

Chicagoland Methane Recapture Project: Reducing GHG Emissions and Producing Renewable Natural Gas from Waste

Lead Applicant Information

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Prepared For

Chicagoland Renewable Natural Gas Coalition

Introduction

This technical memorandum explains the methodology and assumptions used for developing the estimated greenhouse gas (GHG) emissions reduced from the Chicagoland Methane Recapture Project: Reducing GHG Emissions and Producing Renewable Natural Gas from Waste Project as a priority measure included in the Chicago MSA Priority Climate Action Plan. This technical memorandum is supported by the GHG emission reduction spreadsheets included herein.

Assumptions

GHG emission reductions resulting from this series of projects are based on the recovery of biogas (i.e., anaerobic digester gas from publicly owned treatment works (POTWs) and landfill gas from publicly owned landfills) for beneficial reuse as renewable natural gas (RNG), which is a direct replacement for fossil-based natural gas.

Table 1. *List of Coalition members and operations*

Coalition Members	Operations
Fox Metro Water Reclamation District	POTW
Wheaton Sanitary District	POTW
DuPage County Wastewater Division	POTW
Fox River Water Reclamation District	POTW
Kishwaukee Water Reclamation District	POTW
Glenbard Wastewater Authority	POTW
Kenosha Water Utility	POTW
Village of Addison Wastewater Plant	POTW
Forest Preserve District of DuPage County (Mallard Lake and Greene Valley landfills)	Publicly owned landfill

Assumptions included for the biogas production and associated GHG emission reduction calculations include the following:

- Landfill biogas production is based on Landgem modeling. Neither landfill accepts solid waste any longer, and neither landfill beneficially uses any of the biogas produced.
- The Mallard Lake Landfill is assumed to install additional biogas collection wells to increase biogas production by approximately 20%.
- POTW biogas production is assumed to remain essentially constant over time. Biogas production is likely to increase over time as populations increase.
- The POTWs use varying amounts of the biogas for digestion heating needs. Actual biogas volumes used for these purposes are measured at most of the POTWs and estimated based on experience for the others POTWs.
- POTW biogas quality assumes a heating value of 600 BTU/cubic foot based on gas sampling results at several POTWs and comparable projects.
- Landfill biogas quality assumes a heating value of 500 BTU/cubic foot based on estimates provided from the landfill operators.
- The Fox Metro RNG facility and injection point will be operational by January 2026. All other facilities are assumed to be operational by January 2027.
- Power usage by the RNG systems is based on RNG manufacturers' estimates.
- Trucking fuel use estimates assume 6.5 miles per gallon of biodiesel; trucking distances were

- estimated based on preliminary pipeline injection locations.
- Pipeline injection locations are assumed to be at the two landfills, at Fox Metro, and at the Kenosha Water Utility. The first three locations are very likely, and the fourth location may change depending on local utility negotiations.
- RNG production assumes nearly 100% conversion of biogas to RNG, which is based on RNG system manufacturer's performance estimates. Specification will require a minimum of 98% conversion efficiency, and most systems can achieve greater than 99% conversion efficiency.
- Capital cost opinions for the POTWs are based on preliminary engineering design layouts and cost development at Fox Metro, the Wheaton Sanitary District facility, and the Fox River Water Reclamation District. The cost opinions for the other POTWs are scaled based on similar size and needs compared to the three other POTWs.
- Capital cost opinions for the two landfills are based on the costs incurred for the Dane County, Wisconsin landfill, which has a fully functioning RNG production facility, a receiving station for outside RNG deliveries, and has been operating successfully for three or more years.
- For most of the RNG installations, the RNG equipment is assumed to be installed in manufacturer-provided enclosures and not in brick-and-mortar buildings. As an exception, the Fox Metro RNG facility is planned to be installed in an existing repurposed building.
- Operating, maintenance, and supply costs are based on information from the RNG system manufacturers and on professional engineering experience gathered through historical data and facilitation of similar projects.

Methods

The GHG emission reductions calculations account for the following changes in GHG emissions from the existing base condition at each facility:

- Conversion of biogas to RNG, and the use of the RNG as a direct replacement of fossil-based natural gas (net reduction in GHG emissions).
- Additional natural gas required to replace the use of biogas at the POTWs to heat the anaerobic digesters (net increase in GHG emissions).
- Additional electricity needed to operate the RNG systems (net increase in GHG emissions).
- Additional trucking fuel (biodiesel) to haul RNG to the pipeline interconnect facilities included in the coalition (net increase in GHG emissions).

The sum of these changes in GHG emissions is equal to the net GHG emission reduction for the proposed RNG development project.

The coalition utilized EPA’s Simplified GHG Emissions Calculator spreadsheet tool to estimate the net GHG emission reductions for each facility. The emission factors used were the default base-load factors related to electrically related GHG emissions, and electrical grid was RFC-West based on the EPA eGRID2021 (January 2023) embedded in the EPA Emissions Calculator spreadsheet (“Electricity” tab).

