Date: **January 24, 2022**

To: Michigan Public Service Commission, c/o Virginia Halloran

Cc: Chair Dan Scripps
Commissioner Tremaine Phillips
Commissioner Katherine Peretick
Mike Byrne

Re: Comments to the Michigan Public Service Commission on the Renewable Natural Gas Study Outline and January 10 Presentation, Submitted on Behalf of Natural Resources Defense Council, Sierra Club, 5Lakes Energy, Michigan Environmental Council, Strategen, and Energy Futures Group

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Thank you for the opportunity to provide written comments on the proposed Renewable Natural Gas study in response to Public Act 87 of 2021. Stakeholder feedback early in the process is critical for ensuring that the Michigan Public Service Commission (PSC or Commission) and its consultant, ICF, are developing the most accurate and informed study of renewable natural gas's potential in Michigan. This is an important study as we continue to identify pathways for decarbonizing our state and our economy.

In response to the Commission's request for comment, our goal was to be comprehensive and address as many of the topics identified as possible. However, given that we are in the early stages of this study, and we do not yet have sufficient information on the key assumptions and inputs, there are still many unknowns to which we could not respond. As a result, we urge the Commission to hold additional public discussions on the critical building blocks of the study.

In our comments below we make the following recommendations:

1. The PSC should add a series of stakeholder engagements early in the process, far in advance of the release of the draft study.
2. The study should address the role of renewable natural gas for meeting the Governor's economy-wide greenhouse gas (GHG) goals for Michigan.
3. The study should include the consideration of impacts to highly impacted and marginalized communities associated with RNG and the study's alternative resources.
4. ICF should clarify the methodology with stakeholders to determine theoretical, feasible, and achievable potentials.

5. The study should examine the range of potential use cases that may compete for renewable natural gas resources in 5-year increments.
6. The study should consider a broad set of costs to RNG resources and the alternatives.
7. The study should consider a broad set of benefits from RNG and the alternative resources.
8. The study should use a total resource cost test as its cost-benefit test.
9. The study should include economic sensitivities to test the results against various cost conditions.
10. The study should recognize that the most expensive unit of RNG sold in the market will set the clearing price.
11. The PSC and ICF should work with stakeholders to seek out applicable Michigan-specific data.
12. The study should examine the configuration of different livestock operations to account for their suitability for anaerobic digestor operations.
13. The emissions analysis should be broken down by specific feedstock sources and considered on a 20- and 100-year timeframe for assessing methane's global warming potential.
14. The study should, at a minimum, include our list of alternative carbon abatement technologies.
15. ICF needs to provide additional clarity on the study's assumptions about electrification alternatives and the electric grid.
16. Electrification measures should be based on the long-run marginal emissions rates estimated over the life of each electrification measure.
17. If the study relies on the GREET model, then the study must be clear regarding its limitations and use Michigan-specific inputs.

Public Process

Recommendation: The PSC should add a series of stakeholder engagements early in the process, far in advance of the release of the draft study.

We urge the Commission to implement additional public process to discuss the methodologies and inputs of the study, and this should occur early in the process so there is time to incorporate stakeholder feedback into the draft study. Stakeholder engagement is a critical component of the public process because it is important for policy- and decision-makers to hear directly from the people who are impacted by the Commission's actions. Robust engagement with stakeholders can also improve the study, provide education for stakeholders on key technical topics, and increase stakeholder buy-in. The Legislature has recognized the importance of stakeholder involvement and mandated that the Commission identify and engage stakeholders in the development of the study.[1]

On January 12, after the PSC's initial and only planned stakeholder meeting prior to the release of the draft report, the PSC asked stakeholders for comment on specific topics. We appreciate the Commission's solicitation for feedback and provide comments in this document. However, we do not believe that this single stakeholder meeting and solicitation of comments is sufficient to yield a robust report, nor does it meet the spirit of the legislature's requirement to engage interested stakeholders.

