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July 28th IEPR Workshop Comments

Additional submitted attachment is included below.



August 11, 2021

California Energy Commission Docket 21-IEPR-05 Electronic Submittal

2021 IEPR Commissioner Workshop on Hydrogen to Support California's Clean Energy Transition

Dear Commissioner McAllister and Commission Staff:

On behalf of Air Products, we appreciate the opportunity to provide input into the development of the 2021 Integrated Energy Policy Report (IEPR) and specifically related to the significant role that hydrogen will play in California's energy transition to achieve its air quality and climate goals. Indeed, we have oriented our business around three growth platforms – gasification, carbon capture and sequestration (CCS), and hydrogen for mobility (and other applications) – which are key technologies to decarbonize hard-to-abate sectors and enable carbon dioxide removal.

Air Products is not waiting to put our principles and growth platforms into action in a major way, at global scale. As an example, we have announced the world's largest green hydrogen project in Saudi Arabia. This \$5 billion project will deploy nearly five times more electrolyzer capacity than had been installed globally at the time the project was announced. Our company has committed an additional \$2 billion to develop the distribution and refueling infrastructure to bring this fuel to mobility markets around the world. We have also announced a net-zero carbon blue hydrogen project – a \$1 billion investment in a hydrogen energy complex in Alberta, Canada, which deploys CCS coupled with an innovative design and advanced technology. Air Products' hydrogen supply and distribution capabilities stand ready to contribute to California's achievement of its carbon reduction goals.

Together, these projects demonstrate key themes that we hope the Commission will consider as it develops the IEPR, and indeed, that the Commission, CARB, and other state agencies will incorporate into all climate and energy planning activities moving forward:

- Adequately addressing climate change requires global solutions and global scale, and California should continue to position itself as a participant and leader in a global, clean energy marketplace,
- There is no one-size fits all solution to climate change. Different technologies and different solutions will work better than others, based on end use application, geography, resource availability (including electricity grid conditions), and customer preferences, and
- The best way to most quickly advance the broad array of technologies needed to address



climate change is through performance-based, technology neutral policies like the state has traditionally supported to date.

About Air Products

Air Products has been producing hydrogen for over 60 years. As the world's leading hydrogen supplier, it owns and operates over 110 hydrogen plants around the world and produces more than 8,000 metric tons of hydrogen per day with significant increased capacity scheduled to be on-stream in the next 5 years. Air Products has 1,800 miles of industrial gas pipeline in place, including the world's longest hydrogen pipeline in the U.S. Gulf Coast as well as other hydrogen pipelines in the U.S. and other jurisdictions around the globe. Our drivers log about 15 million miles every year transporting hydrogen in all forms including liquid bulk trailers, gaseous tube trailers, and mobile fuelers. In the future, we anticipate utilizing ships to transport ammonia (NH₃) as a carbon-free carrier to move hydrogen long distances.

In California, the company has 9 hydrogen production plants and safely operates 35 miles of hydrogen pipelines in and around the ports and industrial hubs of Los Angeles and Long Beach. Air Products has designed, installed, and supplies a fleet of hydrogen fueling stations across California, facilitating the transition to carbon-free transportation. In fact, Air Products supplies 80% of the hydrogen currently used in the California mobility market.

Based on our extensive experience, we offer the following comments to help the California Energy Commission (CEC) and promote hydrogen as a key component of the state's energy transition.

Air Products Policy Recommendations

Policies that are technology agnostic and promote carbon intensity improvements through performance standards are key to successful transition to a clean hydrogen energy economy.

Hydrogen produced through a variety of processes affords environmental benefits - substantially lower emissions, including criteria and toxic emissions, in both the transport and industrial sectors, compared to current fossil fuel use. Relative to gasoline, hydrogen fuel can realize a carbon intensity improvement of over 30% utilizing natural gas and over 50% with renewable natural gas.¹ Policies that promote hydrogen utilization in the "hard to electrify" sectors while also facilitating transition to increasingly reduced carbon intensity sources, will enable an economically sustainable evolution to the hydrogen energy economy. In fact, technology agnostic performance-based standards like California's Low Carbon

¹ Union of Concerned Scientist "How Clean Are Hydrogen Fuel Cell Electric Vehicles" Fact Sheet (September 2014)



Fuel Standard (LCFS) promote modifications to lower the carbon intensity of these traditional sources of hydrogen.

Air Products produces hydrogen in all forms; from grey to blue to green, and each has a distinct but complementary role to play in the energy transition. Hydrogen produced with a fossil-based feedstock and paired with CCS (blue hydrogen) and hydrogen produced electrolytically from renewable energy (green hydrogen) can both provide carbon intensity improvements beyond that of conventional steam methane reforming produced hydrogen. Both technologies will benefit from strong policy that recognizes the value of reducing carbon intensity but does not favor one type of hydrogen production over the other. As we are demonstrating with concurrent “blue” and “green” hydrogen projects, both technologies can achieve a similar low carbon emissions profile. Favoring a particular technology in policy will truncate innovation and may forego or delay important emission reduction opportunities – in both California and beyond. As an example, coupling CCS with biomass feedstocks can produce hydrogen with negative carbon emissions – something that green hydrogen cannot achieve and is necessary for California to reach its deep decarbonization goals.

