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May 27, 2021

Arizona Corporation Commission
1300 W. Washington St.
Phoenix, AZ 85007-2996

Re: Docket G-00000A-21-0045 - Questions from Arizona PIRG Education Fund

a) *How does the entity define RNG?*

RNG Coalition defines Renewable natural gas (RNG) as biogas created by the natural breakdown of organic waste material under anaerobic conditions, subsequently upgraded to natural gas pipeline quality. Sources of RNG include landfills, wastewater treatment plants, agricultural waste, and diverted organics, among others. This is similar to the definitions for "Biogas Electricity Generator", "Landfill Gas Generator", and "Biogas Thermal System" which are eligible renewable energy resources under Arizona's existing Renewable Energy Standard and Tariff.[1]

Given that the primary goal of promoting RNG is to decarbonize the gas system, the intent of any program should be to ensure that renewable gases provide greenhouse gas benefits compared to geologic natural gas and do so at a reasonable cost. In lieu of any exclusive definition, we would recommend establishing a technology-neutral performance standard analysis that focuses on minimizing the lifecycle greenhouse gas performance and is inclusive of all ways of making renewable gases.

b) What do they see as the potential of RNG and in what timeframe?

As of February 2021, RNG Coalition estimates the total operational, under construction, and planned RNG industry capacity at approximately 100 tBtu. According to ICF, the estimated potential for RNG from anaerobic digestion feedstocks in the 2040 timeframe is 871 tBtu per year,[2] which could replace 5.4% of U.S. residential, commercial, industrial, and natural gas vehicle demand as of 2020 (16,111 tBtu).[3] Arizona's estimated 2040 supply is 23.7 tBtu per year, which could cover approximately 24% of the 98 tBtu used in Arizona in these sectors in 2020.[4]

While these RNG percentage numbers may seem small compared to current gas demand, the same volume estimates become much more significant as gas demand is reduced due to other decarbonization strategies. For example, the New York City Mayor's Office of Sustainability[5] conducted a RNG supply potential exercise (which prorated the regional and statewide supply based on existing gas

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[1] https://www.azcc.gov/divisions/utilities/electric/res.pdf

[2] ICF, *Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment.* https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf

[3] Based on EIA natural gas consumption data from 2019: https://www.eia.gov/dnav/ng/ng_cons_sum_dcu_nus_a.htm

[4] https://www.eia.gov/dnav/ng/ng_cons_sum_dcu_SAZ_a.htm

[5] New York City Mayor's Office of Sustainability, *Pathways to Carbon-Neutral NYC: Modernize, Reimagine, Reach.* https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/Carbon-Neutral-NYC.pdf

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demand) to find that biogenic RNG (from AD feedstocks) can serve 18%-40% of 2050's projected remaining gas demand, if electrification and similar strategies are also maximized. In scenarios where it is possible to convert approximately 60% of New York City's building stock to all-electric applications by 2050, this study shows that RNG has a role to play. A key finding applicable to all scenarios was that "in addition to providing a solution for buildings that do not electrify, a low carbon gas network improves overall system reliability by offering optionality and flexibility within the energy system".[6]

These conclusions align with additional studies conducted by Energy and Environmental Economics (E3) for a number of jurisdictions—including New York[7] and California[8]—which show RNG to be a necessary decarbonization strategy, even in high-electrification scenarios. The role of RNG as a decarbonization strategy was also recently examined by the World Resources Institute, who published a paper illustrating how RNG fills a unique niche as part of a broader low-carbon technology portfolio.[9]

The RNG industry does not claim to be able to solve the daunting challenge of fully decarbonizing all gas consuming sectors alone, but we know that RNG can—and should—be a significant contributor to this effort. In understanding RNG's role, it is important to consider both the well proven technology readiness level of technologies that make RNG, such as anerobic digestion (AD), and the flexibility provided by RNG's full fungibility with all conventional gas applications. In the long run, RNG can be directed to the end-uses where it is most needed, serving in tandem with technologies that require time to scale and achieve production cost reductions (e.g., electrolytic hydrogen), that involve the turnover of long-lived capital stock (e.g., electrification), and will be necessary in applications that have certain reliability requirements, or which are not well suited to electrification.[10] Electrification goals do not preclude the use of RNG and renewable hydrogen as significant long-run energy sources.

