Augean RNG Production Pathway

December 2021

Submitted to:
US Ventures

Submitted by:
ICF

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I. General Information

Augean RNG LLC owns and operates the Augean RNG Project Facility ("Facility") which upgrades biogas generated in dairy manure digesters into Renewable Natural Gas (RNG) that will be trucked and then compressed and injected into the Northwest Pipeline located 3.9 miles away in Outlook, Washington. The Augean RNG Project Facility (facility ID: 71081) is located at 5121 Dekker Rd, Outlook, WA, US 98938 and digests manure solely from the George DeRuyter and Sons Dairy (GDR). The lagoons at GDR were built when the dairy started in 1992. There were additional lagoons built in 2001 and 2005 during expansions for a total of 4 lagoons; a fifth lagoon built in 2019 specifically for a denitrification system. The digester was operational in 2006, but the project converted from electricity to RNG in 2020.The project currently participates in the Federal Renewable Fuel Standard.

The facility is registered with the Climate Action Reserve (CAR 1080) and has participated in California's Offset Program (ARB: CALS 5290). All baseline manure management practices included in this report are detailed in the accompanying Offset Verification Reports or separate manure management documents. The Appendix contains process flow diagrams for the baseline and project manure management practices and a table summarizing the values entered into the calculator.

George DeRuyter and Sons Dairy

George DeRuyter and Sons Dairy houses approximately 10,000 – 11,000 cows between milking, dry, and heifers with approximately 55% of the cows (5,550 – 6,000) being milking and dry cows with the remaining heifers. All of which are housed in two farm complexes, the smaller complex is called D&A Dairy, but manure from these heifer cows is not being transported to the digester. Prior to the digester, almost 100% of the manure from the milking and dry cows was collected from the freestall barns. None of the manure from the heifers was collected and stored anaerobically resulting in the heifers not being included in the carbon intensity analysis.

In the baseline manure management documents, approximately 0.67% of the milking and dry cow manure remains in the dry lot of the exercise pens and the remaining 99.33% was sent to a slope screen separator with a 17% VS removal efficiency. The liquid fraction after the slope screen containing 82.33% of the VS was sent to the lagoon and the remaining 16.89 % was sent to compost. Prior to sending manure to the digester, the dairy farm did not complete full clean-outs of the lagoon manure management system, so no lagoon clean-outs were modeled. The lagoon management system, both in the baseline and project, includes four uncovered lagoons.

In the project, the same amount of manure (99.33%) is collected and all of it is sent to the digester. The digestate is separated using a screw press separator with a 25% VS removal rate. The liquid fraction is transferred back to theanaerobic storage ponds at the dairy and solids are composted to be used for bedding.

