



22 January 2022

Re: Barriers to Renewable Natural Gas (RNG) in Michigan

In response to the MPSC's request for comments on the current RNG Study by ICF, Quantalux is pleased to submit the following information on a major barrier to RNG production in the state.

Introduction:

For several years, Quantalux has been involved with the design/construction of RNG facilities at Michigan dairy farms. Based on our experience with RNG project developers, we are keenly aware of a number of barriers that have slowed (and even prevented) investment in new RNG facilities in Michigan. This memo identifies a major barrier for RNG developers, and also offers a recommended solution.

A major barrier to RNG development in Michigan – Strict gas quality specifications

RNG projects require access to existing natural gas pipelines to deliver RNG sales gas to their customers. All gas (RNG or natural gas) must meet specific gas quality standards before the gas is injected into a pipeline. Gas quality specifications for MPSC-regulated pipelines are applied to both natural gas and RNG. At the current time, the limits on the oxygen concentration in MPSC-regulated pipelines (DTE and Consumers) are set at 0.0005%, or 5-parts-per-million (ppm), and are the strictest in the US.

These strict O₂ limits place a financial and risk burden on any RNG project. Meeting these limits is technically achievable but requires expensive and complex oxygen removal equipment that often uses precious metal catalysts. To meet the 5-ppm limit, sophisticated oxygen removal equipment must be added to the RNG upgrade unit, adding ~ \$600k to \$1M for each RNG project¹. Furthermore, periodic replacement of the precious-metal catalysts adds even more cost - approximately 25% of the capital cost for each replacement².

Understanding gas quality limits: Gas quality specifications are established by either the state or federal regulators with the twin goals of 1) assuring gas quality for their customers and 2) protecting lines, meters, regulators, and other appliances. As Figure 1 shows, the allowable limit on Oxygen (O₂) for any gas (natural gas or RNG) injected into U.S pipelines varies widely. A typical O₂ limit for FERC-regulated pipelines in Michigan such as Great Lakes Gas Transmission (GLGT)³ or the Rover⁴ pipeline is in the range

¹ This cost estimate comes from the supplier of an RNG upgrade skid for a current RNG project in mid-Michigan where Quantalux is a technical consultant. Further data available upon request.

² Platinum and palladium catalysts are used in fixed bed reactors for O₂ removal and must be periodically replaced due to fouling.

³ See Great Lakes Gas Transmission Limited Partnership, FERC Gas Tariff, Third Revised Volume No. 1, Part 6.8, Quality, v 1.0.0.0 Superseding v 0.0.0.

⁴ <https://rovermessenger.energytransfer.com/ipost/ROVER/gas-quality/tariff-provisions>

of <4000 ppm to <10,000 by volume. As noted above, pipelines in Michigan operated by DTE and Consumers have the strictest oxygen specification in the U.S at <5 ppm.