The electric industry has reached similar conclusions. The Electric Power Research Institute has reported that low-carbon fuels, like RNG, will be critical means of decarbonizing the economy.[11] In addition,

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[6] Ibid, page xvii.

[7] E3, *Pathways to Deep Decarbonization in New York State.*
https://climate.ny.gov/-/media/CLCPA/Files/2020-06-24-NYS-Decarbonization-Pathways-Report.pdf

[8] E3, *Achieving Carbon Neutrality in California.*
https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf

[9] World Resources Institute, *Renewable Natural Gas as a Climate Strategy: Guidance for State Policymakers.*
https://www.wri.org/publication/renewable-natural-gas-guidance

[10] Bataille et al., *A Review of Technology and Policy Deep Decarbonization Pathway Options for Making Energy-Intensive Industry Production Consistent with the Paris Agreement.*
https://www.sciencedirect.com/science/article/abs/pii/S0959652618307686

[11] Electric Power Research Institute, *Powering Decarbonization: Strategies for Net-Zero CO2 Emissions.*
https://www.epri.com/research/products/000000003002020700

studies commissioned by the New York Independent System Operator emphasize that dispatchable generation, possibly relying on RNG, will be required to maintain electric reliability in the long-term.[12,13]

The RNG industry has shown extraordinary growth in recent years, driven by policies designed to promote environmental and economic goals—including but not limited to clean air, improved waste management, increased job development, energy independence, and resource diversity. RNG is a mature technology with a long history in the U.S., beginning with the development of North America's first RNG production facility in 1982 at the Fresh Kills Landfill on Staten Island.[14] Between 1982 and 2011, 30 RNG projects were developed. There are now 157 operational RNG production facilities in North America with 155 under construction or in substantial development,[15] exemplifying the RNG industry's ability to scale rapidly in the near term. With this in mind, it is highly likely that the 2040 timeframe examined by the ICF report will be rapidly accelerated.

c) What does the entity see as the costs and benefits of RNG?

The primary benefit of RNG is its ability to reduce the environmental impact of organic waste while simultaneously serving as a fully fungible substitute for conventional natural gas which does not add atmospheric carbon when combusted, thus creating a net reduction of emissions to the atmosphere, especially when displacing diesel fuel. According to a recent study by the World Resources Institute,[16] the cost-effectiveness of RNG on a $/ton CO2e basis ranges from around $48-375 (see Figure 1 below). It is important to note that including any estimate of the social costs of carbon would further reduce these values for all RNG feedstocks. RNG production facilities also improve air quality in the vicinity of organic waste processing facilities due to improved management practices and reduced flaring, exemplified by the City of Phoenix 91st Ave Wastewater Treatment Plant RNG facility.[17]

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[12] Brattle Group, *New York's Evolution to a Zero Emission Power System: Modeling Operations and Investment Through 2040.*

https://www.nyiso.com/documents/20142/12610513/Brattle%20New%20York%20Electric%20Grid%20Evolution%20Study.pdf/6a93a215-9db3-d5a0-6543-27b664229d3e

[13] Analysis Group, *Climate Change Impact and Resilience Study – Phase II: An Assessment of Climate Chance Impacts on the Power System Reliability in New York State.*

https://www.nyiso.com/documents/20142/16884550/NYISO-Climate-Impact-Study-Phase-2-Report.pdf/e9214fd4-9c52-036d-b92b-15f282e686e6

[14] This project has continued to produce RNG for nearly 40 years.

[15] Based on RNG Coalition's production facility data as of April 22, 2021: https://www.rngcoalition.com/rng-production-facilities

[16] World Resources Institute, *Renewable Natural Gas as a Climate Strategy: Guidance for State Policymakers.*

https://www.wri.org/publication/renewable-natural-gas-guidance

[17] https://www.ameresco.com/portfolio-item/city-of-phoenix-91st-avenue-wastewater-treatment-plant-az/