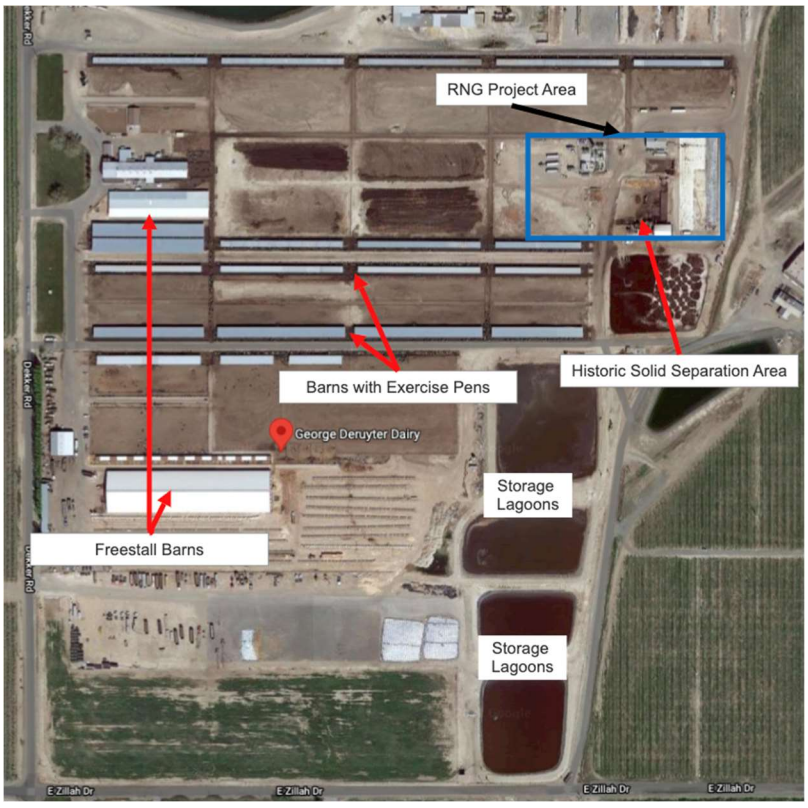
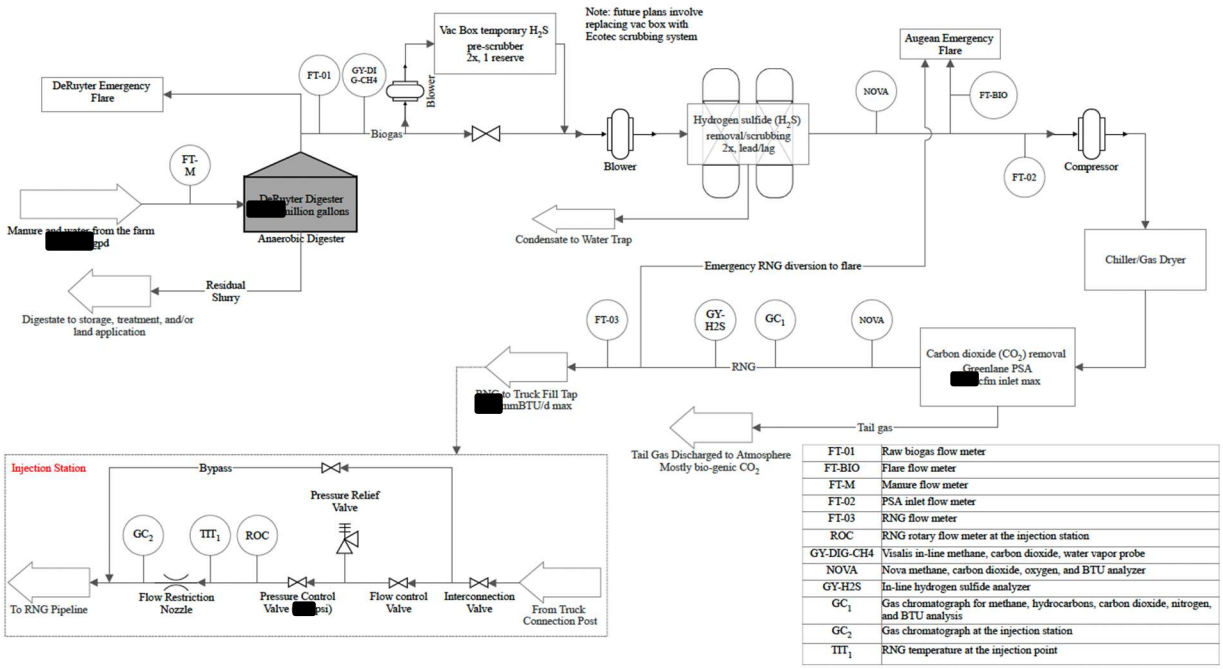


Exhibit 1. Aerial Map of George DeRuyter and Sons Dairy

RNG Facility

The RNG Facility receives biogas from the enclose vessel below ground digester. The digester gas is initially treated to remove H_2S with an absorption system. A pressure swing adsorption system (PSA) is used to remove the CO2 from the gas stream. The finished gas is sent to the truck compressor for compression and loading onto trailers. Oncethe tube trailers are filled, they will be trucked to the pipeline interconnect site 3.9miles away. The project has an enclosed flare used to handle biogas in the event of maintenance emergency. The gas is monitored by an onsite gas analyzer, as well as an onsite Gas Chromatograph and H2S equipment to ensure pipeline specifications are met. No additional materials are blended prior to pipeline injection. The facility has installed an RNG pipeline that was fully operational in 2022 and should reduce the overall CI for the project by eliminating the need to truck RNG. A portion of the RNG produced in October 2021 was sent via the pipeline, and the remaining was trucked.