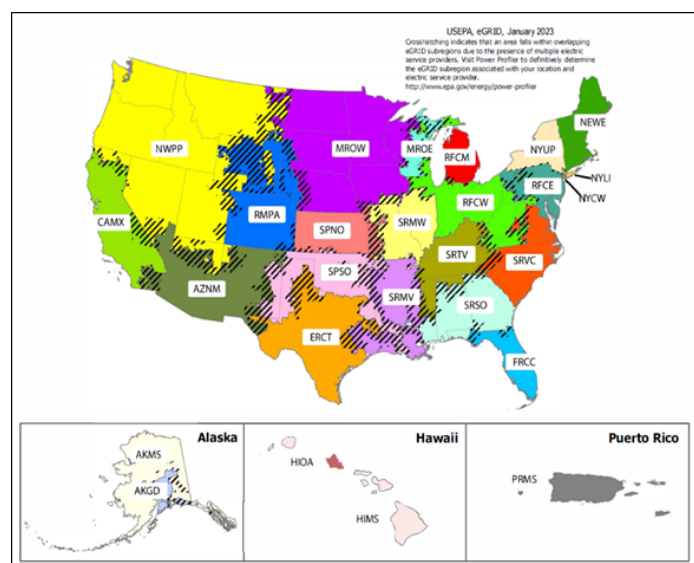


Figure 1. EPA eGRID2021, January 2023

This technical memorandum includes three summary spreadsheets that calculate GHG emission reductions using the EPA Simplified GHG Emissions Calculator spreadsheet):

1. Summary calculations for the 8 POTWs. These eight facilities were combined into one spreadsheet since biogas production over time was assumed to be constant, which allowed the spreadsheet to calculate annual GHG emission reductions. Those annual reductions were then utilized to calculate the Year 2025-2030 and Year 2025-2050 GHG emission reductions for the purpose of this grant application.
2. Summary calculations for the Mallard Lake Landfill assuming declining biogas production over time based on Landgem modeling and 50% methane in the biogas. This spreadsheet was modified (“Stationary Combustion” tab) to include each year of gas production, and the “Summary” tab was modified to allow cumulative GHG emission reductions to be calculated for the Year 2025-2030 and Year 2025-2050 time frames.
3. Summary calculations for the Greene Valley Landfill assuming declining biogas production over time based on Landgem modeling and 50% methane in the biogas. This spreadsheet was modified (“Stationary Combustion” tab) to include each year of gas production, and the “Summary” tab was modified to allow cumulative GHG emission reductions to be calculated for the Year 2025-2030 and Year 2025-2050 time frames.

Reference Case Scenario

The reference case scenario of not implementing this measure includes the continued use of the same proportion of the biogas at the POTWs for heating purposes, flaring of the remaining biogas at the POTWs, and flaring of all the biogas from the landfills. The base year of biogas gas production is 2023, and all of the installations have appropriate gas metering to develop an accurate baseline of existing biogas production and existing electrical use from which to calculate GHG emission reductions.

Implementation Tracking Metrics

This proposed collection of RNG projects presents a straightforward and simple method to quantify actual GHG emission reductions based on measurable data as noted below:

- Measuring generation of biogas at each facility using state-of-the-art gas flow meters.
- Measuring biogas BTU content by monitoring the gas composition using state-of-the-art gas quality meters.
- Measuring the production of RNG injected into the utility pipeline using two sets of gas monitoring and gas quality systems (one by the facility owner and one by the local utility). RNG quality and BTU content will be measured with an EPA and utility approved gas chromatographs.
- Measuring the additional electricity used to produce and inject RNG by installing smart electric meters to monitor new electrical use related to the RNG production and injection.
- Measuring the additional natural gas required to maintain digestion temperatures and the POTWs.
- Measuring the amount of biodiesel required for trucking the RNG to the regional injection locations.

These metrics are proposed to be tracked monthly and reported twice per year for the foreseeable future.

POTWs - Summary

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Emissions Summary

Guidance
The total GHG emissions from each source category are provided below. You may also use this summary sheet to fill out the *Annual GHG Inventory Summary and Goal Tracking Form* (.xls) as this calculator only quantifies one year of emissions at a time.
<https://www.epa.gov/climateleadership/target-setting>

By entering the data below into the appropriate cell of the *Annual GHG Inventory Summary and Goal Tracking Form*, you will be able to compare multiple years of data.

If you have multiple Calculator files covering sub-sets of your inventory for a particular reporting period, sum each of the emission categories (e.g. Stationary Combustion) to get an organizational total, which then can be entered into the *Annual GHG Inventory Summary and Goal Tracking Form*.

(A) Enter organization information into the orange cells. Other cells on this sheet will be automatically calculated from the data entered in the sheets in this workbook. Blue cells indicate required emission sources if applicable. Green cells indicate scope 3 emission sources and offsets, which organizations may optionally include in its inventory.

