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2021 IEPR, Volume III â€“ Renewable Gas and Hydrogen (Docket 21- IEPR-01)

Additional submitted attachment is included below.

RAVEN

January 27, 2022

The Honorable David Hochschild, Chair
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Re: 2021 IEPR, Volume III – Renewable Gas and Hydrogen (Docket 21-IEPR-01)

Dear Chair Hochschild:

Raven SR (Raven), a renewable fuels company, submits these comments on Volume III of the *Draft 2021 Integrated Energy Policy Report*, focused on the gas sector. We appreciate the Commission's recognition that California will continue to need gas for reliability and other purposes, and but strongly support moving to renewable fuels, including decarbonized gas. There are, however, several legal and factual errors we are concerned about in the chapter of Volume III on renewable gas and hydrogen. We urge the CEC to correct the following errors and omissions:

- The definition of biomethane should be corrected to be consistent with state law, which includes the gas from non-combustion biomass conversion, as well as anaerobic digestion in the definition of biomethane.
- The definition of renewable hydrogen should include hydrogen from all RPS eligible resources, especially carbon negative hydrogen from organic waste, not just electrolytic hydrogen.
- The discussion of renewable gas costs should also include costs per ton of carbon reduction, not just fuel costs, since the goal is to decarbonize the gas sector.
- The section on firm renewable power from gas should include biogas and hydrogen.

Raven is a clean fuels company that transforms waste – municipal solid waste, organic waste, and methane – into high-quality, clean hydrogen and Fischer-Tropsch synthetic fuels through our uniquely patented Steam/CO_2 Reforming technology. Our process is non-combustion, producing fewer emissions, and we can process multiple and mixed wastes simultaneously. The clean, renewable fuels we create from this carbon-neutral conversion will reduce and eliminate vast amounts of waste contributing to greenhouse gases, pollution, and climate change.

- Raven has announced that it will build its first production facility at Republic Service's site in Richmond, CA with operations projected to start early Q4 of 2022.
- Raven completed its $20M Round A financing, with investments by Chevron, Itochu, Hyzon Motors, and Ascent Hydrogen Fund.
- Raven and Hyzon Motors are partnering to build 250 hydrogen hubs across the U.S. and globally to fuel Hyzon's zero-emissions commercial truck fleet.

Raven submits these comments on the Renewable Gas and Hydrogen sections of Volume III to ensure that it is consistent with state law and to maximize opportunities to decarbonize the gas sector.

1. Renewable Gas

Raven urges the CEC to make several changes to the chapter on Renewable Gas to ensure that it is consistent with state law and internally consistent. The most important issues are:

A. <u>The Definition of Renewable Gas is Inconsistent with State Law and Internally Inconsistent in Chapter 4.</u>

The Commission should correct the definition of renewable gas to be consistent with state law and to be internally consistent. Chapter 4 incorrectly states that:

> "Renewable gas, also known as biomethane, is biogas that has been upgraded to pipeline quality standards."[1]

This statement is incorrect for several reasons. First, renewable gas is much broader than biomethane. Under state law, the definition of renewable gas also includes biogas in addition to biomethane. In fact, state law explicitly includes both biogas (raw biogas) and biomethane in the term "renewable gas." For example, SB 1383 requires the Commission to adopt recommendations for the development and use of "renewable gas, including biomethane and biogas" and refers to renewable gas repeatedly with the inclusion of both biogas and biomethane.[2]

State law also does not require that all renewable gas, or even all biomethane, be upgraded to pipeline quality gas. That is only a requirement for gas that will in fact be injected into the state's common carrier pipelines and makes no sense for gas that may be used onsite or transported via truck or train. This would contradict multiple CPUC Decisions that allow biomethane, biogas and renewable hydrogen to be used in the Self-Generation Incentive Program, which incentivizes behind the meter power production and therefore does not require upgrading renewable gas to pipeline quality (unless it is directed biogas that will be injected into a common carrier pipeline). It also contradicts state law that requires new, small-scale bioenergy facilities that use biogas for power production (which does not need to be upgraded to pipeline quality).[3]

The definition of renewable gas is also inconsistent with later sections in this same chapter, which discuss the potential for renewable gas from biomass conversion and renewable hydrogen. For example, on pages 62 and 65, the Draft describes the potential for renewable gas production from biomass and states that:

> "Conversion of woody biomass into **renewable gas** is one future possibility for producing greater volumes of **renewable gas**. Gasification and pyrolysis are two technology options for biomass conversion to **renewable gas**."[4]

[1] Draft 2021 IEPR, Volume III, page 58.
[2] Health and Safety Code section 39730.8(b). See also sections (c) and (d), which include both biomethane and biogas as forms of renewable gas.
[3] SB 1122 (Rubio, 2012), codified in Public Utilities Code section 399.20(f)(2).
[4] Draft 2021 IEPR, Volume III, page 65.