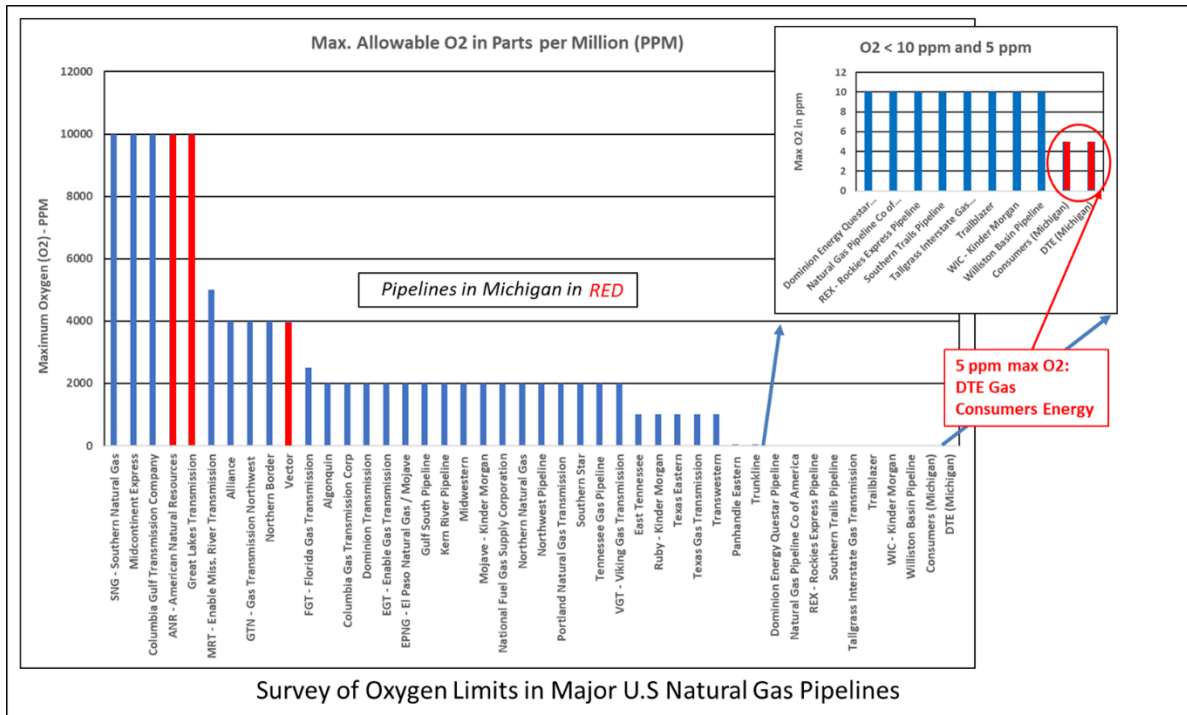


Figure 1: Allowable Oxygen in Pipelines in the US and Michigan

Why do MPSC-regulated pipelines have tight oxygen limits? In discussions with MPSC staff⁵, we have learned that the strict O2 specifications for DTE and Consumers’ pipelines were put in place to prevent corrosion in equipment at Michigan’s gas storage reservoirs (especially relevant when moisture is present). Very strict O2 limits in natural gas were a response to previous corrosion events in and around gas storage reservoirs.

Mitigating Factor: As engineers, the Quantalux team understands the motivation for strict O2 regulations in natural gas pipelines. However, there is a key mitigating factor when dealing with RNG: the fraction of RNG in a pipeline will be very small.

To understand the scale of RNG production relative to the natural gas in Michigan pipelines, our team calculated the amount of RNG that is theoretically available from dairy cows in Michigan, and then compared this value to the total natural gas consumption.

Figure 2 shows the total amount of RNG production that is theoretically possible the major dairy farms in Michigan. This data is based on the five major dairy zones where approximately 85% Michigan’s dairy cows are located⁶. According to EGLE data, the total head count for these 5 zones is 410,000+ dairy animals (lactating cows, dry cows, and heifers on feed).

⁵ Email correspondence with David Chislea, MPSC, 23 October 2020

⁶ Data from EGLE website, https://www.michigan.gov/egle/0,9429,7-135-3313_71618_3682_3713-96774--00.html (Dec 2021)

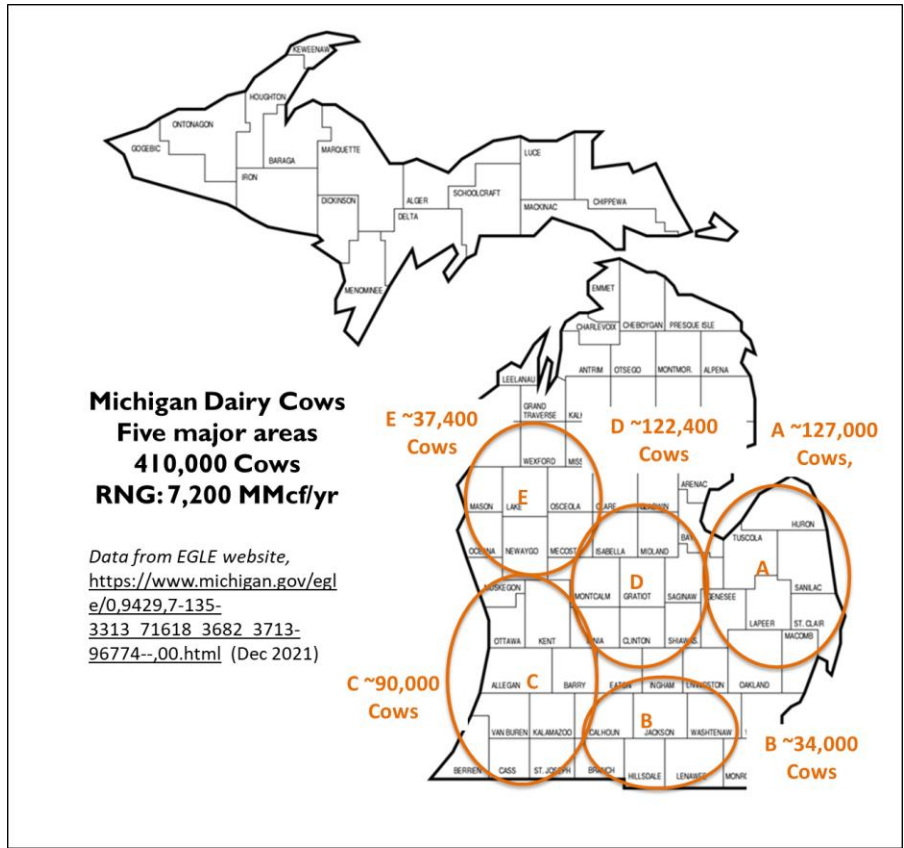


Figure 2: Theoretical Maximum RNG Production from Michigan Dairies

Using industry-standard animal production models, our team calculated the estimated manure, biogas and RNG production for dairy animals in the five zones shown in Figure 2. RNG from all dairy animals is ~7,200 MMcf/yr. In comparison, the total natural gas flowing in Michigan pipelines is ~ 860,00 MMcf/yr⁷, yielding a ratio of RNG/Natural gas of <0.84%. (See Table 1.)

