepayers); A.22-05-015, *Application of Southern California Gas Company for Authority, Among Other Things, to Update its Gas Revenue Requirement and Base Rates Effective on January 1, 2024* (seeking ratepayer funding for hydrogen production and storage, hydrogen refueling station infrastructure for both company-owned vehicles and the general public, research into potential hydrogen blending in existing natural gas pipelines, and for a "hydrogen home" demonstration project); A.22-05-016, *Application of San Diego Gas & Electric Company for Authority, Among Other Update its Electric and Gas Revenue Requirement and Base Rates Effective on January 1, 2024* (proposing various hydrogen investments similar to those proposed by SoCalGas), Ex. SCG-322/SDG&E-320, "2024 GRC Hydrogen Roadmap" available at https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2205015;A2205016/6396/512707621.pdf ; A.22-09-015, *Application of SoCalGas and SDG&E for Authority to Revise their Natural Gas Rates and Implement Storage Proposals effective January 1, 2024 in this Cost Allocation Proceeding,* Ex. 12 at p. 8 (proposing to set a ratepayer-subsidized, below market a rate for publicly-accessible hydrogen refueling stations), available at https://www.socalgas.com/sites/default/files/Chapter_12-Edwin_Harte_Hydrogen_Fueling_Station_Rate.pdf; Advice Letter 6024-G, *Update to Low-Carbon Fuel Standard (LCFS) Program Implementation Plan* (proposing to offer customer fueling cards funded with LCFS credits for use at utility-owned hydrogen fueling stations); Advice Letter 6182-G, Southern California Gas Company 2024 Research Development and Demonstration Plan (proposing to fund various research and demonstration projects for hydrogen products, technologies, and services).

[4] *See* A.22-02-007, *Application of SoCalGas for Authority to Establish a Memorandum Account for the Angeles Link Project*.

[5] A.22-05-015/016 (in which SoCalGas and SDG&E propose to develop publicly accessible and utility-owned hydrogen refueling stations).

[6] A.22-09-015, *Application of SoCalGas and SDG&E for Authority to Revise their Natural Gas Rates and Implement Storage Proposals effective January 1, 2024, in this Cost Allocation Proceeding,* Ex. 12 at p. 8 (proposing to set a ratepayer-subsidized, below market rate for publicly accessible hydrogen refueling stations available to the general public), available at https://www.socalgas.com/sites/default/files/Chapter_12-Edwin_Harte_Hydrogen_Fueling_Station_Rate.pdf.

- Create a ***utility-only hydrogen fueling card*** to incentivize customer use at proposed utility-owned hydrogen fueling stations[7]
- Build ***utility-owned hydrogen electrolyzer*** projects to produce hydrogen[8]
- Build ***utility-owned hydrogen tank storage***[9]
- Develop a "hydrogen home" demonstration project that includes "hydrogen production, hydrogen fuel cell, hydrogen storage, and hydrogen blending into the natural gas system" for use in the home's appliances[10]
- Research and develop new hydrogen ***technologies to generate, transport, and dispense*** hydrogen fuel[11]

When examined in the aggregate, this multi-pronged effort shows the intent of the gas utilities to build hydrogen infrastructure across the value-chain and fundamentally expand their role to produce, store, deliver, and dispense hydrogen across all classes of customers, with the end result being the creation of a vertically integrated hydrogen utility housed within existing natural gas utilities.

A new hydrogen utility within a natural gas utility is unnecessary and not a cost-effective solution for ratepayers. California is already home to one of the nation's largest fleets of hydrogen producers[12], has a network of hydrogen production facilities, fueling stations, storage facilities, customer delivery networks via trucking and pipelines, and an active hydrogen wholesale trading market. Private hydrogen providers are currently investing in and developing even more hydrogen production projects, fueling stations, storage facilities, hydrogen-based sustainable aviation fuel, hydrogen-derivative shipping fuels and new dedicated hydrogen-only pipelines to meet the demand from new industrial and transportation customers.