Regarding several details of the study, it is challenging to provide specific recommendations because the study outline and workshop presentation shared with stakeholders were very high-level. Stakeholders still do not know most of the assumptions ICF intends to use in its study, and it would be overly burdensome

[1] Public Act 87 of 2021, Section 1002(2)

to expect stakeholders to anticipate each assumption that will be necessary and articulate a specific recommendation. Rather, for efficiency and transparency we recommend that ICF share—as soon as possible—its key assumptions and inputs for stakeholder review and feedback. It is important that this stakeholder engagement occur prior to the development of the study so ICF has time to incorporate stakeholder feedback, where necessary. If stakeholders cannot provide feedback until ICF has already completed a draft of the study, as the current schedule stands, it will likely be too late for stakeholders to provide meaningful input on the foundations of the study.

An example of constructive stakeholder engagement can be seen by looking to a similar proceeding before the Minnesota Commission. Minnesota initiated a rulemaking to establish frameworks for lifecycle GHG emissions intensity accounting and cost-benefit accounting for comparing resources and measuring cost effectiveness of innovation plans developed by the natural gas industry. That process is ongoing and includes extensive stakeholder engagement work on the proceeding's methodologies.[2] Although the objective of the process in Minnesota is different than it is in Michigan, and thus it should have a different level of stakeholder involvement, much of the analyses and considerations are the same. Based on our understanding of the proceeding in Minnesota, stakeholders and the utilities are iteratively co-developing analyses with an independent moderator running weekly workshops. The rulemaking proceeding has benefited from stakeholders bringing diverse perspectives and sharing Minnesota-specific information.

In contrast, Michigan is planning to hold just one workshop prior to the development of the draft study and another after the release of the draft. Additionally, the initial meeting was not as constructive as it could have been because minimal information was provided to stakeholders ahead of time and many specifics of the study are still unclear. Furthermore, the workshop format did not allow for a conversation between ICF, the Commission, and stakeholders; a moderator was needed to facilitate discussion. In Minnesota, we understand that the facilitator has helped work through challenging conversations and ensured the meetings were progressing and fruitful.[3]

The second workshop, which is planned for after the release of the draft study, will come too late in the process for stakeholders to provide meaningful input on the building blocks of the study.[4] At that point, it would likely be infeasible from a budgetary and timeline perspective to course correct on key study components that would have benefitted from stakeholders' feedback.

Objectives, Methodologies, and Data

Meeting Public Policy

Recommendation: The study should address the role of renewable natural gas for meeting the Governor's economy-wide greenhouse gas (GHG) goals for Michigan.

In 2020, Governor Whitmer signed Executive Order 2020-182 and Executive Directive 2020-10 to create the MI Healthy Climate Plan, which calls for a 28 percent decline in GHG reductions by 2025, 52 percent decline by 2030, and 100 percent decline by 2050, relative to 2005 levels. For the energy sector, the directive calls for an 80 percent decline from 2005 levels by 2030. The study should be cognization of the state's climate goals and include a discussion, based on the study's findings, of the role RNG (when

[2] Docket 21-566
[3] The Great Plains Institute is facilitating the Minnesota rulemaking
[4] For example, ICF will have determined a methodology and the associated data needs and sources.

compared with alternative technologies like electrification and green hydrogen) can realistically play in meeting those targets.

Equity Inclusion

Recommendation: The study should include the consideration of impacts to highly impacted and marginalized communities associated with RNG and the study's alternative resources.

Sec. 1002(1)(f) requires that the study "identify barriers to developing and utilizing renewable natural gas in this state."[5] We agree with Commissioner Peretick's comments during the January 10 workshop that this requirement includes the consideration of *impacts* to highly impacted and marginalized communities from the resources identified in the study. Highly impacted and marginalized communities, also called frontline communities, have historically shouldered a disproportionate share of our collective environmental burden, yet often do not receive the benefits from policies to reduce pollution.[6]

The study should consider a broad spectrum of costs and benefits, such as the reduction in criteria pollutants, as well as other health, environmental, and economic impacts of a range of RNG facilities and feedstocks. The study should apply these indicators to each resource and type of facility in the study and, if possible, the location of the facility. Ideally this type of analysis would occur at a highly granular level, but the Michigan Prosperity Region Map may be a useful as a starting point. Where possible, the study should identify specific locations of facilities, proximity to frontline communities, and impacts to frontline communities.

