September 3, 2021

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

**Re: 2022 Greenhouse Gas Scoping Plan, Comments on Scenario Concepts Technical Workshop**

Dear Ms. Sahota,

The Coalition for Renewable Natural Gas (RNG Coalition)[1] offers the following input on the initial scenarios proposed by California Air Resources Board (CARB) during the Scenario Concepts Technical Workshop (Workshop).[2] Included within the proposed modeling scenarios are various technological pathways under which the benefits of waste-derived renewable gaseous fuels can be realized. We appreciate CARB's attention to these pathways as an important part of the 2022 Greenhouse Gas Scoping Plan (Scoping Plan or the Plan) and look forward to helping to develop a long-term role for renewable gases within the broader path to a carbon neutral California.

**Feedback on Scenario Details**

*Carbon Neutrality Timeframe*

RNG Coalition supports an ambitious decarbonization timeframe for California (and the world). We are intrigued to see the results of modelling under Option A,[3] which would go beyond the current goals and aim to achieve carbon neutrality by 2035. Consideration of this accelerated goal will necessarily bring additional attention to reducing short-lived climate pollutants (SLCP)—including methane as a critical near-term abatement option. With analysis of more aggressive targets, we expect RNG and organic waste-derived green hydrogen to serve as increasingly important near-term decarbonization strategies in this iteration of the Plan.

*Short-Lived Climate Pollutant – Methane*

The RNG industry's existence is predicated on our ability to improve management practices and reduce methane emissions from organic waste streams, and to produce a uniquely circular and flexible source of renewable energy. Recent work from CalRecycle[4] and the California Public Utilities Commission's SB 1440 white paper[5] correctly summarizes the far-reaching waste and energy sector benefits (and

[1] http://www.rngcoalition.com/

[2] https://ww2.arb.ca.gov/sites/default/files/2021-08/carb_presentation_sp_scenarioconcepts_august2021_0.pdf

[3] See presentation, P. 12

[4] https://www2.calrecycle.ca.gov/Publications/Details/1693

[5] https://www.cpuc.ca.gov/uploadedFiles/CPUC_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Gas/SB1440_Staff_Proposal_FINAL.pdf

methane-reducing potential) that could occur if RNG production is used to enable diversion of the organic portion of municipal solid waste from landfills. Similarly, CARB's recent analysis[6] of methane reductions—largely based on RNG—in California's livestock sector shows a promising path forward.

The urgency of addressing climate change, and SLCPs specifically, is supported by the Intergovernmental Panel on Climate Change's most recent report, which also identifies "methane capture and recovery from solid waste management" as one of the best "short-term 'win-win' policies".[7] All of these reports reemphasize that more must be done to meet the methane reduction goals within SB 1383.[8] With this in mind, RNG Coalition appreciates the specific questions posed by CARB related to methane from organic wastes in the proposed modeling scenarios.

Notably, CARB poses the question of, "How should we use biogas captured from dairies and landfills – electricity generation, industrial heat, transportation fuel, other?" First, it is important to ensure that there *is* a productive use and that the methane does not continue to be emitted or wasted (via flaring). It is important to consider the extent to which natural gas is currently used for various services in California, and how that demand is expected to change over time. Given the large number of end-uses which currently require natural gas, the appropriate near-term strategy is to incentivize RNG use across all sectors.[9] In addition to providing heat for industrial processes, CARB should also consider the ability of RNG to serve as a biochemical feedstock in applications which require $CH_4$ or $CO_2$—these processes can also serve as pathways to negative emissions through Carbon Capture and Sequestration (CCS, discussed in more detail below).