Each method of hydrogen production has a distinct role to play in various geographies depending on the availability of resources including sequestration pore space, renewable power capacity, fossil and biomass feedstock options but all production methods can fundamentally provide a significant reduction in greenhouse gas emissions. Regardless of the hydrogen “color”, transitioning to hydrogen as fuel source can have an immediate impact on reducing greenhouse gas emissions when compared to other fuel sources.

A hydrogen sourcing glide-path from “grey” to “blue” to “green” also allows for the build-out of the substantial increase in renewable power supply and the transmission capacity to deliver it where it is needed. The ability to simultaneously decarbonize the current power sector, increase power demand for further electrification, and add the incremental renewable generation capacity to support hydrogen via electrolysis will constrain achieving all three objectives. On the contrary, “blue” hydrogen supply can satisfy the near-term requirements while hydrogen demand and renewable energy supply can grow in parallel. This enables an economically sustainable pathway for transition to hydrogen.

There will continue to be a place for all hydrogen production approaches as the transition to a hydrogen energy economy proceeds since reliability of supply becomes increasingly critical. Diversity of supply chains reduces the risks associated with focusing on a single pathway. Each production technology has a role to play, and the synergy of multiple pathways makes the entire system stronger and more efficient. This further reinforces Air Products position: *Policies that are technology agnostic and promote carbon*

intensity improvements through performance standards are key to successful transition to a clean hydrogen energy economy.

Achieving low-cost green hydrogen at scale requires continuous commitment to and investment in hydrogen markets, starting now with the most cost-effective (mobility).

We appreciate the vision for quickly achieving low-cost green hydrogen established by the DOE Hydrogen Energy Earthshot and others, but it is important that California and other policymakers not assume these outcomes will happen or wait for them to materialize. The only way we will get to the DOE's goal of \$1/kg, for example, is through significant global scaleup of hydrogen demand, renewable power generation and transmission, and electrolyzer deployment, as well as continued technological developments and breakthroughs.

Still, the initiative is exciting and builds on DOE's successful Sunshot initiative, which is illustrative for our approach on reducing hydrogen costs, as well. That initiative set a goal to reach \$1/W for solar power, which felt like a moonshot at the time, but was ultimately achieved three years before the initiative's target date. While DOE supported the initiative with targeted research, success was achieved through a massive, global scale up of the solar industry. California's Renewable Portfolio Standard helped lead the way, but without similar efforts in Europe and elsewhere and a huge scaleup of solar manufacturing in China – we likely would not have succeeded.

There's an important distinction between hydrogen and solar moonshot initiatives, however. The demand for low-cost solar power was already there, which provides the driver for economies of scale and low-cost manufacturing. For hydrogen, although it is already a well-established global industry, the prospects for future demand growth, and therefore future supply, is less certain. This is plainly visible across a number of forums and policy deliberations in California and elsewhere today.

At Air Products, we believe enough in the global market prospects for green hydrogen at costs much higher than DOE's target in order to begin investing billions today. However, getting anywhere near those targeted costs will require development of dozens more similarly-sized projects and an associated scaleup of the global electrolyzer industry. And getting to those levels will require a significant and real growth in global hydrogen demand.

This means our approach to achieving low cost green hydrogen needs to consider growing demand for hydrogen and developing the market for green hydrogen and electrolyzers as related, but distinct elements. The first is a pre-requisite for the second and requires access to low cost hydrogen supplies today, even while we continue to develop global supply chains to help significantly reduce the costs for green hydrogen. Accordingly, to the extent California wants to support development of low-cost green hydrogen, we suggest it considers itself as one element of a global market and:

- Put in place policies that will drive hydrogen demand growth and greenhouse gas emission reductions, regardless of hydrogen color, including long-term financial incentives to deploy fuel cell trucks and buses, and the fueling infrastructure they need,
- Develop performance-based (i.e., carbon intensity) policies and metrics that will drive additional greenhouse gas emission reductions, accelerate development of green hydrogen, and allow it to compete at scale when and where it is cost-effective, and
- Invest in green hydrogen demonstration projects in California.

Financial incentives are critical to advancing the transition to hydrogen and are best targeted at developing low-carbon production sources and creation of end use markets

To support growth in the hydrogen economy, the industry needs policy support for both developers and customers. Air Products supports direct investment in large-scale low or zero carbon hydrogen production hubs. Direct investment aligned with energy demand centers is necessary to rapidly deploy decarbonized production sources to effectuate rapid decarbonization in the transportation and other hard-to-abate industrial sectors. Support for production encourages the development and innovation in end use technology while providing supply reliability necessary to encourage the transition to new sources of energy.