In accordance with the MPSC's stated commitment to equity, the Commission should seek direct input from environmental justice leaders and frontline community members living in and around existing and potential RNG facilities by engaging with them on this aspect of the study. The MPSC should formally involve EGLE's Office of Environmental Justice Public Advocate and the Michigan Advisory Council on Environmental Justice in the development of this study and the contextualization of its findings.

Classifications of RNG Potential

Recommendation: ICF should clarify the methodology to determine theoretical, feasible, and achievable potentials.

The January 10 presentation by ICF identified three resource potential scenarios: technical, feasible, and achievable. Although the presentation defined each scenario, neither the presentation nor the outline discussed the methodology that the study will use to determine each scenario. For example, "feasible" potential is defined as "any sources of RNG that are applicable to MI [Michigan] while eliminating sources from the theoretical list due to relative cost effectiveness," but ICF did not elaborate on the methodology or the type of cost-effectiveness test it would use to screen resources.[7]

This type of screening is often informed by academic and professional literature and, if possible, should be Michigan-specific. The consideration for Michigan-specific studies is important because there are often competitive uses, or competing policies, for the same feedstock. (e.g., reduction and recycling of

[5] Public Act 87 of 2021, Section 1002(1)(f)
[6] https://www.nrdc.org/stories/roadmap-frontline-communities
[7] As we will discuss later in our comments, we recommend the PSC and ICF to use a total resource cost test that includes non-energy benefits.

municipal solid waste, reductions and diversions of food waste, incentives to keep more crop residues in situ to improve soil health, tighter regulation of combined feeding operations, expansion of pasture-raised livestock, etc.)[8] that should inform the study.

ICF should also clearly explain its methodology for applying "theoretical," "economic," and "stricter" constraints that it references in its slide deck presentation for stakeholder review and response.

Recommendation: The study should examine the range of potential use cases that may compete for renewable natural gas resources in 5-year increments.

As Minnesota continues down a path of decarbonization, industries seeking pathways to net-zero GHGs, including industrial processes, electric power generation, and clean vehicles and transit, are vying for a limited stock of low-carbon or carbon-free resources. The study should analyze potential sources and comparison to projected demand from all sectors of the economy should be made for 2025, 2030, 2035, and 2040. The study should also clearly differentiate new, incremental biogas production from existing biogas production, by source type.

Resource Costs, Benefits, Tests, and Sensitivities

Recommendation: The study should use a total resource cost test as its cost-benefit test.

The MPSC solicitation for additional comments asked for feedback on the appropriate cost-benefit test. The Michigan PSC has historically relied on the utility cost test (UCT) for its energy efficiency programs to measure the cost-effectiveness of a program. The utility cost test is an appropriate analysis for a utility program as it measures the benefits to the utility, which in turn implies a benefit to ratepayers. However, the UCT is not the appropriate test in this circumstance. One of the key motivators of the study is to understand options for reducing greenhouse gases, which cannot be captured in the UCT. The most appropriate test, in this case, is the total resource cost, or a societal cost test which captures all costs and benefits including greenhouse gas costs.

Recommendation: The study should include the full range of costs and benefits of RNG and the alternative resources.

Consistent with our recommendation to include a total resource cost test, the study should use the full range of costs and benefits for RNG and alternative resources that are being considered.[9] This is especially important when considering impacts to frontline communities. For example, RNG has a different ability to reduce criteria pollutants that an alternative such as electrification. There is also extensive literature on quantifying non-energy benefits, particularly in the energy efficiency sphere.[10]

All costs should be compared back to projected costs of natural gas on an equivalent heat basis. The examined costs should include, but may not be limited to:

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[8] Citation needed

[9] We use the term alternative resources, which are identified as "other carbon abatement technologies in the authorizing legislation. Public Act 87 of 2021, Section 1002(1)(d).

