July 9, 2021

Rajinder Sahota
California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: AquaHydrex Initial Comments on Development of the 2022 Scoping Plan Update

Dear Ms. Sahota:
AquaHydrex, Inc. (AquaHydrex) is pleased to provide these comments in response to the kickoff workshops related to development of the 2022 Scoping Plan Update (Scoping Plan). This Scoping Plan will represent CARB's most far-reaching evaluation of climate change mitigation strategies developed to date. It will look both over a longer period of time and to achieve deeper reductions, including net-negative emissions statewide, than any Scoping Plan has done previously. Accordingly, CARB will need to take a deeper look at strategies to decarbonize the last of the power and transportation sectors, industry and other gas end uses, agriculture, and carbon dioxide removal.

Deploying green electrolytic hydrogen at scale will be a critical element of all these strategies and to successfully achieving net-negative emissions in California as soon as possible. We strongly encourage CARB to take a deep look at this important technology in the Scoping Plan, and consider steps to rapidly deploy it scale.

AquaHydrex is an American company commercializing a purpose-driven, clean-sheet redesign of electrolysis for producing low-cost green electrolytic hydrogen from intermittent renewables at scale. We see green electrolytic hydrogen, aided by the dramatic reduction in the cost of renewable energy, practical at scale and as a key component of achieving decarbonization. And we look forward to helping the state transition to 100 percent clean energy and achieve carbon neutrality and net-negative emissions as soon as possible.

We respectfully submit the following comments for your consideration as you begin developing the first Scoping Plan designed to achieve carbon neutrality.

CARB Should Consider Accelerated Greenhouse Gas Reduction Scenarios to Achieve Carbon Neutrality as Soon as Possible

Previous Scoping Plans have evaluated a range of scenarios to achieve similar emissions

outcomes, and specifically, the minimum emissions reductions required by law, including AB 32 and SB 32. In developing the current Scoping Plan, we encourage CARB to explore a wide array of scenarios that achieve different emissions outcomes, including scenarios that achieve carbon neutrality before 2045 and look to maximize net-negative emissions.

Such an evaluation is the plain requirements of law, the carbon neutrality Executive Order, and the urgent threats posed by climate change. AB 32 directs CARB to evaluate the maximum technology feasible and cost-effective greenhouse gas reductions, while the Executive Order guiding the development of the Scoping Plan specifically establishes a new statewide goal, additional to existing greenhouse gas targets, to "achieve carbon neutrality as soon as possible" and to "achieve and maintain net negative emissions thereafter."[1] The date of 2045 is only a backstop that sets a floor on the State's ambition. And certainly, as California continues to endure seemingly perpetual drought and wildfire threats, in addition to other costly climate change impacts, there is no time to waste in doing all we can to address climate change. CARB's role in the Scoping Plan is to explore what "as soon as possible" and "net negative emissions" may encompass. CARB should design the Scoping Plan to achieve the best possible climate change outcomes, and not just explore different ways to achieve the minimum letter of the law.

Reject False Tradeoffs, Including Electrification versus Zero-Carbon Gas

CARB should not artificially impose conflicts between viable strategies to address climate change, which creates a perception of arbitrary "tradeoffs" that continue to come up in workshops and discussions about the State's climate policies. All practical and ready strategies to address climate change should be considered additive and immediately needed. Indeed, the way to achieve carbon neutrality as soon as possible and maximize net-negative emissions is to support any viable, cost-effective greenhouse gas reduction or carbon dioxide removal strategy. Similarly, we urge CARB to resist "either-or" solutions or speculating that certain clean energy investments today will become stranded assets decades into the future – after which they would likely have been fully capitalized, anyways. No scenario developed by the State has suggested a decreasing demand for clean energy into the future.

These concerns often come up in discussions around building electrification, and are used to dissuade investment in zero-carbon gases, including green electrolytic hydrogen. The argument is if buildings are going to increasingly electrify, demand for natural gas will fall and zero-carbon gas projects could become stranded assets. This exaggerated argument misses the fact that

[1] Executive Order B-55-18. https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf

electrification alone cannot achieve deep decarbonization and that a clean molecule is required to achieve decarbonization of a wide range of sectors and to provide the necessary flexibility and reliability of widescale renewable energy generation. The simplest and most versatile clean molecule is hydrogen, which using our technology is incredibly easy to produce from intermittent and variable renewable energy – as well as from more firm zero carbon electricity sources such as hydro, geothermal, or nuclear.