The Commission should correct the definition of renewable gas to be consistent with state law and internally consistent. We urge the Commission to adopt the following definition:

> Renewable gas is gas that is generated from a renewable (RPS eligible) feedstock, including biogas, biomethane, and renewable hydrogen.

B. The Definition of Biomethane is Inconsistent with State Law

The definition of biomethane used in Chapter 4 is also inconsistent with state law, which includes both the gas from anaerobic digestion and the gas from the non-combustion thermal conversion of organic waste in the definition of biomethane. Chapter 4 limits the definition and discussion of biomethane to only the gas from anaerobic digestion, which is a small fraction of California's biomethane potential.

Public Utilities Code section 650 defines biomethane as follows:

> (a) The methane is produced from the anaerobic decomposition of organic material, including co-digestion.
> (b) The methane is produced from the non-combustion thermal conversion of any of the following materials, when separated from other waste:
> (1) Agricultural crop residues.
> (2) Bark, lawn, yard, and garden clippings.
> (3) Leaves, silvicultural residue, and tree and brush prunings.
> (4) Wood, wood chips, and wood waste.
> (5) Nonrecyclable pulp or nonrecyclable paper materials.
> (6) Livestock waste.
> (7) Municipal sewage sludge or biosolids.

The Commission should include the full definition from Public Utilities Code section 650 in Chapter 4 and should include a discussion of the potential to convert biomass resources to biomethane, biogas and hydrogen. While there is some discussion of biomass resources, it is not included as a source of biomethane nor is the discussion in any way complete.

This is especially important since 80 percent of California's biomethane/biogas potential is from biomass resources, as the table below illustrates. To meet the state's climate goals, it is critical to include biomass resources in addition to the resources that can be converted through anaerobic digestion. This is also important since the CPUC has just issued a Proposed Decision in the biomethane procurement proceeding (R.13-02-008) that calls for procurement of 88 billion cubic feet of biomethane annually and includes biomethane from biomass conversion, as required by AB 3163 (Salas, 2020).

California Biogas Potential from Organic Waste

Feedstock	Amount Technically Available	Billion Cubic Feet Methane	Million Gasoline Gallon Equivalents
Landfill Gas	106 BCF	53	457
Animal Manure	3.4 M BDT	19.5	168
Waste Water Treatment Gas	11.8 BCF	7.7	66
Fats, Oils and Greases	207,000 tons	1.9	16
Municipal Solid Waste (food, leaves, grass)	1.2 M BDT	12.7	109
Municipal Solid Waste lignocellulosic fraction)	6.7 BDT	65.9	568
Agricultural Residue (Lignocellulosic)	5.3 M BDT	51.8	446
Forest, Sawmill, Shrub & Chaparral Residues	26.2 M BDT	256	2,214
BIOGAS POTENTIAL		**468.5**	**4,044**

80% of instate biogas potential is from cellulosic waste

Sources: Rob Williams and Stephen Kaffka, UC Davis, presentation to the California Energy Commission on January 30, 2017; Lawrence Livermore National Lab assessment of forest, sawmill, shrub & chaparral residues

C. The Description of SB 1383 is Inaccurate

Chapter 4 provides an incomplete and misleading description of SB 1383 (Lara, 2016), the state's Short-Lived Climate Pollutant law. Chapter 4 states that SB 1383 set methane reduction and landfill diversion targets, but that is only part of what the law does. First, the law set requirements – not just targets – and for both black carbon and methane reduction. SB 1383 requires a 50 percent reduction in black carbon and a 40 percent reduction in methane by 2030. It also requires a number of incentives to increase the production and use of renewable gas, including both biogas and biomethane.

Providing an incomplete description of SB 1383 is misleading as it incorrectly narrows the scope of the discussion to only those renewable gas sources that help to reduce methane emissions and ignores the potential for renewable gas production to reduce black carbon emissions from landfills, forest and agricultural waste that would otherwise be open burned, the three large sources of anthropogenic black carbon emissions in California. It also ignores the potential for renewable gas to displace diesel, which is the third largest source of black carbon emissions in California.

The description of SB 1383 in Chapter 4 should be corrected to include both the black carbon and the methane reduction requirements, and the discussion of how renewable gas can help achieve these should be broadened to include biomass use and diesel displacement as ways to reduce the top three sources of black carbon emissions in California.

Raven's technology can immediately begin reducing SLCPs later this year when it begins production of hydrogen from organic waste and methane, significantly helping the State reach its goals by 2030.

D. Cost Comparisons Should Include Cost Per Ton of Carbon Reduction

The Chapter on renewable gas contains some helpful cost data, but most of it focuses on the costs per MMBtu of renewable gas and ignores the costs or cost-effectiveness of carbon reductions from renewable gas. This makes for a misleading presentation on the relative costs and benefits of renewable gas. The reason to increase renewable gas production and use is not because it is less expensive than fossil fuel gas – it is to reduce carbon emissions from the landfill, gas, power, manufacturing, agriculture, food processing, and other sectors. Any evaluation of costs should, therefore, include a discussion of the costs per ton of carbon reduction and how that compares to other carbon reduction measures.