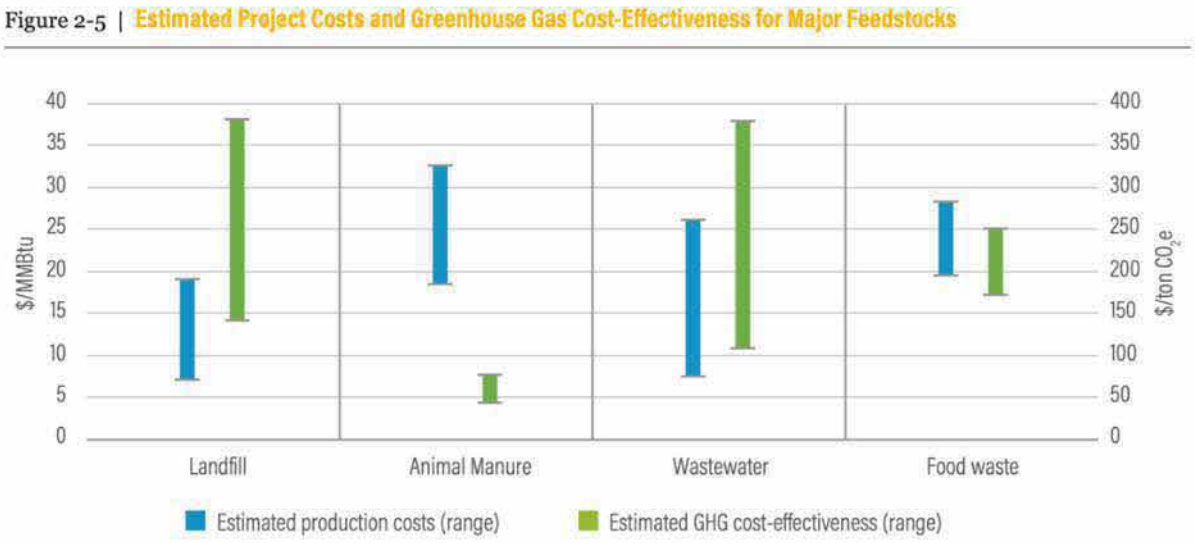

Figure 1. RNG Cost Estimates

Here it is also important to consider the additional benefits of RNG that can be realized with improved waste management processes, facilitating a more circularized waste system. Absent comprehensive management through aggregation and containment processes, many organic waste sources present water quality issues, especially from run-off. AD is a cost-effective treatment of manure and biosolids used by thousands of facilities across the U.S. to remedy these issues.[18] Nitrogen and phosphorus are concentrated and controlled during the AD process, decreasing runoff into ground water and other water resources,[19] and AD reduces pathogen levels up to 99% compared to undigested manure.[20] Because RNG can be sold into a diversity of energy markets, the addition of RNG upgrading technology to an anaerobic digester helps financially incentivize better waste stream management and the mitigation of air and water quality impacts from waste.

RNG production through anaerobic digestion of materials such as food waste, animal manure and wastewater also yields valuable by-products. AD converts nutrients into a form more accessible by plants than raw manure, allowing for more effective use as fertilizer.[21] After the elimination of pathogens, digested solids can be recycled for use as animal bedding.[22] Direct use or sale of AD by-product materials can add an important revenue stream or savings to aid farmers and local governments, adding another layer of circularity to the RNG production process.

RNG projects developed in Arizona would also bring substantial economic benefits to the state. RNG production facilities attract between $10-$100 million in capital investment per project and the creation

[18] U.S. EPA. (2014, August). Biogas Opoortunities Roadmap.

[19] Id.

[20] Id.

[21] U.S. EPA. (2020, August 18). The Benefits of Anaerobic Digestion.

[22] Id.

of up to 173 direct and indirect jobs per project.[23] For example, the City of Phoenix 91st Ave Wastewater Treatment Plant RNG facility generates tens of millions of dollars over a 20-year term for the sub-regional operating group.[24]

d) *What are the estimated GHG saving from RNG?*

All commercially available methods of producing RNG from waste feedstocks have excellent greenhouse gas performance, exemplified by carbon intensity (CI) modeling employed by California's LCFS program.[25] Moreover, some RNG projects capture and destroy a greater amount of GHG (as measured on a tons of carbon dioxide equivalency basis) than are emitted during the fuel's combustion, making it one of the few fuels available commercially today with a carbon-negative impact (i.e., better than carbon-neutral).