Green Electrolytic Hydrogen is a Ready and Necessary Carbon Neutrality Solution

Green electrolytic hydrogen, in particular, will be a needed and useful technology in virtually any sector and wherever energy is used. It has the unique ability to decarbonize hard-to-abate sectors at any scale, including the last parts of the power and transportation sectors, as well as a wide range of industrial sectors, buildings, fertilizer and agriculture. It will be an important element of carbon capture and carbon dioxide removal strategies, as pairing green hydrogen molecules with captured CO_2 can create new fuels for aviation, long-distance transport, shipping, and other uses as well as various materials and polymers required by society – to either permanently sequester CO_2 or otherwise recycle it.

CARB Should Develop a Green Electrolytic Hydrogen Strategy in the Scoping Plan to Help Deploy this Technology at Scale and Accelerate Cost Reductions

A key element of CARB's Scoping Plan should be developing a strategy – with a deliberate set of measures, milestones, and goals – to deploy green electrolytic hydrogen at scale, rapidly reduce the costs of the technology, and enable deep decarbonization of all sectors of the economy. One of the key sets of goals should be near-term (2025) and mid-term (2030) targets for electrolyzer deployment and green electrolytic hydrogen use in California, as Europe has done and in alignment with California's carbon neutrality and SB 100 objectives. The green electrolytic hydrogen strategy should also identify measures to meet those goals and accelerate electrolyzer deployment and cost reductions.

Notably, while several studies forecast deep and rapid reductions in the cost of electrolyzers and green electrolytic hydrogen at scale, including prevailing goals of achieving costs on the order of $1-1.50/kg, this won't happen on its own, and it's not something that California can likely make happen on its own, either. Achieving those costs levels will require both significant, global scale and access to near-zero renewable electricity prices. CARB's green electrolytic hydrogen strategy should therefore consider how the State fits in a global context and partners with others to accelerate this important technology, and also how the state can increase access to very low priced renewable power.

Critically, those price targets are not levels needed to deploy green hydrogen cost effectively in all applications. There are many applications where green electrolytic hydrogen offers a cost-effective solution well before those price levels may be met, including in the power, transportation and industrial sectors. For example, an analysis by McKinsey for the Hydrogen Council finds that green electrolytic hydrogen could become an increasingly cost-effective solution for decarbonizing many sectors of the economy, beginning as soon as the 2025-2030 timeframe.[2] This is validated in a recent study by E3, which shows that power plants using green electrolytic hydrogen could be profitable in Southern California by 2025-2030.[3] CARB should support policies that quickly deploys green electrolytic hydrogen in those sectors and wherever else it makes the most sense in the near-term. CARB should also consider other opportunities to create market conditions to rapidly scale the technology, including through a blending standard in the natural gas pipeline – which could provide fixed, long-term contracts to help deploy projects and bring down costs – and through creation of major green hydrogen and industrial decarbonization hubs, including in the Los Angeles basin.

The Scoping Plan Should Set California on a Path to Achieve Zero Greenhouse Gas Emissions in the Power Sector by 2035

The power sector offers a clear opportunity to accelerate climate action in a cost-effective and technologically feasible manner, while creating new market opportunities to deploy and further develop important technologies like green electrolytic hydrogen. Moving to rapidly deploy green electrolytic hydrogen in the power sector can help to achieve the State's SB 100 and carbon neutrality goals effectively and more rapidly.

The recent joint agency SB 100 report shows very little difference in costs or technology deployment rates needed to achieve SB 100 goals by 2030 compared with later years, including 2035, 2040 or 2045.[4] Still, it shows high ongoing greenhouse gas emissions from the power sector, even in SB 100-compliant scenarios, due to an assumed ongoing reliance on existing natural gas power plants to provide firm power. These plants can be decarbonized, too, including through the use of green electrolytic hydrogen, and they must be decarbonized if we are to achieve carbon neutrality.