CARB also poses the question of, "What would be the long-term operations for dairies in the state?" The goal of California's regulatory agencies should be to develop a suite of policies which will result in the California dairy sector improving sustainability—from both an environmental and human health standpoint—and to avoid forcing the industry to relocate to other jurisdictions. RNG is a proven technology in the realm of mitigating GHG emissions from agricultural operations and should be considered as a primary technology option. With respect to scenario modeling, CARB should look at the expected rate of dairy decarbonization from RNG and other manure management technologies as outlined in the recent CARB report.[10] Ultimately, RNG paves the way for additional improvements in the dairy sector which can ensure there are no sustainability concerns in other areas—such as air and water impact on local communities. Therefore, improvement in dairy GHG performance should be viewed as a crucial first step toward full sustainability, but it is not as a substitute for completing the journey in some cases. Consequently, RNG Coalition supports focus on Option B,[11] which allows for the productive use of biomass-derived fuels from all organic waste streams (including from landfills and dairies).

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[6] https://ww2.arb.ca.gov/sites/default/files/2021-06/draft-2030-dairy-livestock-ch4-analysis.pdf

[7] IPCC, 2021. Climate Change 2021: The Physical Science Basis. Chapter 6. Short-Lived Climate Forcers. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_06.pdf

[8] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383

[9] While shifting RNG resources toward specific sectors may be necessary in the medium- to long-term there is no need to exclude RNG from use in any sector today.

[10] https://ww2.arb.ca.gov/sites/default/files/2021-06/draft-2030-dairy-livestock-ch4-analysis.pdf

[11] See presentation, P. 24

*Role of Engineered Carbon Removal*

Carbon capture and sequestration holds significant potential to mitigate some of the impacts of fossil fuel consumption as those fuels are phased out, and—more importantly—to achieve carbon-negative emissions performance when paired with biologically-derived RNG and green hydrogen (also known as Bioenergy with Carbon Capture and Storage, or BECCS) and/or direct air capture technologies. RNG Coalition supports CARB's modeling of CCS for all applicable processes and urges that the Scoping Plan should fully consider the negative-emissions capability of BECCS. Indeed, the use of carbon capture and sequestration in tandem with biological inputs provides a second[12] major scalable energy pathway which can achieve significant carbon-negative emission performance.

The BECCS strategy is particularly important given the likely requirement to employ carbon-negative technologies to further reduce global temperatures after anthropogenic greenhouse gas emissions have largely been halted (to address the excess stock of $CO_2$ that will already be in the atmosphere at that point in time). Although not pertinent to renewable gas use, direct air capture is also likely a critical option and should be considered in tandem with BECCS. To this end we support focus on Option B,[13] which aims for the most aggressive GHG reductions using the most comprehensive set of technologies projected to be available.

*Carbon Free Electricity Grid*

RNG Coalition is intrigued to see how accelerating the zero-carbon grid target to align with a scenario of achieving carbon neutrality by 2035 would impact demand for RNG and biogas. As part of this goal there should be a clear emphasis in the power sector on developing all resources which can be carbon neutral or carbon negative (on a lifecycle basis) that can also be dispatched to help balance other intermittent sources of power that would need to deployed at a rate that would exceed the already-record-pace called for by SB 100.

One potential role for biogas, RNG, and green hydrogen in such a timeframe would be to serve as a replacement for fossil-derived resources in combustion-based generation. Over longer timeframes these resources can also be used to produce electricity through chemical processes in fuel cells. To this end we support deep study of Option B,[14] which includes the accelerated carbon neutrality timeline while allowing all for all available carbon neutral technologies to reduce emissions in the power sector.

*Vehicle Fleet Decarbonization*

Since the inception of California's Low-Carbon Fuel Standard (LCFS), the RNG industry has demonstrated its ability to fuel natural gas vehicles (NGV)—including near-zero emission NGVs[15]—in a way which is extremely beneficial from both a climate and criteria pollutant perspective. More recently, pathways using biogas and RNG to power that is used to charge electric vehicles have also emerged as has the use of RNG to make low-carbon hydrogen for fuel cell vehicles.

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[12] RNG production that accounts for the lifecycle impacts of methane destruction is the first commercially available carbon negative fuel pathway.