There remain thousands of landfills, wastewater treatment facilities, and livestock operations across North America where raw biogas (methane) is being flared, or worse, is uncollected and escaping fugitively into the atmosphere. Methane is a short-lived climate pollutant that—when assessed over a 20-year timeframe—is up to 84 times as potent as a greenhouse gas as carbon dioxide.[26] Pursuing increased development and utilization of RNG will incentivize improved management of these waste streams while simultaneously providing a flexible, truly circular renewable energy resource.

Because of the breadth of technological options to make renewable gases, the RNG industry has long advocated for employing metrics to assess the GHG emissions from each RNG production pathway. In particular, we believe that a lifecycle analysis (LCA) is the most appropriate method of doing so because it accounts for all greenhouse gas emissions benefits and disbenefits[27] from a given RNG production pathway. These various emissions steps are then combined to produce a carbon intensity (CI) score for each production pathway. A common tool for calculating RNG CI scores is the GREET model[28] created by Argonne National Lab, which is widely accepted among both regulatory agencies and the scientific community.[29]

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[23] https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/59077544ebbd1ad192d13ff6/1493660998766/ICF_RNG+Jobs+Study_FINAL+with+infographic.pdf

[24] https://www.ameresco.com/portfolio-item/city-of-phoenix-91st-avenue-wastewater-treatment-plant-az/

[25] For example, see the lifecycle analyses conducted by California's Air Resources Board: https://ww3.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm

[26] Myhre, G. et al., *Anthropogenic and Natural Radiative Forcing*. https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf

[27] For example, benefits may include avoidance of upstream emissions while disbenefits may include leakage, energy usage, and non-CO_2 combustion emissions.

[28] See more information about Argonne National Lab's GREET model:

https://greet.es.anl.gov/

[29] GREET can easily be modified to provide CI scores for stationary uses of RNG, as is required in other jurisdictions' RNG utility procurement program. For example, the California Public Utilities Commission (CPUC) required Southern California Gas Company and San Diego Gas and Electric to use a modified version of GREET to measure the Carbon intensity of procured RNG. See CPUC Decision 20-12-022 dated December 17, 2020.