The Augean facility purchased brown gas, from the pipeline, to be used as boiler fuel to heat the digester. The brown gas was transported back to the Augean facility via tube-trailer until the physical pipeline connection is completed. The brown gas was transported with dedicated tube-trailers for the transportation of brown gas back to the facility's boiler.



FT-01	Raw biogas flow meter
FT-BIO	Flare flow meter
FT-M	Manure flow meter
FT-02	PSA inlet flow meter
FT-03	RNG flow meter
ROC	RNG rotary flow meter at the injection station
GY-DIG-CH4	Visalis in-line methane, carbon dioxide, water vapor probe
NOVA	Nova methane, carbon dioxide, oxygen, and BTU analyzer
GY-H2S	In-line hydrogen sulfide analyzer
GC_1	Gas chromatograph for methane, hydrocarbons, carbon dioxide, nitrogen, and BTU analysis
GC_2	Gas chromatograph at the injection station
TIT_1	RNG temperature at the injection point

Exhibit 2. RNG Process Flow Diagram

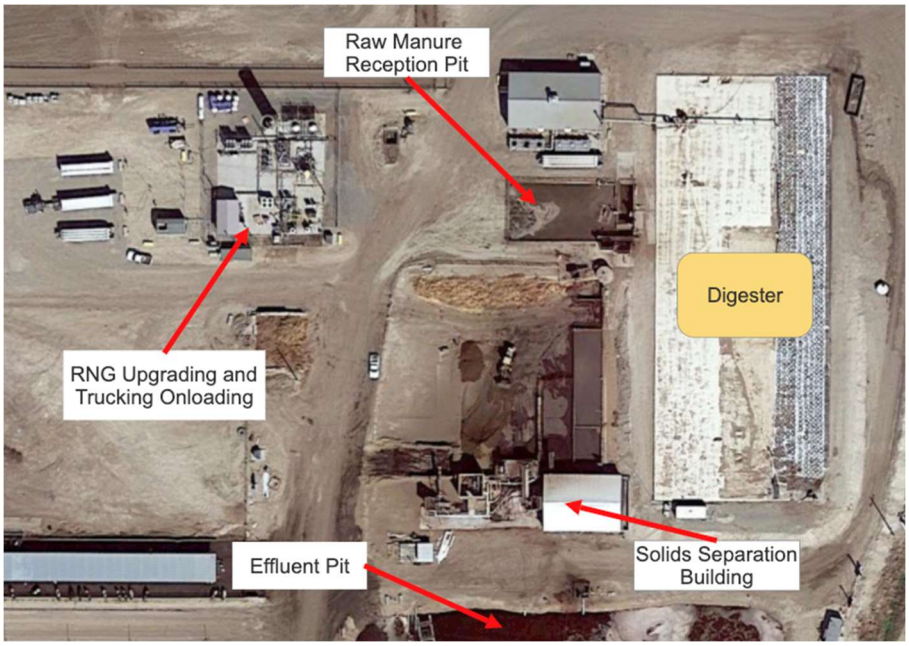


Exhibit 3. Aerial Map of the RNG Project Area

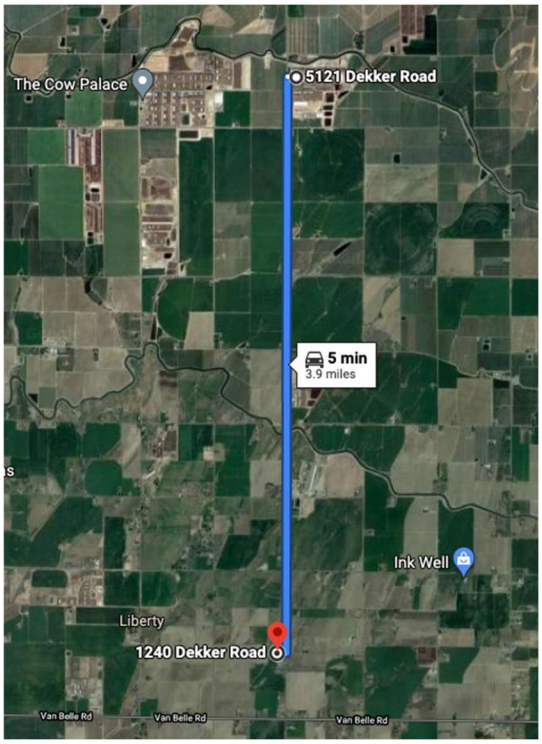


Exhibit 4. RNG Trucking from Augean RNG Facility to the Pipeline Interconnect

For this pathway, a well-to-wheel life cycle assessment (LCA) was conducted using the Tier 1 calculator to estimate the CI of CNG used in the California CNG stations. The system boundary of the LCA is shown in Exhibit 5.