A new federal production tax credit, more demand-side market incentives, and lower carbon hydrogen production incentives at CARB through the Low Carbon Fuel Standard (LCFS), Cap and Trade or new market-based programs, and additional support for fueling stations from the CEC will continue to drive these private sector hydrogen deployments. Authorizing natural gas utilities to become hydrogen utilities and service providers by leveraging natural gas customer rate revenues and LCFS credit revenues will chill private investments.

The expansion of hydrogen in the transportation and power sector does not require the creation of a utility-like market or a new hydrogen utility. The decades-old existing private market framework is driving significant progress in the transition to hydrogen, including:

- Large shipping lines'[13] consideration of hydrogen derivatives for zero-carbon shipping fuel

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[7] Advice Letter 6024-G, *Update to Low-Carbon Fuel Standard (LCFS) Program Implementation Plan* (proposing to offer customer fueling cards funded with LCFS credits for use at utility-owned hydrogen fueling stations).

[8] A.22-05015/016, Ex. SCG-322/SDG&E-320, "2024 GRC Hydrogen Roadmap" available at https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2205015;A2205016/6396/512707621.pdf

[9] *Id.*

[10] *Id.*

[11] Advice Letter 6182-G, Southern California Gas Company 2024 Research Development and Demonstration Plan (proposing to fund various research and demonstration projects for hydrogen products, technologies, and services).

[12] Alternative Fuels Data Center: Hydrogen Production and Distribution (energy.gov)

[13] Ammonia as a shipping fuel (globalmaritimeforum.org)

- Legacy refineries converting to produce low carbon fuels like sustainable aviation fuel (World Energy) and renewable diesel.
- Large industrial customers contemplating moving away from natural gas to hydrogen for high-heat processing needs
- The nation's largest port complex (Los Angeles and Long Beach) integrating hydrogen into their operations for powering microgrids, cargo handling and long-haul trucking[14],
- The conversion of certain critical power plants – including Intermountain Power, Scattergood to hydrogen capable turbines.

These planned conversions by heavy industry and heavy-duty transportation to decarbonize and move away from natural gas, diesel, crude, oil, and jet fuel are happening today and these players are not anticipating nor relying on a utility-based model for hydrogen production, dispensing and delivery.

If longer-term future hydrogen consumption expands to commercial and residential heating or other small-scale distributed end-uses, a distributed utility model to serve these customers should be evaluated – with an emphasis on safety, reliability, and consumer cost-effectiveness – especially if legacy natural gas piping is used. Allowing California's regulated natural gas utilities to suddenly enter the existing, functional, competitive hydrogen market and use ratepayer funds and customer LCFS credit revenue to subsidize capital investment costs[15] and unfairly compete against the private sector will not serve to catalyze an expanded hydrogen market. Instead, it will undermine long-term cost-effectiveness and send negative market signals to the private sector.

The CEC's IEPR Evaluation of Hydrogen for Transportation and Expanded Infrastructure Must Include Lessons Learned

Multi-modal, reliable hydrogen fueling stations and ZEV solutions should be a priority. 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 benefit the most from available, reliable hydrogen supply and fueling infrastructure.

Additionally, the CEC should include an analysis in the IEPR that examines all transportation needs, the benefits from deploying ZEVs like fuel cell electric vehicle (FCEV) Class 8 and drayage trucks, hydrogen-capable aircraft, and ammonia (hydrogen derivative) fueled ships. And the analysis should help determine how to provide supply-side incentives and drive the growth of multi-modal fueling infrastructure for a variety of transportation mediums that will require a reliable, cost-effective hydrogen and ammonia fueling and storage system. We provide further discussion about fueling station reliability later in these comments.

Heavy-duty, Long-haul Trucking Should Be a Priority: Large Fleet Conversions Drive Cost Reductions

[14] Reference 4th quarter 2022 Progress Update Report at https://cleanairactionplan.org/2017-clean-air-action-plan-update/#

[15] *See, e.g.*, A.22-09-015, Chapter 12 at 8 (proposing to design a hydrogen fueling rate that would recover only 50% of the capital costs for developing the refueling station); *id.* at 7 (explaining that "the capital-related costs for these [hydrogen refueling] stations would be embedded in SoCalGas's base margin revenue requirement," *i.e.*, funded by ratepayers).