(B) The "Go To Sheet" buttons can be used to navigate to the data entry sheets.

Organizational Information:

Organization Name: POTW Summary

Organization Address:

Inventory Reporting Period: Start: End:

Name of Preparer: Strand Associates, Inc.

Phone Number of Preparer:

Date Prepared: 3/27/2024

Summary of Organization's Emissions:

Scope 1 Emissions

Go To Sheet	Stationary Combustion	-13,374	CO ₂ -e (metric tons)
Go To Sheet	Mobile Sources	69	CO ₂ -e (metric tons)
Go To Sheet	Refrigeration / AC Equipment Use	0	CO ₂ -e (metric tons)
Go To Sheet	Fire Suppression	0	CO ₂ -e (metric tons)
Go To Sheet	Purchased Gases	0	CO ₂ -e (metric tons)

Location-Based Scope 2 Emissions

Go To Sheet	Purchased and Consumed Electricity	8,114	CO ₂ -e (metric tons)
Go To Sheet	Purchased and Consumed Steam	0	CO ₂ -e (metric tons)

Market-Based Scope 2 Emissions

Go To Sheet	Purchased and Consumed Electricity	8,114	CO ₂ -e (metric tons)
Go To Sheet	Purchased and Consumed Steam	0	CO ₂ -e (metric tons)

Total organization Emissions

Total Scope 1 & Location-Based Scope 2	-5,190	CO ₂ -e (metric tons)
Total Scope 1 & Market-Based Scope 2	-5,190	CO ₂ -e (metric tons)

Reductions

Go To Sheet	Offsets	0	CO ₂ -e (metric tons)
Net Scope 1 and 2 Location-Based Emissions	0	CO ₂ -e (metric tons)	
Net Scope 1 and 2 Market-Based Emissions	0	CO ₂ -e (metric tons)	

Scope 3 Emissions

Go To Sheet	Employee Business Travel	0	CO ₂ -e (metric tons)
Go To Sheet	Employee Commuting	0	CO ₂ -e (metric tons)
Go To Sheet	Upstream Transportation and Distribution	0	CO ₂ -e (metric tons)
Go To Sheet	Waste	0	CO ₂ -e (metric tons)

Required Supplemental Information

Go To Sheet	Biomass CO ₂ Emissions from Stationary Sources	0	CO ₂ -e (metric tons)
Go To Sheet	Biomass CO ₂ Emissions from Mobile Sources	16	CO ₂ -e (metric tons)

POTWs - Stationary Combustion

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Scope 1 Emissions from Stationary Combustion Sources

Guidance
(A) Enter annual data for each combustion unit, facility, or site (by fuel type) in ORANGE cells on **Table 1**. Example entry is shown in first row (*GREEN Italics*).
- Select "Fuel Combusted" from drop down box.
- Enter "Quantity Combusted" and choose the appropriate units from the drop down box in the unit column. If it's necessary to convert units, common heat contents can be found on the "Heat Content" sheet and unit conversions on the "Unit Conversion" sheet.
(B) If fuel is consumed in a facility but stationary fuel consumption data are not available, an estimate should be made for completeness. See the "Items to Note" section of the Help sheet for suggested estimation approaches.
(C) Biomass CO₂ emissions are not reported in the total emissions, but are reported separately at the bottom of the sheet.

Table 1. Stationary Source Fuel Combustion

Source ID	Source Description	Source Area (sq ft)	Fuel Combusted	Fuel State (solid, liquid, gas)	Quantity Combusted	Units
Fox Metro	Digester Heating - Additional Nat Gas Burned		Natural Gas	Gas	46,700	MMBtu
Fox Metro	Avoided Fossil-Based Natural Gas		Natural Gas	Gas	-131,400	MMBtu
Wheaton SI	Digester Heating - Additional Nat Gas Burned		Natural Gas	Gas	7,600	MMBtu
Wheaton SI	Avoided Fossil-Based Natural Gas		Natural Gas	Gas	-15,330	MMBtu
DuPage Co	Digester Heating - Additional Nat Gas Burned		Natural Gas	Gas	0	MMBtu
DuPage Co	Avoided Fossil-Based Natural Gas		Natural Gas	Gas	(24,090)	MMBtu
FRWRD	Digester Heating - Additional Nat Gas Burned		Natural Gas	Gas	17,500	MMBtu
FRWRD	Avoided Fossil-Based Natural Gas		Natural Gas	Gas	-32,850	MMBtu
KWRD	Digester Heating - Additional Nat Gas Burned		Natural Gas	Gas	15,300	MMBtu
KWRD	Avoided Fossil-Based Natural Gas		Natural Gas	Gas	(54,750)	MMBtu
GWA	Digester Heating - Additional Nat Gas Burned		Natural Gas	Gas	17,500	MMBtu
GWA	Avoided Fossil-Based Natural Gas		Natural Gas	Gas	(59,130)	MMBtu
KWU	Digester Heating - Additional Nat Gas Burned		Natural Gas	Gas	17,500	MMBtu
KWU	Avoided Fossil-Based Natural Gas		Natural Gas	Gas	(48,618)	MMBtu
Addison	Digester Heating - Additional Nat Gas Burned		Natural Gas	Gas	7,600	MMBtu
Addison	Avoided Fossil-Based Natural Gas		Natural Gas	Gas	(15,330)	MMBtu