[13] See presentation, P. 14

[14] See presentation, P. 16

[15] Which reduce criteria pollutants

In 2021, RNG in California's NGV sector has reached a unique milestone in that the average pathway carbon intensity (CI) is carbon negative on a lifecycle basis.[16] Furthermore, the carbon intensity of all RNG resources continues to decrease based on other energy inputs.[17] In scenarios that push ZEV adoption above the levels currently considered (potentially displacing NGV growth), CARB should explicitly show how the RNG resources are shifted toward ZEVs or other sectors, to inspire long-run investor confidence for RNG projects. While it may be useful to examine such scenarios, just to test the boundaries of best-case ZEV adoption rates, we caution that in practice such transitions may prove challenging for vehicle fleet owners in the shortened timeframes under consideration and will likely not be the least-cost and least-emitting strategy in many heavy-duty applications in the near term.

Accordingly, and in line with our earlier assertions regarding the ability to produce carbon-negative electricity and green hydrogen from biological feedstocks, we believe RNG will continue to play a valuable role in the transportation sector in both near-zero NGVs and ZEV applications. Additionally, we urge CARB to include potential pathways for renewable electricity and green hydrogen production from biological feedstocks—including those which produce carbon-negative emissions, via CCS or otherwise—within the modeling of transportation sector emissions.

*Petroleum Fuels*

The ultimate conversion of California's petroleum refineries for use in producing renewable fuels and other renewable chemical feedstocks represents an important opportunity. Even after the phase-out of petroleum use, various liquid fuels and carbon-based chemicals will be needed and some of the existing infrastructure will likely prove useful once converted for this purpose. RNG Coalition supports the use of renewable gases as part of these renewable refining processes and recommends that CARB explore their use in this Scoping Plan accordingly. With this caveat in mind, we support at least reviewing the scenario proposed in Option A,[18] which targets the most expedient phase-down of fossil petroleum production and use.

*Woody Biomass and Solid Biomass Waste*

In this section, CARB poses the questions, "Should biomass play a role in producing energy?" and "How should we best utilize solid biomass waste?" with the latter question providing the options of producing renewable hydrogen for use in zero-emission fuel cells, producing liquid fuels, producing RNG for the industrial or electricity sector, composting and soil reincorporation, or multiple paths. The process of producing carbon-negative green hydrogen through gasification of woody biomass and solid biomass waste (when paired with CCS) presents a significant opportunity for California's energy and waste sectors to decarbonize, with additional opportunities for the use of produced $CO_2$, but it is not without

[16] See information on LCFS Pathway Certified Carbon Intensities: https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities

[17] As the nation's electricity grid sees an increased amount of zero-carbon electricity generation, the CI for all RNG pathways which utilize grid electricity will decrease. This means that the RNG pathways which are currently low-carbon (due to upstream electricity inputs from the current grid) will move increasingly toward zero-carbon as their upstream energy inputs are derived from a greater and greater share of renewable electricity, and those which are currently carbon negative will produce even greater benefits.

[18] See presentation, P. 22

risks.[19] CARB must be sure to integrate these important resources into the forthcoming Scoping Plan, and should use the leading study from Lawrence Livermore National Laboratory[20] as a starting point.

RNG Coalition supports a multiple paths approach, with significant attention put on the prospect of producing carbon-negative energy using CCS with RNG and green hydrogen derived from these resources. To this end we support a focus on properly modelling Options B and C.[21]

*Residential and Commercial Building Decarbonization*

With respect to current levels of gas use in the residential and commercial sectors, the RNG industry does not claim to be able to completely decarbonize all of California's conventional natural gas demand.[22] However, given the California Energy Commission's projected near- and mid-term gas demand trends in these sectors, electrification and efficiency alone also cannot fully address these emissions in the 2035 timeframe.[23]

Therefore, RNG procurement on behalf of utilities' residential and commercial customers can (and should) be incentivized generally in this timeframe and viewed as a near- to mid-term solution as part of the decarbonization strategy for many of these applications. This does not preclude the use of other strategies (e.g., electrification) to satisfy residential and commercial applications in the long term, and the RNG should ultimately be directed to its highest and best end use over time.