[10] Notable non-energy benefits include job and health impacts. An incomplete list of studies include "Evaluating and Quantifying the Non-Energy Impacts of Energy Efficiency" by LBNL and "Non-Energy Benefits of Energy Efficiency" by the Midwest Energy Efficiency Alliance.

- Equipment, infrastructure, and vehicles needed to gather, store, treat, and transport feedstocks from their points of origin to biogas production facilities.
- Facilities and equipment needed to produce biogas and upgrade it for use in pipelines.
- Piping and equipment needed to connect RNG production facilities to existing natural gas transportation and distribution networks.
- Environmental, public health, and other community burdens associated with biogas feedstocks, production, and use.

Recommendation: The study should include sensitivities to test the results against various cost conditions.

Forecasts cannot perfectly predict the future; therefore, the study should include sensitivities to test results against various cost conditions. Specifically, the study should test results against various changes in natural gas price or changes in demand. Additionally, the study should also test results using various diesel fuel prices, biogas feedstock prices, future carbon prices, and new entries into the low carbon fuel standard market, such as Washington state in 2023.

Recommendation: The study should recognize that the most expensive unit of RNG sold in the market will set the clearing price.

Renewable natural gas facilities will have different production costs based on the type of resource, its feedstock type and supply, and its ability to access the market. However, regardless of the production costs of a single source of RNG, the price at which consumers will pay for RNG will be the cost of the marginal RNG unit. A supply curve of RNG resources – in increasing prices per increment of biogas supply – should be included so that the Commission can see the market clearing price at different levels of demand.

Data Inputs and Methodologies

Recommendation: The PSC and ICF should work with stakeholders to seek out applicable Michigan-specific data.

As we will discuss throughout our comments, where it is possible, the study should use Michigan-specific data. The PSC and ICF should engage stakeholders to help identify this data through additional public process,[11] and seek expert consultation with entities who have Michigan-specific agricultural and anaerobic digestor knowledge.

[11] The PSC should make sure that there is an appropriate length of time for stakeholders to respond to solicitations for data.

Recommendation: The study should examine the configuration of different livestock operations to account for their suitability for anaerobic digestor operations.

Initial analysis from a 2021 Michigan State University shows that, while Michigan livestock farms have opportunities for developing biogas, there are some limitations.[12] That study found that,

- Dairy is the best livestock opportunity for Michigan as the farms are larger in size and have very low carbon intensity scores, in the range of -150 to -300 CO2e/MJ.
- There are fewer large operations for steers and those operations do not qualify for the low carbon fuels standard program.
- Feeder pigs are most often raised over underfloor storages making it difficult to collect "fresh" manure for anaerobic digestion.
- Poultry's lower moisture content makes the material less desirable for digestion which typically is used for liquid or semi-solid material.

Recommendation: The emissions analysis should be broken down by specific feedstock sources and considered on a 20- and 100-year timeframe for assessing methane's global warming potential.

We agree with the study's proposal to measure GHG emissions on both a lifecycle and a combustion approach. Both measurements are important for understanding the value of a resource. But we encourage the study to also take both a short- and long-term view of emissions, and measure methane's GHG impacts on 20- and 100-year timeframes in the life cycle analysis. The emissions analysis should consider the following for each feedstock:

- Effect of using the feedstock source at the projected level on the projected subsequent amounts of carbon contained in biomass, soil, and other carbon pools.
- Methane leakage from the collection, holding, and transfer of biogas feedstocks.
- Methane leakage from biogas production, upgrading to pipeline standards, and delivery of biogas to existing natural gas infrastructure.
- Methane leakage from existing natural gas storage, transmission, and distribution
- infrastructure used to handle biogas.
- Whether methane resulting from a given biogas feedstock would have otherwise been emitted to the atmosphere or flared and whether the feedstock is already being used for energy production (specifically relevant to landfill methane).

Alternative Carbon Abatement Technologies

Recommendation: The study should, at a minimum, include the below list of alternative carbon abatement technologies.