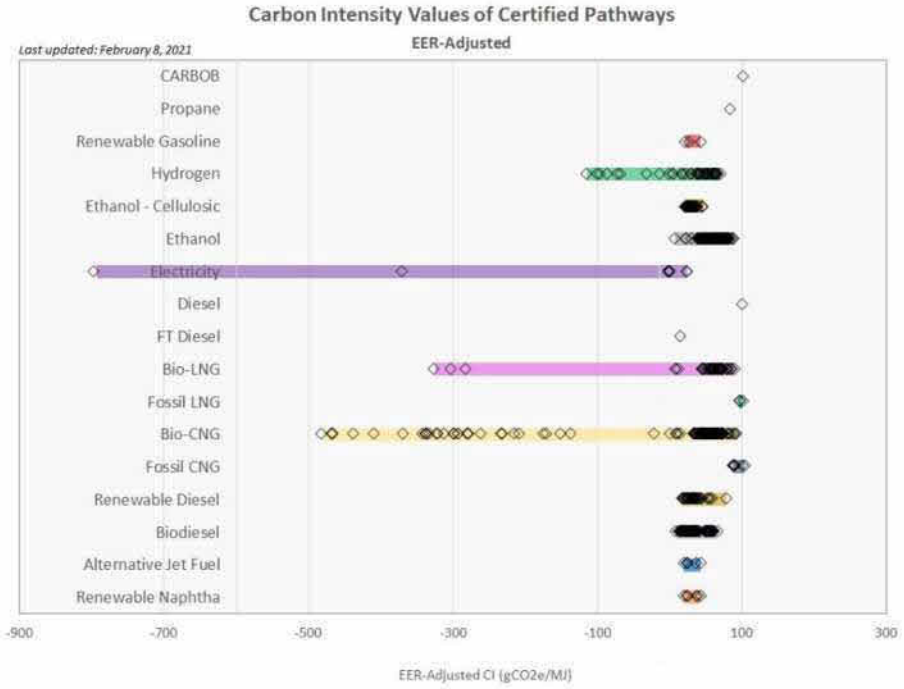

Figure 2. LCFS Pathway Certified Carbon Intensity Scores

Figure 2 depicts current CI scores under California's Low Carbon Fuel Standard (LCFS). Pathway-specific CI scores for RNG production facilities range from low-carbon to carbon-negative.[30] Based on this information, we believe that RNG currently available for development or purchase in Arizona (even those which are low-carbon as opposed to carbon-neutral or carbon-negative) will provide emission reduction benefits to gas users immediately. While it would be technically possible to produce RNG with a higher CI than conventional natural gas for a variety of reasons—due to methane leakage, energy consumption, or other factors—this is not the current practical reality at real-world RNG facilities in the U.S. today,[31] nor are we advocating for Arizona to endorse the development of such facilities.

As Arizona'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 Arizona's current grid) may eventually be carbon-neutral from a lifecycle standpoint (as their upstream energy inputs are derived from a greater and greater share of renewable electricity).[32] The use of a continually updated LCA framework will provide an incentive for RNG producers to maximize their greenhouse gas benefit.

e) *What are the specific impacts for Arizona ratepayers?*

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

[31] RNG Coalition does not support the utilization of RNG from high-CI sources.

[32] RNG pathways which are currently carbon-negative will have an even larger carbon benefit.

As explained in World Resource Institute's[33] recent study, based on modeling conducted by ICF,[34] "a significant share of RNG can be produced at a cost ranging from $15-$20/MMBtu". Although this price is higher than current prices for conventional natural gas, it is important to recognize the carbon reduction and local supply benefits provided to ratepayers by RNG, and the difference in price if the social cost of carbon were to be factored into these estimates.

Furthermore, the specific impact to Arizona's ratepayers would depend on how a given RNG program or contract is structured. If Arizona wants to maximize the use of RNG to help generally decarbonize residential, commercial, and industrial end-uses, the adoption of renewable gas procurement programs or standards (RGS) which utilize a form of renewable energy certificates should be prioritized. Such a program would operate in an analogous fashion to a renewable portfolio standard (RPS) or Clean Energy Standard (CES) in the electricity sector. RGS policies could be structured around either volumetric percentage targets (like RPS/CES) or GHG performance targets.[35] In this case, certain costs related to RNG production and procurement would be rate-based. Comparatively, some entities may sell RNG into other markets (e.g., transportation fuel), which typically involves the separation of environmental attributes from the physical gas. Such is the case with the City of Phoenix 91st Ave Wastewater Treatment Plant RNG facility, in which there are no costs incurred by gas ratepayers.

Given the fact that significant natural gas usage will remain through 2050—as evidenced by the aforementioned studies conducted by E3 for the Climate Action Council and ICF for the New York City Mayor's Office of Sustainability—it is important that Arizona recognizes the value of pilot programs, voluntary offerings, and programs which will allow utilities to procure RNG on behalf of their customers in the near term. RNG is a no regrets decarbonization strategy that is ready for broad deployment immediately. Moving swiftly to begin the use of RNG will allow alignment with the major studies outlining full decarbonization of our energy system.

Conclusion

RNG Coalition appreciates the opportunity to participate and provide comment in this proceeding. Our members look forward to investing in and constructing new methane-capturing and RNG production facilities that create clean energy sector jobs in pursuit of Arizona's decarbonization goals. Please feel free to reach out with any additional questions.

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[33] World Resources Institute, *Renewable Natural Gas as a Climate Strategy: Guidance for State Policymakers.* https://www.wri.org/publication/renewable-natural-gas-guidance

[34] ICF, *Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment.* https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf

[35] We prefer RGS policies based on GHG performance targets using full LCA, as discussed above. Full LCA has already been successfully included in multiple regulatory programs, including for transportation uses of RNG in the California Low Carbon Fuel Standard, British Columbia Low Carbon Fuel Standard and Oregon Clean Fuels Standard, and Oregon's and California's renewable gas standard procurement programs for gas utilities. Under these programs, projects with the lowest CI scores receive the greatest incentive.

Sincerely,

/s/

Sam Lehr
Manager of Sustainability and Markets Policy
Coalition for Renewable Natural Gas
1017 L Street #513
Sacramento, CA 95814
302.757.0866
sam.lehr@rngcoalition.com