GHG Emissions

Total Organization-Wide Stationary Source Combustion by Fuel Type

Fuel Type	Quantity Combusted	Units
Gaseous Fuels		
Natural Gas	-245,417,154	scf
Propane Gas	0	scf
Landfill Gas	0	scf

Total Organization-Wide CO₂, CH₄ and N₂O Emissions from Stationary Source Fuel Combustion

Fuel Type	CO ₂ (kg)	CH ₄ (g)	N ₂ O (g)
Gaseous Fuels			
Natural Gas	-13,360,509.9	-252,779.7	-24,541.7
Propane Gas	0.0	0.0	0.0
Landfill Gas	0.0	0.0	0.0
Total Fossil Fuel Emissions	-13,360,509.9	-252,779.7	-24,541.7
Total Emissions for all Fuels	-13,360,509.9	-252,779.7	-24,541.7

Total CO₂ Equivalent Emissions (metric tons) - Stationary Combustion **-13,374.1**

Total Biomass CO₂ Equivalent Emissions (metric tons) - Stationary Combustion **0.0**

POTWs - Electricity

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Help - Market-Based Method

Scope 2 Emissions from Purchase of Electricity

Guidance

The Indirect Emissions from Purchased Electricity Guidance document provides guidance for quantifying two scope 2 emissions totals, using a **location-based method** and a **market-based method**. The organization should quantify and report both totals in its GHG inventory. The location-based method considers average emission factors for the electricity grids that provide electricity. The market-based method considers contractual arrangements under which the organization procures electricity from specific sources, such as renewable energy.

(A) Enter total annual electricity purchased in kWh and each eGRID subregion for each facility or site in ORANGE cells of **Table 1**.
 (B) If electricity consumption data are not available for a facility, an estimate should be made for completeness. See the "Items to Note" section of the Help sheet for suggested estimation approaches.
 (C) Select "eGRID subregion" from drop box and enter "Electricity Purchased."
 - Use map (Figure 1) at bottom of sheet to determine appropriate eGRID subregion. If subregion cannot be determined from the map, find the correct subregion by entering the location's zip code into EPA's Power Profiler:
<https://www.epa.gov/egrid/power-profiler/>
 (D) See the market-based emission factor hierarchy on the market-based method Help sheet. If any of the first four types of emission factors are applicable, enter the factors in the yellow cells marked as "<enter factor>". If not, leave the yellow cells as is, and eGRID subregion factors will be used for market-based emissions.
 Example entry is shown in first row (*GREEN Italics*) for a facility that purchases RECs for 100% of its consumption, and therefore has a market-based emission factor of 0.

*Tips: Enter electricity usage by location and then look up the eGRID subregion for each location.
 If you purchase renewable energy that is less than 100% of your site's electricity, see the example in the market-based method Help sheet.*