The statute asks that the estimated per-unit cost savings of greenhouse gas emission reductions for RNG sources be compared to comparable, alternative technologies. As we addressed earlier in our comments, we recommend that the study take a more expansive view and identify all the costs and benefits of each

[12] *See* attachment, Kirk, Dana. Renewable Natural Gas Potential of Michigan Livestock Manure. June 9, 2021.

alternative carbon abatement technology identified. As requested by PSC, we identify the most viable low and zero carbon abatement technologies identified by leading US decarbonization studies,[13] including:

- cold climate heat pumps, heat pump water heaters, other electrification measures, green hydrogen injected into gas distribution system at minimal to no system upgrades, a 100 percent green hydrogen distribution system, natural gas efficiency program investments at various savings levels, plugging dormant oil and gas wells in Michigan, reducing fugitive methane emissions from existing natural gas infrastructure within the state, and hydrogen based RNG production.

Recommendation: The study should use Michigan specific assumptions about electric grid and its associated emissions.

Based on the January 10 presentation, we believe that ICF may intend to rely on data about the electric grid, and its associated emissions, that has no relationship to the Michigan grid. Reliance on electric grid information that has no connection to Michigan would be a fatal flaw for the study. Each utility, and thus each state, has a unique generation portfolio and its own pathway towards decarbonization. As electrification measures are likely to be the most prominent alternative resources used in the study, inaccurate data of the profile of the electric grid would critically injure the results of the study.

Recommendation: The study should use analysis of electrification alternatives based on Michigan data.

Electrification measures are likely to be the most prominent alternatives in the study, given the prevalence of electrification pathways identified in US decarbonization modeling. Unfortunately, the outline and presentation lacked detail on electrification technologies. These are critical assumptions for comparing the costs of alternatives, and particularly important to inform state policy in light of Governor Whitmer's net-zero economy-wide decarbonization goal; yet, under the PSC's current plan, stakeholders will not have an opportunity to review the assumptions until after the draft report, at which time it may be too late to meaningfully impact these assumptions. This is another area in which the study could be improved by having additional public process for ICF, the Commission, and stakeholders to identify and collaborate on optimal assumptions.

Recommendation: The cost of electrification measures should use the marginal cost of new generation (and associated marginal new emissions).

We were also concerned with some of the statements on electrification assumptions made during the January 10 presentation. Specifically, the presentation included a slide with decarbonization costs for

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[13] Princeton Net-Zero America study, https://netzeroamerica.princeton.edu/img/Princeton_NZA_Interim_Report_15_Dec_2020_FINAL.pdf; Energy Innovation Analysis, https://energyinnovation.org/wp-content/uploads/2021/04/A-1.5-C-Pathway-to-Climate-Leadership-for-The-United-States_NDC-update.pdf; 2021 NRDC Study, https://www.nrdc.org/sites/default/files/2030-biden-climate-pollution-ib.pdf; Midcontinent Power Sector Collaborative, Feb 2021, https://roadmap.betterenergy.org/wp-content/uploads/2021/02/GPI_Roadmap_Buildings_Final.pdf.

electrification alternatives from a warm weather state in the south. It was not clear, based on the comments of the presenter, that the study will be using Michigan specific data. Nor was it clear what sort of assumptions the study makes about the emissions profile of the electric grid. The cost of electrification measures should use the marginal cost of new generation (and associated marginal new emissions) based on the incremental load that the electrification measures are adding to the system. This is especially important to ensure that the costs are being treated on an equal basis if the cost of RNG is based on incremental production and delivery costs.

Recommendation: Electrification measures should be based on the long-run marginal emissions rates estimated over the life of each electrification measure.

Considering those comments, we feel it is critical to address the study's inclusion of electrification measures. Costs per ton of GHG emissions reduction for electrification measures should be based on long-run marginal emissions rates (reflecting the characteristics of additions to generating capacity that will be added to meet new load), estimated over the life of each electrification measure in at least the following two scenarios:

1. The forecasted emissions from electric utility integrated resource plans, and
2. An accelerated decarbonization of the grid, including 80 percent GHG reductions by 2030 and 95 percent by 2045.