Air Products plans to convert our heavy-duty truck fleet to zero-emission 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 heavy-duty fleets to zero-emission technologies. While light-duty FCEV markets continue to grow, the expanded adoption of FCEVs in medium- and heavy-duty vehicle segments can help support the buildout of hydrogen refueling network and ultimately support the State's ZEV goals. Accordingly, we encourage the CEC to evaluate policies, incentives, and new market rules to support similar fleet transitions in the heavy-duty transportation sector, including on-going FCEV truck purchase incentives.

Prioritize Ports and Maritime Industry in the CEC IEPR Transportation Growth Review

Some of the most severe air quality impacts are to communities living and working in and around the port complexes, which often host heavy industry, aviation, and power production. As the CEC looks across the transportation sector to expand hydrogen, ports should be kept top of mind, especially when it comes to potential incentives. Any incentives should be deployed in a manner that maximizes emission reductions in the frontline communities that surround the ports, goods movement corridors and other heavy industry, as these communities are disproportionately impacted by the criteria air pollutants emitted by those economic sectors.

Port greening has co-benefits with the potential to expand hydrogen infrastructure and deployment to neighboring industries with similar environmental objectives. Providing incentives for the ports and their hydrogen providers to increase production, fueling, bunkering, and delivery of hydrogen in these regions will have a high impact and result in immediate, dramatic air quality improvements. Furthermore, it will position the ports for energy diversity, resiliency and create international market advantages as green ports accommodating zero-emission shipping lines. Equally important, targeting ports and the industrial sites near ports as a priority investment in the energy transition will create hundreds of new skilled jobs in locations where jobs may be lost due to reductions at refineries and other industries.

Consider Ancillary Benefits in Your Hydrogen Growth Analysis for IEPR: Workforce Development and Skilled Job Opportunities

As we look toward expanding California-based hydrogen production, handling, delivery and fueling infrastructure, there are opportunities to grow the green economy and increase the availability of skilled jobs in California's already vibrant hydrogen industry. Just as wind, solar, and refinery developers worked with partners to train a new class of skilled workers and expand the state's green economy, the hydrogen expansion into heavy industry and heavy transportation will create a concomitant workforce training program and workforce deployment for generations. Our state's energy blueprint should prioritize this along with community environmental benefits.

CEC's Hydrogen Growth Analysis Should Include a Review of Real, Verifiable Emissions Reductions Protocols: Be Rigorous in the Analysis and Track Back to Climate Change Policies

The CEC's analysis and recommendations around hydrogen expansion into the power and transportation sectors should include prioritization and support for new clean projects with verifiable greenhouse gas emission reductions. The recommendations should be linked to

existing state and federal climate and air quality policies and advance durable accounting and tracking environmental attributes that ensure real, verifiable emission reductions. It is important to note that the energy sources that will be replaced by hydrogen in the state—such as diesel, crude oil, gasoline, and natural gas—are currently imported into California. Their replacements will therefore also be likely to come from both in-state and imported sources. Despite the multi-jurisdictional nature of its energy supply chain, California has a strong track record of designing emission-based compliance protocols for all energy consumed to ensure verifiable emission reductions, like the Cap-and-Trade application for electricity imports, LCFS rules for clean fuel imports, and RPS rules for imported electricity.

All Strategies for New, Low Carbon Hydrogen Production Capacity are Needed

Because hydrogen growth will serve to displace primarily imported energy sources, it is important to look to all supply options. As the leading supplier in California and globally, Air Products recognizes that creating a reliable supply of hydrogen for new end uses identified in this process requires local and global investments. We are doing our part and have committed **~$15 billion by 2027** to expand the supply of new low carbon hydrogen to serve the California and global markets, which include the following announced projects:

- **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, zero-emissions 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.