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Help - Market-Based Method

Table 1. Total Amount of Electricity Purchased by eGRID Subregion					Market-Based Use these cells to enter applicable market-based emission factors						Location-Based		
Source ID	Source Description	Source Area (sq ft)	eGRID Subregion <i>where electricity is consumed</i>	Electricity Purchased (kWh)	Emission Factors			Emissions			Emissions		
					CO ₂ Emissions (lb/MWh)	CH ₄ Emissions (lb/MWh)	N ₂ O Emissions (lb/MWh)	CO ₂ Emissions (lb)	CH ₄ Emissions (lb)	N ₂ O Emissions (lb)	CO ₂ Emissions (lb)	CH ₄ Emissions (lb)	N ₂ O Emissions (lb)
Fox Metro	RNG Equipment ~ 300 kW		RFCW (RFC West)	2,628,000	<enter factor>	<enter factor>	<enter factor>	2,749,150.8	249.7	36.8	2,749,150.8	249.7	36.8
Wheaton SI	RNG Equipment ~ 90 kW		RFCW (RFC West)	788,400	<enter factor>	<enter factor>	<enter factor>	824,745.2	74.9	11.0	824,745.2	74.9	11.0
DuPage Co	RNG Equipment ~ 120 kW		RFCW (RFC West)	1,051,200	<enter factor>	<enter factor>	<enter factor>	1,099,660.3	99.9	14.7	1,099,660.3	99.9	14.7
FRWRD	RNG Equipment ~ 140 kW		RFCW (RFC West)	1,226,400	<enter factor>	<enter factor>	<enter factor>	1,282,937.0	116.5	17.2	1,282,937.0	116.5	17.2
KWRD	RNG Equipment ~ 150 kW		RFCW (RFC West)	1,314,000	<enter factor>	<enter factor>	<enter factor>	1,374,575.4	124.8	18.4	1,374,575.4	124.8	18.4
KWRD	Lost Cogen Power ~ 300 kW		RFCW (RFC West)	2,628,000	<enter factor>	<enter factor>	<enter factor>	2,749,150.8	249.7	36.8	2,749,150.8	249.7	36.8
GWA	RNG Equipment Power ~ 150 kW		RFCW (RFC West)	1,314,000	<enter factor>	<enter factor>	<enter factor>	1,374,575.4	124.8	18.4	1,374,575.4	124.8	18.4
GWA	Lost Cogen Power ~ 200 kW		RFCW (RFC West)	1,752,000	<enter factor>	<enter factor>	<enter factor>	1,832,767.2	166.4	24.5	1,832,767.2	166.4	24.5
KWU	RNG Equipment Power ~ 150 kW		RFCW (RFC West)	1,314,000	<enter factor>	<enter factor>	<enter factor>	1,374,575.4	124.8	18.4	1,374,575.4	124.8	18.4
KWU	Lost Cogen Power ~ 250 kW		RFCW (RFC West)	2,190,000	<enter factor>	<enter factor>	<enter factor>	2,290,959.0	208.1	30.7	2,290,959.0	208.1	30.7
Addison	RNG Equipment Power~ 90 kW		RFCW (RFC West)	788,400	<enter factor>	<enter factor>	<enter factor>	824,745.2	74.9	11.0	824,745.2	74.9	11.0
Total Emissions for All Sources				16,994,400				17,777,841.8	1,614.5	237.9	17,777,841.8	1,614.5	237.9

GHG Emissions

CO ₂ Equivalent Emissions (metric tons)	
Location-Based Electricity Emissions	8,114.5
Market-Based Electricity Emissions	8,114.5

Notes:

1. CO₂, CH₄ and N₂O emissions are estimated using methodology provided in EPA's Center for Corporate Climate Leadership Greenhouse Gas Inventory Guidance

- Indirect Emissions from Purchased Electricity (January 2016).

POTWs - Mobile Sources

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Scope 1 Emissions from Mobile Sources

Guidance

(A) Enter annual data for each vehicle or group of vehicles (grouped by vehicle type, vehicle year, and fuel type) in ORANGE cells in Table 1. Example entry is shown in first row (GREEN *italics*). Only enter vehicles owned or leased by your organization on this sheet. All other vehicle use such as employee commuting or business travel is considered a scope 3 emissions source and should be reported in the corresponding scope 3 sheets.


- Note: As of the v9 Simplified GHG Calculation tool update, the latest mobile combustion factors reflect year 2020 data. Therefore, for all vehicle model years 2021 onward, the 2020 year factor is used.

- Select "On-Road" or "Non-Road" from drop down box to determine the Vehicle Types available. **Must make this selection before picking vehicle type.**
- Select "Vehicle Type" from drop down box (closest type available).
- Enter "Fuel Usage" in appropriate units (units appear when vehicle type is selected).
- If mileage or fuel usage is unknown, estimate using approximate fuel economy values (see Reference Table below).
- Vehicle year and Miles traveled are not necessary for non-road equipment.

(B) When using biofuels, typically the biofuel (biodiesel or ethanol) is mixed with a petroleum fuel (diesel or gasoline) for use in vehicles. Enter the biodiesel and ethanol percentages of the fuel if known, or leave default values.

Biodiesel Percent: %
 Ethanol Percent: %

(C) Biomass CO₂ emissions from biodiesel and ethanol are not reported in the total emissions, but are reported separately at the bottom of the sheet.



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Source ID	Source Description	On-Road or Non-Road?	Vehicle Type	Vehicle Year	Fuel Usage	Units	Miles Traveled
	Fox Metro				Injection Location - No Hauling by Fox Metro		0
	Wheaton SD	OnRoad	Heavy-Duty Trucks - Biodiesel	2027	800	gal	5,200
	DuPage Co		Heavy-Duty Trucks - Biodiesel	2027	1,154	gal	7,500
	FRWRD		Heavy-Duty Trucks - Biodiesel	2027	1,231	gal	8,000
	KWRD		Heavy-Duty Trucks - Biodiesel	2027	2,308	gal	15,000
	GWA		Heavy-Duty Trucks - Biodiesel	2027	1,846	gal	12,000
	KWU				Injection Location - No Hauling by KWU		0
	Addison		Heavy-Duty Trucks - Biodiesel	2027	1,077	gal	7,000

Reference Table: Average Fuel Economy by Vehicle Type

Vehicle Type	Average Fuel Economy (mpg)
Passenger Cars	25.3
Motorcycles	44.0
Diesel Buses (Diesel Heavy-Duty Vehicles)	7.3
Other 2-axle, 4-Tire Vehicles	18.0
Single unit 2-Axle 6-Tire or More Trucks	7.6
Combination Trucks	6.2

Average mpg values from the U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 2020 (November 2022), Table VM-1.