Recommendation: If the study relies on the GREET model, then the study must be clear with its limitations, and use Michigan-specific inputs.

During the January 10 presentation, ICF stated that it intends to use the GREET model for evaluating lifecycle carbon emissions.[14] While this model is an appropriate tool for evaluating lifecycle carbon emissions, it has limitations. GREET was developed specifically to evaluate avoided emissions from the transportation sector—not buildings.[15] First, it is our understanding that in Minnesota, where the state is undertaking a similar analysis using the GREET model, stakeholders have recognized that to provide meaningful guidance to regulators that will inform statewide decarbonization policy pathways from energy consumption, it is important to incorporate region-specific and even utility-specific data wherever possible.[16]

Second, it is our understanding that there have been issues with the model if applied to electrification or if electricity is being used as a power source at any point. The GREET model can only use one resource mix

[14] https://greet.es.anl.gov/
[15] https://greet.es.anl.gov/homepage2
[16] Minnesota Public Utilities Commission, In the Matter of Establishing Frameworks to Compare Lifecycle Greenhouse Gas Emission Intensities of Various Resources, and to Measure Cost-Effectiveness of Individual Resources and of Overall Innovation Plans Docket No. G-999/M-21-566, Compliance Filing – Proposed Lifecycle GHG Accounting Framework, Exhibit B, p.2-3, January 13, 2022.

as an input but the electric fuel mix varies on an hourly basis which cannot be captured in the GREET model.[17] Thus, exact system impacts cannot be captured.

Conclusion

We appreciate the opportunity to provide feedback to the Commission and ICF on this study. We urge the Commission to immediately plan for additional public process so that we can all ensure that this study meets the legislature's request and provides meaningful policy guidance for regulators as we move forward identifying the optimal pathways for decarbonizing Michigan.

[17] Minnesota Public Utilities Commission, In the Matter of Establishing Frameworks to Compare Lifecycle Greenhouse Gas Emission Intensities of Various Resources, and to Measure Cost-Effectiveness of Individual Resources and of Overall Innovation Plans Docket No. G-999/M-21-566, Compliance Filing – Proposed Lifecycle GHG Accounting Framework, Exhibit B, p.5, January 13, 2022.

Renewable Natural Gas Potential of Michigan Livestock Manure

Dana Kirk, June 9, 2021

Michigan is home to a diverse and robust animal agriculture industry, boasting top 10 rankings in the U.S. for milk and egg production. Table 1 summarizes the four year (2017-2020) average herd and flock size in Michigan[1] and "as excreted manure" production estimates[2]. Dairy is the leading animal type in animal units (1,000 pounds of body weight) and manure production.

Table 1: Michigan Animal Inventory and Manure Production Estimate, average animal numbers between 2017 and 2020

Animal Type	Head*	Weight (lb)	Animal Units	Manure Production (lb/d/animal)	Manure Production (ton/d)	Moisture Content (%)
Dairy cows	425,500	1400	595,700	150	31,913	87%
Dairy heifers	170,250	700	119,175	35	2,949	83%
Steers[1]	176,000	700	123,200	20	1,725	92%
					-	
Feeder pigs[2]	1,093,438	110	120,278	7.14	3,904	90%
Breeding pigs	120,000	420	50,400	25	1,500	90%
					-	
Layers	17,895,000	7.5	134,213	0.19	1,700	74%
Pullets	3,706,250	6	22,238	0.15	282	74%
Turkeys[3]	5,225,000	28	146,300	0.56	1,463	75%

Since 2016, there has been significant interest in anaerobic digestion of livestock manures for the purpose of creating renewable natural gas (RNG). The drivers behind the interest are the Federal Renewable Fuel Standard (RFS) and the California Low Carbon Fuel Standard (LCFS) programs which have created significant demand and value for low Carbon Intensity (CI) RNG. Anaerobic digestion is a naturally occurring process of breaking down organic matter in a warm, oxygen deprived environment to create biogas, a mix of methane, carbon dioxide and trace gases, and digested manure. At the start of 2020, Michigan had five digesters operating on farms in the state.