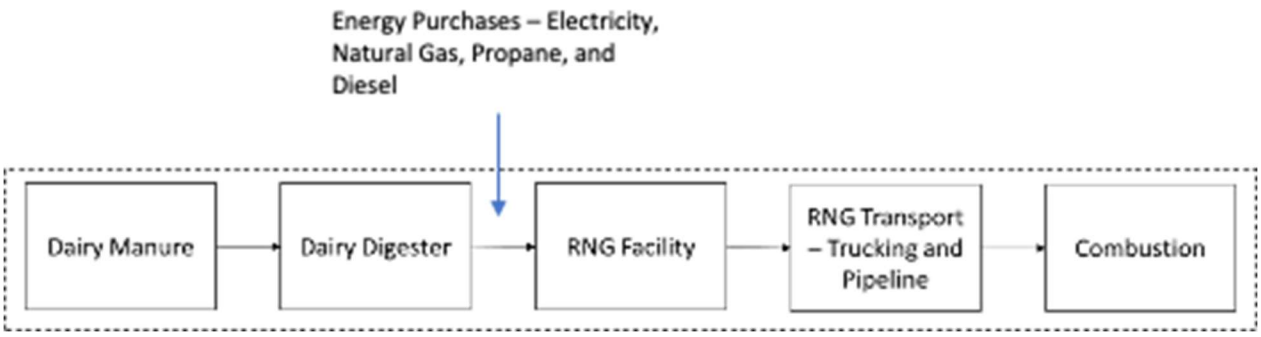


Exhibit 5. System Boundary of Manure Biogas to CNG

II. Data Collection

To calculate the baseline methane emissions, Augean provided 32 months of data (03-2019 to 10-2021). A separate calculator using the March 2019 – October 2020 was used to quantify the VS carryover to go into the first month in the actual CI calculator (November 2020). Augean provided 3 months of digester operating data for the CI calculation.

Below are the main files containing the source data for this pathway.

1) Herd Count
    a. Summary excel file of the cow counts
2) Plant Inlet and Flare folder:
    a. 15-min methane and flow measurements with flow corrections – See Alternative Method Request
3) Truck Onloading and Offloading Reconciliation
    a. Augean Truck QAP Data Excel Files which includes fossil natural gas deliveries for boiler use
    b. Augean – RIN Generation Template
4) Utilities folder
    a. Utility invoices folder the actual invoices including propane, diesel (for pipeline decant station) and electricity
5) Manure Management folder
    a. Multiple verification reports and verified COP Tools
6) GREET Model folder
    a. Tier 1 calculator to estimate the CI of RNG
    b. Tier 1 calculator to estimate the VS carryover for the first month

In the Tier 1 calculator, section L1.X.14, the carryover VS from the previous month is defined as thedifference between the VS available for degradation and the VS degraded from previous month.VS carryover in month 1 (November 2020) was quantified in the VS Carryover GREET model found inthe GREET Model Folder. GREET model inputs and cell modifications can be found in the Site Specific Inputs file. Previously CARB has requested default fugitive emissions associated with RNG loading and unloading to be included, which combine to 0.35%. See the Site Specific Inputs for howthis was incorporated in the model where the minimum fugitive is 2.35%.