Fortunately, the same report clearly points to the value of doing so, including deploying green electrolytic hydrogen and other firm, zero carbon resources – which it suggests can reduce new power plant requirements under SB 100 by about 70 GW, or nearly 40 percent. At costs

[2] https://hydrogencouncil.com/wp-content/uploads/2020/01/Path-to-Hydrogen-Competitiveness_Full-Study-1.pdf
[3] https://www.ethree.com/e3-evaluates-hydrogen-opportunities-in-a-low-carbon-future/
[4] https://efiling.energy.ca.gov/EFiling/GetFile.aspx?tn=237167&DocumentContentId=70349

specified in the analysis, it would reduce costs of complying with SB 100 by nearly $5 billion annually, and reduce emissions associated with doing so. Overall, the scenarios in the report show that the SB 100 goals can be achieved by 2030, with zero added costs through at least 2027, and with relatively small incremental costs afterwards that appear to be less than the savings identified by including zero carbon firm resources in the modeling.

When accounting for avoided Cap-and-Trade compliance costs and the social cost of carbon, accelerated SB 100 compliance and further efforts to decarbonize gas plants and provide firm, zero carbon power undoubtedly offers a cost-effective strategy to contribute to the State's carbon neutrality framework. The cost effectiveness of this strategy has been further reinforced by a recent study by Energy Innovation, which finds that zero-carbon gas can lead to a zero-carbon grid across the U.S. by 2035, without increasing customer costs.[5]

We encourage CARB to identify achieving zero greenhouse gas emissions in the power sector by 2035 as a key measure in the Scoping Plan. As part of the Scoping Plan, CARB should also set a new greenhouse gas planning target for the electricity sector of 0 MMT/year by 2035 and re-evaluate the greenhouse gas planning targets for 2030 in-line with this new goal.

These steps would align California with President Biden's goal to achieve zero carbon in the power sector by 2035 nationally, and continue California's climate leadership by a path to achieve this important goal. It would also move the State in a direction that many of its utilities are already moving. Many of the State's largest publicly owned utilities and Community Choice Aggregators have already committed to achieving SB 100 and/or zero carbon goals in the 2030-2035 timeframe. Notably, Los Angeles just committed to achieving zero carbon in the power sector by 2035, and will convert existing power plants to use green electrolytic hydrogen to help achieve this goal.

Response to Questions Posed in Electricity Sector Focus Area Workshop

While they may not be the only answers, "achieving zero carbon by 2035" and "green electrolytic hydrogen" are key solutions to many of the questions posed in Electricity Sector Focus Area workshop. As described above, accelerating decarbonization of the electricity sector and providing clear signals in the Scoping Plan through a 0 MMT planning target for 2035:

[5] https://energyinnovation.org/wp-content/uploads/2020/09/Pathways-to-100-Zero-Carbon-Power-by-2035-Without-Increasing-Customer-Costs.pdf

- Provides certainty and flexibility in planning for a zero-carbon electricity system that will be both reliable and affordable, regardless of where future technology advancements may take us,
- Prioritizes and maximizes air quality and public health benefits, including in vulnerable communities, where legacy natural gas plants may otherwise continue to operate and pollute, and
- Is exactly what the public/private partnership looks like in this transition.

Further, moving to quickly support and deploy green electrolytic hydrogen in the electricity sector, including in existing fossil fueled power plants:

- Elegantly maintains grid reliability, jobs and builds resiliency while supporting the transition away from fossil fuels,
- Will significantly reduce emissions impacts from legacy power plants, including virtually eliminating toxic air contaminants and particulate matter emissions,
- Protects against economic impacts by maximizing the use of existing resources and avoiding unnecessary overbuild of others, and
- Should be prioritized in the Scoping Plan and other energy planning efforts as a critical and strategic firm, zero carbon resource for the State.