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[1] USDA NASS. 2021. 2020-2021 Michigan Annual Bulletin: Livestock. https://www.nass.usda.gov/Statistics_by_State/Michigan/Publications/Annual_Statistical_Bulletin/stats21/index.php

[2] ASAE. 2005. Manure Production and Characteristics Standard. ASAE D384.2. https://elibrary.asabe.org/abstract.asp?aid=32018

While Michigan livestock farms have opportunities, there are limitations:

- Dairy – is the best livestock opportunity for Michigan as the farms are larger in size and have very low CI scores, in the range of -150 to -300 CO_2e/MJ
- Steers (beef) – fewer large operations and does not qualify for the LCFS program
- Pork – feeder pigs are most often raised over underfloor storages making it difficult to collect "fresh" manure for anaerobic digestion
- Poultry (chickens & turkeys) – lower moisture content makes the material less desirable for digestion which typically is used for liquid or semi-solid material

Not considering the limitation, livestock manure in Michigan has the potential to generate approximately 36,00 MMBtu/d or 24,000 SCFM of methane. Table 2 summarizes the energy potential of the different animal manures. Dairy, specifically dairy cows, represents 62% of the total manure energy potential.

Table 2: Energy Potential of Michigan Livestock by Species

Animal Type	Biogas Potential (SCFM)	Methane (SCFM)	Energy Generation (MMBtu/d)	
Dairy cows	28,239	15,531	22,589	62%
Dairy heifers	3,405	1,873	2,724	8%
	-	-		
Steers[1]	1,005	553	804	2%
	-	-		
Feeder pigs[2]	2,878	1,727	2,512	7%
Breeding pigs	1,231	739	1,075	3%
	-	-		
Layers	3,593	2,084	3,031	8%
Pullets	595	345	502	1%
	-	-	-	
Turkeys[3]	3,205	2,083	3,030	8%
Total	44,152	24,935	36,266	

To further evaluate the potential for RNG from dairy farms, Table 3 was generated to summarize the farm size distribution[3]. It is generally understood that farms of scale benefit from better economics. This is the case for RNG as well, larger dairy farms generate more manure and thus the digesters benefit from better economics. Approximately 48% of the milk cows are housed on 86 farms with over 1,000 head of animals. Assuming a market penetration of 50% for farms over 1,000 cows, Michigan could

[3] USDA. 2017. Census of Agriculture. Volume 1. Chapter 1:State Level Data "Michigan". https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/Michigan/

expect to have approximately 40 on farm or community (multiple farm) anaerobic digester projects soon. Looking at the milk cows on the larger farms, it is fair to estimate that 40 digester projects would utilize manure from 100,000 to 150,000 dairy cows. Manure from that range of cows could generate between 5,300 and 8,000 MMBtu/d of equivalent RNG. Given the high value of the LCFS and RFS credits, there are currently between 5 and 10 systems under construction in Michigan and another 20+ in the planning and design phase which could break ground in 2022.

Table 3: Total Number of Michigan Dairy Farms and Milk Cow Distribution, 2017

Herd Size	# of Farms		Milk Cows	
<100	1,397	65%	38,039	9%
100 to 199	303	14%	42,077	10%
200 to 499	270	13%	81,805	19%
500 to 999	102	5%	69,218	16%
1000 to 2499	51	2%	79,253	18%
>2500	35	2%	131,640	30%
Totals	2,158		442,032	

While not all livestock types are able to benefit from the current RNG programs and interest in anaerobic digestion, dairy farms stand to take advantage of the opportunity. The dairy industry and Michigan will benefit from the widespread adoption of anaerobic digestion through reduced carbon emissions and odors associated with manure management, manure treatment which improves the ability for future nutrient separation, skilled labor job creation in rural areas, and diversification of on farm income. The current opportunity will drive adoption of manure management technologies that greatly benefit the State faster than at any other time without state or local incentives.