Admittedly, our estimate of RNG production is wildly optimistic, but this exercise is useful in showing that very, very little oxygen will be added given the small quantities of RNG injected into Michigan’s pipelines. An extremely tight oxygen specification mostly serves to increase the cost of any RNG project with hardly any measurable benefit.

Recommended Solution – An RNG-specific quality specification: Our team recommends the MPSC enact an RNG-specific gas quality specification and operational protocol. This makes sense primarily because RNG has unique trace gas characteristics, so the “rules-of-the-road” should be specific to RNG.

Table 1: RNG production from Dairy in Michigan

Dairy Zone	Dairy Cows (Milk and Dry)	Heifers on Feed	Total Dairy	* RNG [MMcf/yr]
A	73,827	53,207	127,034	2,117.0
B	22,143	11,795	33,938	598.6
C	63,418	26,004	89,422	1,646.5
D	80,039	42,452	122,491	2,162.2
E	30,152	7,285	37,437	738.4
Dairy Totals	269,579	140,743	410,322	7,262.7
* Theoretical maximum RNG production from Dairy Farms Zones A-E				
Natural Gas Consumption in Michigan (2017) in MMcf				860,000
RNG to NG fraction (estimated)				0.84%

⁷ Data based on Residential, Commercial, Industrial, and power plant consumption of natural gas in Michigan in 2017.

The RNG-specific specifications shown in Table 2 can be used by Michigan regulators for guidance:

NW Pipeline (Williams): Northwest Pipeline⁸ is a bi-directional pipeline that crosses Washington, Oregon, Idaho, Wyoming, Utah, and Colorado. The Oxygen (O₂) limit in the NW Pipeline specification is set at a reasonable <2000 ppm, which is the same limit as 15 other pipelines in the US (see Figure 1).

In addition, NW Pipeline has established an RNG Operating Policy for any producer wishing to inject RNG into NW Pipeline’s system. This policy includes a gas sampling policy for continuous and periodic gas sampling, and actions needed when RNG receipts are unacceptable.⁹ The Operating Policy recognizes that RNG can be sources from either dairy, landfills, or wastewater plants, and provides guidance on the sampling & testing for each RNG source,

Table 2: Selected RNG Gas Quality Specifications

RNG Quality Specifications (Examples)		
Constituents	Northwest Pipeline	NW Natural (Oregon)
CO ₂	< 2%	CO ₂ < 2%
O ₂	< 2000 ppm	< 2000 ppm
H ₂ S	< 0.25 grain per CCF gas)	< 0.25 grain per CCF gas)
N ₂		N ₂ < 2%
Inerts + O ₂	CO ₂ + N ₂ + O ₂ < 4%	CO ₂ + N ₂ + O ₂ < 2.7%
Mercaptan Sulfur	< 0.3 grains per CCF	
Total Sulfur	< 5 grains per CCF	< 5 grains per CCF
Siloxanes		.019 grain
Water vapor	< 7 lbs per 1000 MCF	< 7 lbs per 1000 MCF
Mercury	No detectable Hg	BDL
Hydrocarbon Dewpoint	< 15F, btwn 100 and 1000 psia	< 15F, btwn 100 and 1000 psia
Temperature	GasTemp<120F	GasTemp<120F
Heating Value	HV > 970 Btu	HV > 985 Btu
Bacteria	No detectable bacteria	No detectable bacteria
Toxics	None	None
Dust, gums, etc	Commercially free of all dust/gums/solid matter	Commercially free of all dust/gums/solid matter
Data from Northwest Pipeline LLC, 5th Revised Volume No.2 // NW Natural Gas Company RNG Specification, RFP #2021-01		

NW Natural (Oregon): NW natural is an Oregon-based utility seeking to decarbonize their system by transporting RNG. Their RNG Gas Quality specification (shown in in Table 2) is similar to the specification for Northwest Pipeline and is applicable to any RNG from a variety of renewable sources.

Other utilities across the US have developed similar RNG-specific specifications and regulations.

Summary: While project-specific waivers on gas quality may be granted by the MPSC on an interim basis, a better long-term solution is to implement a consistent RNG standard for all RNG projects in Michigan. The RNG-specific specifications from Northwest Pipeline and NW Natural are but two of many examples of successful regulations on RNG quality. We urge Michigan regulators to use existing RNG programs as guidance for a Michigan-based solution.

We thank the MPSC for their openness to comments from the RNG community and look forward to additional technical discussions.

Thank you,

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⁸ <https://www.williams.com/pipeline/northwest-pipeline/>

⁹ See http://www.northwest.williams.com/NWP_Portal/