GHG Emissions

Total Organization-Wide Mobile Source Fuel Usage and CO₂ Emissions (On-Road and Off-Road Vehicles)

Fuel Type	Fuel Usage	Units	CO ₂ (kg)
Motor Gasoline	0	gallons	0.0
Diesel Fuel	0	gallons	0.0
Residual Fuel Oil	0	gallons	0.0
Aviation Gasoline	0	gallons	0.0
Kerosene-Type Jet Fuel	0	gallons	0.0
Liquefied Petroleum Gas (LPG)	0	gallons	0.0
Ethanol	0	gallons	0.0
Biodiesel	8,415	gallons	68,736.9
Liquefied Natural Gas (LNG)	0	gallons	0.0
Compressed Natural Gas (CNG)	0	scf	0.0

Note: emissions here are only for the gasoline portion of the fuel, biogenic CO2 emissions are reported below
Note: emissions here are only for the diesel portion of the fuel, biogenic CO2 emissions are reported below


Total Organization-Wide On-Road Non-Gasoline Mobile Source Mileage and CH₄/N₂O Emissions

Vehicle Type	Fuel Type	Vehicle Year	Mileage (miles)	CH ₄ (g)	N ₂ O (g)
Heavy-Duty Trucks	Methanol		0	0.0	0.0
	Ethanol		0	0.0	0.0
	CNG		0	0.0	0.0
	LPG		0	0.0	0.0
	LNG		0	0.0	0.0
	Biodiesel		54,700	492.3	2,352.1

Total CO₂ Equivalent Emissions (metric tons) - Mobile Sources	69.5
Total Biomass CO₂ Equivalent Emissions (metric tons) - Mobile Sources	15.9

Mallard Lake Landfill - Summary

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Emissions Summary

Guidance

The total GHG emissions from each source category are provided below. You may also use this summary sheet to fill out the *Annual GHG Inventory Summary and Goal Tracking Form* (.xls) as this calculator only quantifies one year of emissions at a time.

<https://www.epa.gov/climateleadership/target-setting>

By entering the data below into the appropriate cell of the *Annual GHG Inventory Summary and Goal Tracking Form*, you will be able to compare multiple years of data.

If you have multiple Calculator files covering sub-sets of your inventory for a particular reporting period, sum each of the emission categories (e.g. Stationary Combustion) to an organizational total, which then can be entered into the *Annual GHG Inventory Summary and Goal Tracking Form*.

(A) Enter organization information into the orange cells. Other cells on this sheet will be automatically calculated from the data entered in the sheets in this workbook. Blue cells indicate required emission sources if applicable. Green cells indicate scope 3 emission sources and offsets, which organizations may optionally include in its inventory.

(B) The "Go To Sheet" buttons can be used to navigate to the data entry sheets.

Organizational Information:

Organization Name: **Mallard Lake Landfill**

Organization Address:

Inventory Reporting Period: **2027-2050 (model predictions)**
Start: **MM/DD/YY** End: **MM/DD/YY**

Name of Preparer: **Strand**

Phone Number of Preparer:

Date Prepared:

Summary of Organization's Emissions:

	Year 2027-2030 (cumulative)	Year 2031-2050 (cumulative)
Scope 1 Emissions		
Go To Sheet		
Stationary Combustion	-177,619 CO ₂ -e (metric tons)	-562,104
Go To Sheet		
Mobile Sources	0 CO ₂ -e (metric tons)	
Go To Sheet		
Refrigeration / AC Equipment Use	0 CO ₂ -e (metric tons)	
Go To Sheet		
Fire Suppression	0 CO ₂ -e (metric tons)	
Go To Sheet		
Purchased Gases	0 CO ₂ -e (metric tons)	
Location-Based Scope 2 Emissions		
Go To Sheet		
Purchased and Consumed Electricity	16,731 CO ₂ -e (metric tons)	83,655
Go To Sheet		
Purchased and Consumed Steam	0 CO ₂ -e (metric tons)	
Market-Based Scope 2 Emissions		
Go To Sheet		
Purchased and Consumed Electricity	16,731 CO ₂ -e (metric tons)	83,655
Go To Sheet		
Purchased and Consumed Steam	0 CO ₂ -e (metric tons)	
Total organization Emissions		
Total Scope 1 & Location-Based Scope 2	-160,888 CO ₂ -e (metric tons)	-478,449
Total Scope 1 & Market-Based Scope 2	-160,888 CO ₂ -e (metric tons)	
Reductions		
Go To Sheet		
Offsets	0 CO ₂ -e (metric tons)	
Net Scope 1 and 2 Location-Based Emissions	0 CO ₂ -e (metric tons)	
Net Scope 1 and 2 Market-Based Emissions	0 CO ₂ -e (metric tons)	
Scope 3 Emissions		
Go To Sheet		
Employee Business Travel	0 CO ₂ -e (metric tons)	
Go To Sheet		
Employee Commuting	0 CO ₂ -e (metric tons)	
Go To Sheet		
Upstream Transportation and Distribution	0 CO ₂ -e (metric tons)	
Go To Sheet		
Waste	0 CO ₂ -e (metric tons)	
Required Supplemental Information		
Go To Sheet		
Biomass CO ₂ Emissions from Stationary Sources	0 CO ₂ -e (metric tons)	
Go To Sheet		
Biomass CO ₂ Emissions from Mobile Sources	0 CO ₂ -e (metric tons)	