CEC's Hydrogen Evaluation in the IEPR Should Promote a Diverse Set of Hydrogen Production Technologies and Resources

SB1075 directs that "the commission shall study and model potential growth for hydrogen and its role in decarbonizing the electrical and transportation sectors of the economy". Although the CEC indicated that SB 1075 directed only an evaluation of renewable hydrogen, SB 1075 is in fact more expansive, and directs growth for all hydrogen. Because hydrogen as a transportation fuel delivers ZEV solutions today for heavy-duty long-haul transportation, aviation, shipping, and drayage, all of which are hard-to-abate sectors that typically use fossil crude or fossil feedstocks, building out the supply chain and end use demand to enable this global transition should be a priority. In addition to evaluating low carbon hydrogen solutions in the transportation sector and power sector, we respectfully request that the CEC include in the IEPR an analysis of hydrogen growth as a ZEV and ZEF solution and make recommendation for new incentives and market signals to promote this growth.

Evaluate Global Markets as Part of the CEC Hydrogen Growth Energy Strategy

The CEC is in a unique position in that it has the charge to evaluate and plan California's comprehensive energy strategy. Hydrogen advances important state energy objectives around decarbonization, energy diversity and resiliency, air quality improvements and jobs. Recognizing this, hydrogen deployments in non-traditional economic sectors are receiving more focus and support, including new valuable federal tax incentives and national hydrogen hub strategy designed to expand deployment in non-traditional end-uses and create a market lift-off.

California's energy policies in the past recognized the impact that our economy and our energy policies have on regional, national, and international energy supply – and vice versa. Policies like Cap-and-Trade, the LCFS, and the RPS were designed with a recognition of impacts beyond our borders.

According to CEC data, 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 an all-of-the above strategy including, expanding in-state resources as a priority, and supporting regional, national, and international hydrogen and hydrogen derivatives supply chains. We encourage the CEC to recognize hydrogen's role in the global energy economy, the impact of the state's efforts on the global supply of hydrogen and to analyze and recommend market incentives to ensure that there is a robust, reliable supply of hydrogen in place to supplant the use of diesel, crude, oil, and natural gas in key sectors. This will enable a cost-effective expansion of hydrogen and position California competitively in the global hydrogen economy.

CEC's analysis should also 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 comprehensive energy strategy and climate goals. In addition to existing private hydrogen pipeline and production, the U.S. and California already have extensive infrastructure in place for hydrogen derivatives, such as ammonia. California is home to one of the only port-side ammonia import terminals in the West Coast, which currently serves the agricultural industry. Furthermore, ammonia production, and deployment sites are being planned in Northern Los Angeles County. Clean ammonia can serve as feedstock for expanded hydrogen deployment in the transportation and power sectors.

IEPR Recommendations for Future State Policies Should Prioritize Dedicated Hydrogen Storage and Delivery to Ensure Safety and Environmental Integrity

While not a specific focus at the IEPR workshop, as you consider the growth of hydrogen in transportation and power, 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 non-traditional methods needs to be carefully reviewed to ensure safety and continued system reliability. Additionally, blending hydrogen in small quantities into natural gas pipelines should be carefully evaluated to determine if it is in fact an effective emission reduction approach.

As identified by the University of California, Riverside report to the CPUC[16], 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%[17] 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.

Policies that Drive Market Expansion

As the CEC considers the state energy strategy and the expanded role of hydrogen, the framework for rapid development of new projects should include the drivers listed below:

- 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.

- Promote power and transportation sector policies to substantially **increase demand**, including:

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

- Incentives to accelerate **fleet transition** from diesel to zero-emission FCEVs
- Incentives for **Ports** investments in hydrogen infrastructure and ZEVs
- Incentives for **heavy industry** to move away from fossil energy for high heat applications.
- Incentives for **new lower carbon hydrogen** production
- Incentives for **power plant** owners to convert from natural gas to hydrogen and mandates to meet or exceed natural gas power plant NOx emission standards.
- Highlight the role for hydrogen solutions in the **power sector**, including in the forthcoming SB 423 evaluation of firm zero carbon resources, and guide the CPUC **Integrated Resource Planning** (IRP)and **procurement** strategies to enable private sector investment in hydrogen solutions for SB 100 compliance;
    - Including clean resource adequacy procurement, strategic reserve investments in hydrogen, directives to load-serving entities to procure hydrogen baseload capacity, procurement directives for hydrogen as long-term storage solutions (e.g. PG&E's third-party partnership to develop a hydrogen fuel cell project to improve grid resiliency at substations as approved by Commission Resolution E-5261)[18], consideration of distributed generation and grid resiliency in the IRP and procurement orders for electric LSEs that include hydrogen fueled equipment.
- Updated **CEC RPS guidebook** for broad application of hydrogen electric generation beyond fuel-cells, including turbines.
- Long-term visibility into incentives for heavy-duty fuel cell vehicles, including exempting fuel cell vehicles from the large-fleet cap proposed under the HVIP program.