III. GREET Results

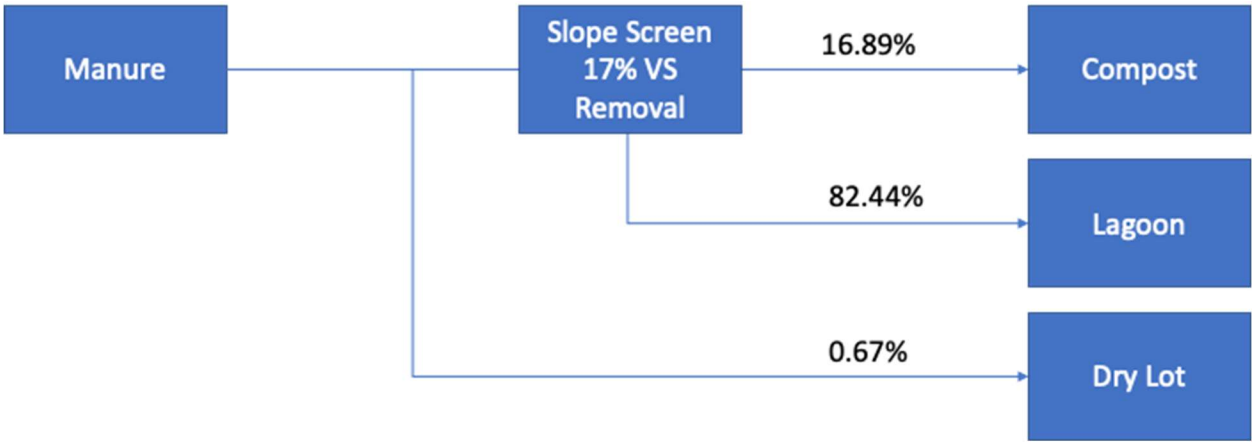
Exhibit 6 shows the extracted results from a table created on the “Biogas to RNG” tab for the dairy manure in Section 4 of the Tier 1 calculator.

Exhibit 6. Total Carbon Intensity for RNG

Process Stage	Carbon Intensity (gCO_2e/MJ)
Raw Biogas Production-Digester	[redacted]
Biogas Upgrading	[redacted]
NG Transmissions	[redacted]
RNG Compression	3.50
Combustion	60.73
Methane Credit	[redacted]
CO_2 Diverted	[redacted]
Total – (gCO_2e/MJ)	**-216.63**

IV. Appendix

Pre-digester – Milking and Dry Cows



Post-digester – Milking and Dry Cows

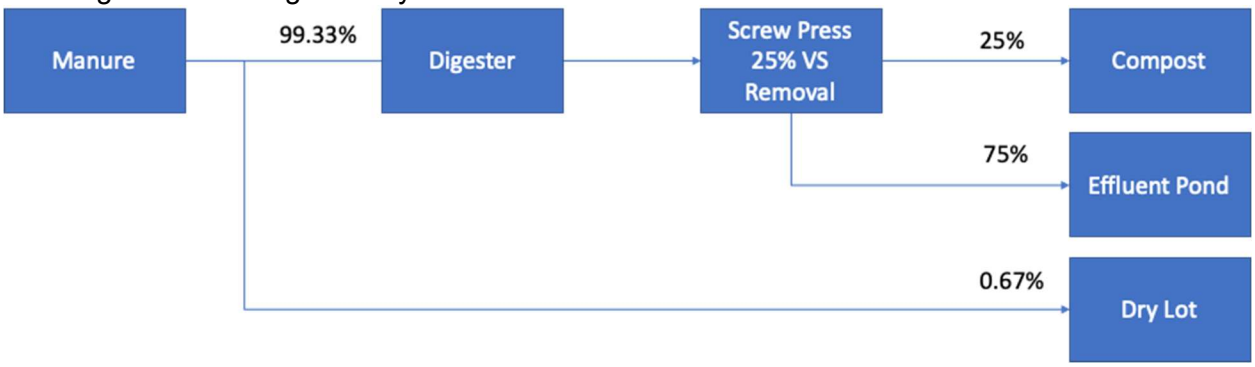


Exhibit 7. List of Calculator Inputs for Manure Management of Milking and Dry Cows

Model Location	Value	Comments
Section L1.X.11	82.44%	Total VS going to the lagoon
Section L2.3	16.89%	Total VS going to compost
Section L2.3	0.67%	Total VS going to dry lot
Section 4.5	99.33%	Fraction of raw manure going to the digester
Section 4.6	Existing formula * (1-25%)	To account for 25% of the VS being removed by the screw press
Section 5.3	0.67%	Total VS going to dry lot
Section 5.3	99.33% * 30% * 25% = 7.45%	Total VS going to compost