Mallard Lake Landfill - Stationary Combustion

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U.S. Environmental Protection Agency

Scope 1 Emissions from Stationary Combustion Sources

Guidance

(A) Enter annual data for each combustion unit, facility, or site (by fuel type) in ORANGE cells on **Table 1**. Example entry is shown in first row (*GREEN Italics*).

- Select "Fuel Combusted" from drop down box.
- Enter "Quantity Combusted" and choose the appropriate units from the drop down box in the unit column. If it's necessary to convert units, common heat contents can be found on the "Heat Content" sheet and unit conversions on the "Unit Conversion" sheet.

(B) If fuel is consumed in a facility but stationary fuel consumption data are not available, an estimate should be made for completeness. See the "Items to Note" section of the Help sheet for suggested estimation approaches.

(C) Biomass CO₂ emissions are not reported in the total emissions, but are reported separately at the bottom of the sheet.

Table 1. Stationary Source Fuel Combustion

Source ID	Source Description	Quantity Gas as CH ₄ (CFD)	Fuel Combusted	Fuel State (solid, liquid, gas)	Quantity Combusted	Units
2027	RNG Use - Avoidance of Fossil Nat. Gas	2,429,568	Natural Gas	Gas	(886,792)	MMBtu
2028	RNG Use - Avoidance of Fossil Nat. Gas	2,334,528	Natural Gas	Gas	(852,103)	MMBtu
2029	RNG Use - Avoidance of Fossil Nat. Gas	2,242,944	Natural Gas	Gas	(818,675)	MMBtu
2030	RNG Use - Avoidance of Fossil Nat. Gas	2,154,816	Natural Gas	Gas	(786,508)	MMBtu
2031	RNG Use - Avoidance of Fossil Nat. Gas	2,070,144	Natural Gas	Gas	(755,603)	MMBtu
2032	RNG Use - Avoidance of Fossil Nat. Gas	1,988,928	Natural Gas	Gas	(725,959)	MMBtu
2033	RNG Use - Avoidance of Fossil Nat. Gas	1,911,168	Natural Gas	Gas	(697,576)	MMBtu
2034	RNG Use - Avoidance of Fossil Nat. Gas	1,835,136	Natural Gas	Gas	(669,825)	MMBtu
2035	RNG Use - Avoidance of Fossil Nat. Gas	1,764,288	Natural Gas	Gas	(643,965)	MMBtu
2036	RNG Use - Avoidance of Fossil Nat. Gas	1,695,168	Natural Gas	Gas	(618,736)	MMBtu
2037	RNG Use - Avoidance of Fossil Nat. Gas	1,627,776	Natural Gas	Gas	(594,138)	MMBtu
2038	RNG Use - Avoidance of Fossil Nat. Gas	1,563,840	Natural Gas	Gas	(570,802)	MMBtu
2039	RNG Use - Avoidance of Fossil Nat. Gas	1,503,360	Natural Gas	Gas	(548,726)	MMBtu
2040	RNG Use - Avoidance of Fossil Nat. Gas	1,444,608	Natural Gas	Gas	(527,282)	MMBtu
2041	RNG Use - Avoidance of Fossil Nat. Gas	1,387,584	Natural Gas	Gas	(506,468)	MMBtu
2042	RNG Use - Avoidance of Fossil Nat. Gas	1,332,288	Natural Gas	Gas	(486,285)	MMBtu
2043	RNG Use - Avoidance of Fossil Nat. Gas	1,280,448	Natural Gas	Gas	(467,364)	MMBtu
2044	RNG Use - Avoidance of Fossil Nat. Gas	1,230,336	Natural Gas	Gas	(449,073)	MMBtu
2045	RNG Use - Avoidance of Fossil Nat. Gas	1,181,952	Natural Gas	Gas	(431,412)	MMBtu
2046	RNG Use - Avoidance of Fossil Nat. Gas	1,135,296	Natural Gas	Gas	(414,383)	MMBtu
2047	RNG Use - Avoidance of Fossil Nat. Gas	1,092,096	Natural Gas	Gas	(398,615)	MMBtu
2048	RNG Use - Avoidance of Fossil Nat. Gas	1,048,896	Natural Gas	Gas	(382,847)	MMBtu
2049	RNG Use - Avoidance of Fossil Nat. Gas	1,007,424	Natural Gas	Gas	(367,710)	MMBtu
2050	RNG Use - Avoidance of Fossil Nat. Gas	893,376	Natural Gas	Gas	(326,082)	MMBtu