Summary Recommendations for Developing the Scoping Plan

Given the urgency of climate change, the need for renewable molecules as well as electrons to achieve carbon neutrality and net-negative emissions, and the growing promise of green electrolytic hydrogen to quickly come down the cost curve and provide those renewable molecules at scale, we encourage CARB in the Scoping Plan to:

- Evaluate and pursue scenarios that achieve:
    - All technologically feasible, cost-effective greenhouse gas emission reductions,
    - Accelerated 2030 greenhouse gas reductions, at least in-line with national targets,
    - Carbon neutrality as soon as possible, and
    - Maximum net-negative emissions and overall climate benefits.
- As part of the evaluation, identify the full need and opportunity for zero-carbon gases, especially green electrolytic hydrogen, to contribute to the outcomes listed above.
- Develop a strategy for deploying green electrolytic hydrogen at scale and on timelines needed to capture its full need and opportunity. The strategy should include:

  - Near-term (2025) and mid-term (2030) milestones and goals for deploying electrolyzers and green electrolytic hydrogen use
  - A deliberate set of measures to achieve these near- and mid-term milestones and goals, including:
    - A green electrolytic hydrogen blending standard in the pipeline to support project development and cost reductions (just as the RPS did for utility-scale solar),
    - Recommendations for enabling access to wholesale power markets for electrolysis projects, to enable low-cost green electrolytic hydrogen production, utilization of curtailed power, and effective grid integration,
    - Strategies to support quickly converting existing natural gas power plants to green electrolytic hydrogen, in support of a zero-carbon power sector target,
    - Identification of one or more major green hydrogen and industrial decarbonization hubs, including in the Los Angeles region where deploying green electrolytic hydrogen at scale can effectively decarbonize a concentration of emissions sources – including ports, refineries and other industrial operations, power plants, buses and other transit vehicles, and heavy-duty trucks – and provide a global demonstration of California's climate leadership heading into the 2028 Olympics, and
    - Other sector specific measures.
  - A review of hydrogen strategies, goals and measures developed by other countries and recommendations to align California's efforts with those global efforts, to accelerate total deployments of electrolyzers and economies of scale, enabling green electrolytic hydrogen to quickly become a widely-available, cost-effective global climate solution

- Set a goal to achieve zero carbon emissions in the power sector by 2035. This goal would reinforce California's climate leadership, align with President Biden's national target and plans already underway at many of the state's largest utilities and load-serving entities, and has been shown to be cost-effective and technologically feasible by the joint agency SB 100 report and other studies.
- Establish a new electricity sector greenhouse gas planning target of 0 MMT/year by 2035 and re-evaluate the 2030 planning targets in-line with this goal.
- Identify measures to rapidly decarbonize industrial operations, including cement plants and refineries, through the use of green electrolytic hydrogen and other strategies.
- Identify measures to decarbonize other hard-too-abate sectors, including rail, aviation, shipping and agriculture – where the use of green electrolytic hydrogen or green ammonia derived from green hydrogen offer promising climate solutions.

- Identify measures to support carbon capture and utilization, including the production of new fuels and materials, and including through the use of carbon dioxide pulled from the atmosphere or ocean.

Green Electrolytic Hydrogen Can Be an Economic Growth Driver

California has always been, and continues to be, an international leader in creating long-term sustainable new market frameworks that result in expanding the green economy, drastically increasing clean technology jobs and accelerating greenhouse gas emission reductions – both in the State and globally. Under California's policy leadership, we have benefitted from a robust clean energy sector boom for nearly two decades, creating more than half-a-million clean energy jobs in the State, constant technology innovations, and new market opportunities and private investments in infrastructure in California. A similar policy effort around green electrolytic hydrogen, rapidly decarbonizing industry and other hard-to-abate sectors, and carbon removal and utilization will yield similar economic results, while also rapidly improving air quality in many low income and disadvantaged communities.

Green electrolytic hydrogen, in particular, offers double job benefits across the renewable power and zero-carbon gas sectors. Policies supporting green electrolytic hydrogen will turbocharge job creation in the renewable power sector, while also supporting existing and new jobs in the gas and other sectors. Upgrading and repurposing fossil gas systems, power plants, and industrial operations to quickly decarbonize is our next big opportunity in energy diversity and for the state's green economy.

As a purpose-driven company that's focused on helping to achieve a zero-carbon future in California, we look forward to tackling this challenge with you.

Sincerely,

Steven Kloos
President, AquaHydrex, Inc.