The California Air Resources Board provides this information in its 2021 report to the Legislature on the state's climate investments.[5] That report makes clear that investments in renewable gas are the most cost-effective of all the state's climate investments, reducing carbon emissions at the tiny cost of $9 and $10 per ton.[6]

The Commission should, therefore, include data on the costs per ton of carbon reduction from renewable gas, not just the cost per MMBtu of gas, which ignores the value of renewable gas to decarbonize California's energy sector.

2. Green Hydrogen

Raven also strongly urges the Commission to correct the definition of green hydrogen in the Draft IEPR. Volume III, Chapter 4 defines green hydrogen produced by splitting water using renewable electricity. That is the definition in state law of "green electrolytic hydrogen" only, not all green hydrogen.[7] If the Legislature had wanted to define all green hydrogen in this way, it would have done so. It was only defining green electrolytic hydrogen as a subset of all green hydrogen.

Green, or renewable, hydrogen can also be produced from organic waste, including biomass and biomass. In fact, California allocated $50 million to the Department of Conservation for pilot projects to demonstrate forest biomass to hydrogen and other biofuels. The CPUC also allows hydrogen from biomass conversion in the SGIP program and allows hydrogen from biomethane in the BioMAT program. It would make no sense to exclude these from the definition of green hydrogen provided in the IEPR.

Carbon negative hydrogen should not be excluded – which is hydrogen derived from organic waste – from the definition of green hydrogen. According to Lawrence Livermore National Lab, converting organic waste to hydrogen with carbon capture and storage can provide significant carbon negative emissions and can do so quite cost-effectively using existing technologies, including Raven's Steam/CO_2 Reforming process. In fact, a recent report by LLNL on getting to carbon neutrality found that bioenergy

[5] California Air Resources Board, *California Climate Investments – Annual Report to the Legislature,"* issued April 2021. Available at: https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/2021_cci_annual_report.pdf

[6] Id., Table 2, pages 17-18.

[7] SB 1369 (Skinner, 2018) defines "green electrolytic hydrogen," not all green hydrogen. Public Utilities Code section 400.2.

with CCS can provide two-thirds of all the carbon negative emissions needed to reach carbon neutrality by 2045 and recommends production of hydrogen as the most beneficial end use.[8]

Raven produces green hydrogen with addition green benefits:

- Uses less electricity per kilogram of H_2 than other methods (i.e. electrolysis, plasma gasification, microwave plasma, etc.
- Use no clean water unlike electrolysis (an increasingly limited resource) and processes wet waste without drying (biogenic and non-biogenic at the same time.)
- Technology has fewer process emissions since it is non-combustion.
- Helps divert waste from landfills (reducing demand of landfill expansion) to meet California's SB 1383's goal of reducing organic waste disposal by 75% from 2014 levels (up to 27M tons of organic waste) by 2025.
- Converting 5 garbage trucks of organic waste per day, Raven creates more than 1,600 MT of hydrogen which is enough to travel 97+ million miles in a passenger car or 12+ million miles in a Class 8 truck. This avoid 4,750+ MT of CO_2e from the landfill, while diverting 23,000 MT of organic waste from going to the landfill.

The Commission should adopt a definition of "green hydrogen" that includes hydrogen from all renewable (RPS eligible) resources. Raven's technology is non-combustion, significantly reducing carbon emissions as compared to steam methane reforming. Those minor emissions can be offset by upstream reductions in avoided methane or black carbon emissions from organic waste that would otherwise be landfilled, piled and burned, or piled and left to decay. The hydrogen Raven produces from organic waste is carbon negative (-15 or more) based on the feedstock on a full lifecycle basis. Electrolysis can only be carbon neutral at best. Raven asks the Commission to include a performance-based definition of green hydrogen that ensures a net reduction in carbon emissions on a lifecycle basis rather than omitting hydrogen from organic waste altogether.

Raven SR urges the Commission, therefore, to revise the definition of green hydrogen to include all renewable feedstocks and not to make "green hydrogen" synonymous with "green electrolytic hydrogen," which would undercut several existing programs and policies to convert organic waste to hydrogen to immediately begin reduction of SLCP emissions and provide carbon negative emissions.

Conclusion

Raven SR appreciates the inclusion of a chapter on renewable gas in the *2021 IEPR*, but it is essential to provide definitions of renewable gas, biomethane, and hydrogen that are consistent with state laws, policies, and programs. The definitions should include all RPS eligible resources and should certainly not exclude renewable gas derived from organic waste, which can provide the only carbon negative form of renewable gas or power and also cuts Short-Lived Climate Pollutants.

Sincerely,

JuliAnne H. Thomas
Director of Communications & Government Relations
Raven SR

[8] Lawrence Livermore National Lab, "*Getting to Neutral – Options for Negative Carbon Emissions in California,"* 2020.