Consider Public Hydrogen Fueling Station Funding Reforms

As the CEC evaluates growth in transportation, Air Products makes the following suggestions, which are informed by recent trends and shifts in the hydrogen fuel cell vehicle and refueling market. These changes will maximize the state's investments by directing funding toward hydrogen fueling stations that are built with the future in mind.

- **Prioritize investing in multi-modal stations:** Multi-modal stations can serve several vehicle types, such as light-duty and heavy-duty vehicles, at a single site. This mimics the existing gas station model, in which passenger vehicles fill up with gasoline at one pump while a big rig refills with diesel at an adjacent pump. The ability to serve multiple markets with a single station increases efficiencies for the station operator, reduces delivery costs for hydrogen supply, increases station reliability and provides convenience for customers driving all types of vehicle classes.
- **Invest in stations with more capacity:** larger stations with more on-site hydrogen storage capacity are more practical for enabling CA's transition to meet its ZEV targets. In contrast, the model of building out numerous smaller stations causes supply chain-related costs to increase significantly, as each station will need its own logistical plan to get fuel delivered, obtain spare parts, and be generally maintained, thus reducing station reliability.
- **Make reliability a priority**: Station reliability problems, in the form of supply shortages and station equipment malfunctions, have hurt consumer confidence in hydrogen for mobility. Larger multi-modal stations enable station developers to address this issue

[18] Resolution E-5261, adopted on April 27, 2023, approved PG&E's plan to develop a Clean Substation Microgrid Pilot Project in partnership with Energy Vault, as presented in PG&E Advice Letter 6808-E.

because they can economically incorporate a more resilient design. Multi-modal stations are equipped with more infrastructure, such as compressors, storage tanks, and dispensers, which provide increased redundancy and reduce single points of failure. This means that stations stay online for longer and provide for a better consumer experience. Additionally, we recommend that claw-back mechanisms be added to the programs so that the State can recoup funds from station projects that do not perform reliably. Such a safeguard will ensure that taxpayer investments are protected and help increase consumer confidence in station reliability.

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

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 comprehensive 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 **technology-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.

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 reduction 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 carbon intensity.

Conclusion

California is a global leader in the green economy with renewable and low carbon energy markets that drive state, national and international policies. The CEC IEPR process examining hydrogen growth in the transportation and power sectors, will produce a comprehensive effective energy framework, critical to an affordable, safe, reliable hydrogen system. This new hydrogen system must prioritize climate and air quality benefits, energy diversity and resiliency, protect frontline communities and grow our skilled and trained workforce. State programs across the Joint Agencies can provide important market signals for hydrogen that enable a balanced hydrogen market, compelling expansion of our robust green economy and continued support for private sector investments.

California is moving toward the next phase of economy-wide decarbonization for hard-to-abate sectors, which now includes expanding hydrogen to a wider, non-traditional end-user base. Air Products urges you to consider in your analysis and final recommendation the principles of a competitive market and appropriate state incentives to support new hydrogen production and demand in this context. Competitive markets with technology-neutral and performance-based (carbon intensity) metrics will facilitate immediate meaningful environmental benefits, drive costs down, and will deliver real projects with verifiable emission reductions, quickly, safely, and reliably.

As the state's largest hydrogen producer and systems operators, the only U.S.-based global hydrogen provider, and an international leader in low carbon hydrogen deployment, we look forward to working with the CEC and Joint Agencies to review hydrogen growth in the transportation and power sectors through this IEPR update, the SB 1075 process, the Scoping Plan, ARCHES, and the Governor's Hydrogen Market Development Strategy.

Thank you again for the opportunity to comment. If you have any questions, please feel free to contact me or Miles Heller (hellermt@airproducts.com).

Respectfully,

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H2fM and Clean Hydrogen