For this section RNG Coalition supports closely examining a modified version of Option A,[24] which would electrify new construction to the furthest extent possible, as quickly as possible while not overestimating the feasible pace of residential and commercial electrification in existing buildings.

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[19] For example, if these facilities are not constructed in a way that ensures minimal methane leakage, they could have high carbon intensities. Due to this issue, hydrogen may be the most appropriate long-term energy carrier from projects targeting such feedstocks.

[20] LLNL, *Getting to Neutral: Options for Negative Carbon Emissions in California*, Baker et al., January, 2020, Lawrence Livermore National Laboratory (LLNL) https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf

[21] See presentation, P. 26

[22] Current trends imply approximately a 1% decline in gas demand per year through 2035. Meaning gas demand in 2035 would still be 86% of 2021 levels under current policy expectations. Even if RNG buildout was maximized in this timeframe it could serve only a portion of this level of demand. For a current discussion of gas demand forecasts, see the California Energy Commission's (CEC) August 30 IEPR Workshop on Natural Gas Markets and Dmeand Forecasts: https://efiling.energy.ca.gov/getdocument.aspx?tn=239505

[23] Page 35 of the CEC's report entitled *The Challenge of Retail Gas in California's Low Carbon Future,* found that natural gas in California's residential, commercial, and industrial sectors would still be ~1,500 tBtu in 2035 and ~1,000 tBtu in 2050, even in the high-building-electrification case (see Figure 11). https://ww2.energy.ca.gov/2019publications/CEC-500-2019-055/CEC-500-2019-055-F.pdf

[24] See presentation, P. 28

(Full retrofit of all buildings to electricity is likely impossible to accomplish by 2035, due to consumer behavior issues.[25]) Modifying Option A in this way would allow for the use of renewable gases in remaining applications in the near-term as an important and reliable GHG reduction strategy.

*Industry (Manufacturing, Construction, and Agriculture)*

RNG and renewable hydrogen will be important long-term options for applications which are best served by gaseous energy, rather than electric energy. Given the GHG profile and ancillary benefits of using waste-derived RNG and green hydrogen, renewable gaseous fuels should not be seen as secondary to electrification in these applications. Indeed, the long-term goal for some of these applications should be to use renewable gaseous fuels, including RNG and renewable hydrogen, which should eventually be required to reach a lifecycle CI score of neutral or negative.

If California's leadership on climate is to be emulated by other jurisdictions, it is important to recognize that many industries are essential parts of the state's economy and we must help lead them toward feasible decarbonization options, rather than simply forcing these activities to relocate to other jurisdictions. CARB should use this as an opportunity to think synergistically and specifically about how large gaseous fuel users can combine biologically derived RNG, green hydrogen, and CCS, to provide high heat energy and biochemical feedstocks in strategic locations in the state.

To this end, we generally support Option B[26] as not only the most reasonable path, but a path which will allow for the continued interconnected benefits of using biologically-derived renewable gaseous fuels in certain processes. Given the ability to provide carbon-negative emissions and other benefits, these resources should not be viewed as secondary to electrification in all applications. However, if this framing is retained, we look forward to detailed analysis by CARB of each industrial sector to determine what opportunities are likely to remain for RNG (i.e., where electrification is not expected to be feasible).

**Conclusion**

The formulation of modeling scenarios for CARB's Scoping Plan represents an important opportunity to reflect our most up-to-date understanding of the many technologies which will be necessary to decarbonize California. In particular, our industry is excited about the prospect of painting a clear picture for the use of RNG, biologically-derived green hydrogen, and CCS, and the various cross-sector interactions and benefits which these resources are uniquely positioned to create. We thank CARB for your prudence in requesting feedback on the proposed scenarios and—understanding that such in-depth modeling is never an easy task—look forward to the next iteration of this conversation.

[25] CARB should be cautious about relying upon unrealistic projections of consumers voluntarily choosing to replace existing functioning gas appliances. The challenges associated with early retirement are discussed extensively by E3 in prior work, including in *The Challenge of Retail Gas in California's Low Carbon Future.*

[26] See presentation, P. 30

Sincerely,

/S/

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