California should continue its long history of support (regulatory and financial) for the zero-emission vehicle marketplace including support for fuel cell vehicles. Long-term visibility on purchase incentives for transit, heavy-duty, and off-road vehicles is critical. Additionally, policies that create decarbonized hydrogen demand from the hard-to-abate industrial sector and power sector will help promote the scale-up of related production and infrastructure – including CCS and the production of low-carbon blue hydrogen.

Air Products believes that with strong policies to incent production and demand, the private sector will install the necessary hydrogen fueling infrastructure to support this transition. To the extent that agencies provide incentives for infrastructure, we strongly believe that these incentives should include a pay for performance or contracts for differences component. This will maximally leverage state investments by ensuring recipients invest their fair share while supporting a broadly competitive marketplace for those others making their own investments without state incentives. A good example of such a mechanism is the LCFS capacity credits for hydrogen refueling stations, which could be improved if CARB extends the credit mechanism to heavy-duty vehicle refueling stations and if the state developed something like a contracts-for-difference mechanism to provide greater certainty on the value of LCFS credits.



Renewable energy and hydrogen are complementary and essential for decarbonization of transportation and heavy industry

Both battery and hydrogen solutions are needed for transportation electrification and deep decarbonization. Smaller vehicles or larger vehicles on shorter routes can benefit from battery electric vehicles. Similarly, light industries or residential heating applications are good targets for electrification; along with shorter-term energy storage applications where battery back-up is well-suited.

Hydrogen is particularly useful in larger mobility applications based on vehicle class, scale and/or the need to travel long distances. These include applications in transit, long-haul trucking, rail, marine shipping and aviation. CARB has also indicated that hydrogen and fuel cells will provide the lowest cost zero emission solution for larger passenger trucks and SUVs, especially those with cold-weather or towing packages. In fact, we believe in the heavy-duty vehicle opportunities as well. Air Products and Cummins Inc. have jointly announced the signing of a memorandum of understanding (MOU) to work together to accelerate the integration of hydrogen fuel cell trucks in the Americas, Europe and Asia. Cummins will provide hydrogen fuel cell electric powertrains integrated into selected OEM partners' heavy-duty trucks for Air Products, as Air Products begins the process of converting its global fleet of distribution vehicles to hydrogen fuel cell vehicles.

Hydrogen also offers useful benefits of scale in the mobility sector. For example, while the infrastructure costs may be manageable, but still significant, for a transit agency looking to transition tens of buses to electric, they may become untenable for larger transit agencies with hundreds of buses to manage. For electric charging, incremental costs will often increase with scale, whereas for hydrogen refueling, they only decline. Ultimately, each transit agency, fleet, or car buyer will have their own unique needs and constraints that will dictate the type of zero emission vehicles and charging or refueling solutions that will work for them.

As mentioned before, hydrogen is a reliable fuel to replace natural gas and decarbonize industry and the power sector, as well. Hydrogen (and/or CCS) is especially well-suited to decarbonize heavy industries where high temperature is required for process heat including steel, aluminum, glass, cement, and other hard-to-abate industrial sectors. In the power sector, hydrogen is a critical complement to renewables and short-duration batteries. While those technologies clearly have a primary role to play in our transition to clean energy, the state's SB 100 report and other studies² show that scenarios with firm,

² For example, see:

<https://www.wartsila.com/energy/learn-more/downloads/white-papers/path-to-100-renewables-for-california>
<https://energyinnovation.org/wp-content/uploads/2020/09/Pathways-to-100-Zero-Carbon-Power-by-2035-Without-Increasing-Customer-Costs.pdf>



zero carbon resources like hydrogen lead to significantly better outcomes – including lower costs, greenhouse gas emissions, land use impacts and overbuild of solar and short-duration storage. In the power sector, hydrogen can – and should – be considered both multiday and seasonal storage for intermittent renewable power resources, as well as zero carbon fuel to displace the use of natural gas in power plants.

For those applications that are not well suited for electrification, hydrogen is an excellent fuel substitution for transportation and industrial sources that are in proximity to communities and especially those disadvantaged from long-standing air pollution impacts. Hydrogen fuel use results in no localized criteria or toxic pollutant emissions.

Collaborate with companies that have demonstrated capabilities in production, distribution, and dispensing technologies

To expeditiously meet California’s deep decarbonization goals, the hydrogen energy transition needs hydrogen production, transport, and use to scale quickly. Hydrogen hubs like those developed by and safely operated by Air Products in California and the U.S. Gulf Coast around refining centers can serve as a model. These hubs are networks comprised of production facilities, pipelines and end users that provide the highest degree of integration, flexibility, reliability, and effective deployment of capital. Matching supply with demand in large central hubs and working with experienced and well capitalized companies is the only way that hydrogen energy will grow to the scale, and in the timeframe needed to meet the state’s energy goals.

Again, we appreciate the opportunity to submit these comments and participate in the IEPR development. I am happy to answer any questions you have and can be reached at (916) 860-9378 or hellermt@airproducts.com.

Respectfully,

A handwritten signature in black ink, appearing to read "Miles Heller".

Miles Heller
Director, Greenhouse Gas Government Policy