GHG Emissions

Total Organization-Wide Stationary Source Combustion by Fuel Type

Fuel Type	Quantity Combusted	Units
Gaseous Fuels		
Natural Gas	-13,574,004,205	scf
Propane Gas	0	scf
Landfill Gas	0	scf

Total Organization-Wide CO₂, CH₄ and N₂O Emissions from Stationary Source Fuel Combustion

Fuel Type	CO ₂ (kg)	CH ₄ (g)	N ₂ O (g)
Gaseous Fuels			
Natural Gas	-738,968,788.9	-13,981,224.3	-1,357,400.4
Propane Gas	0.0	0.0	0.0
Landfill Gas	0.0	0.0	0.0
Total Fossil Fuel Emissions	-738,968,788.9	-13,981,224.3	-1,357,400.4
Total Emissions for all Fuels	-738,968,788.9	-13,981,224.3	-1,357,400.4

Total CO₂ Equivalent Emissions (metric tons) - Stationary Combustion

-739,722.8

Total Biomass CO₂ Equivalent Emissions (metric tons) - Stationary Combustion

0.0

Greene Valley Landfill - Summary

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 U.S. Environmental Protection Agency

Emissions Summary

Guidance
 The total GHG emissions from each source category are provided below. You may also use this summary sheet to fill out the Annual GHG Inventory Summary and Goal Tracking Form (.xls) as this calculator only quantifies one year of emissions at a time.
<https://www.epa.gov/climateleadership/target-setting>

By entering the data below into the appropriate cell of the Annual GHG Inventory Summary and Goal Tracking Form, you will be able to compare multiple years of data.

If you have multiple Calculator files covering sub-sets of your inventory for a particular reporting period, sum each of the emission categories (e.g. Stationary Combustion) to an organizational total, which then can be entered into the Annual GHG Inventory Summary and Goal Tracking Form.

(A) Enter organization information into the orange cells. Other cells on this sheet will be automatically calculated from the data entered in the sheets in this workbook. Blue cells indicate required emission sources if applicable. Green cells indicate scope 3 emission sources and offsets, which organizations may optionally include in its inventory.

(B) The "Go To Sheet" buttons can be used to navigate to the data entry sheets.

Organizational Information:

Organization Name: **Greene Valley Landfill**

Organization Address:

Inventory Reporting Period: **2027-2050 (model predictions)**
 Start: **MM/DD/YY** End: **MM/DD/YY**

Name of Preparer: **Strand**
 Phone Number of Preparer:
 Date Prepared:

Summary of Organization's Emissions:

	Year 2027-2030 (cumulative)	Year 2031-2050 (cumulative)
Scope 1 Emissions		
Stationary Combustion	-96,958 CO ₂ -e (metric tons)	-307,757
Mobile Sources	0 CO ₂ -e (metric tons)	
Refrigeration / AC Equipment Use	0 CO ₂ -e (metric tons)	
Fire Suppression	0 CO ₂ -e (metric tons)	
Purchased Gases	0 CO ₂ -e (metric tons)	
Location-Based Scope 2 Emissions		
Purchased and Consumed Electricity	10,039 CO ₂ -e (metric tons)	50,193
Purchased and Consumed Steam	0 CO ₂ -e (metric tons)	
Market-Based Scope 2 Emissions		
Purchased and Consumed Electricity	10,039 CO ₂ -e (metric tons)	50,193
Purchased and Consumed Steam	0 CO ₂ -e (metric tons)	
Total organization Emissions		
Total Scope 1 & Location-Based Scope 2	-86,917 CO ₂ -e (metric tons)	-257,564
Total Scope 1 & Market-Based Scope 2	-86,917 CO ₂ -e (metric tons)	
Reductions		
Offsets	0 CO ₂ -e (metric tons)	
Net Scope 1 and 2 Location-Based Emissions	0 CO ₂ -e (metric tons)	
Net Scope 1 and 2 Market-Based Emissions	0 CO ₂ -e (metric tons)	
Scope 3 Emissions		
Employee Business Travel	0 CO ₂ -e (metric tons)	
Employee Commuting	0 CO ₂ -e (metric tons)	
Upstream Transportation and Distribution	0 CO ₂ -e (metric tons)	
Waste	0 CO ₂ -e (metric tons)	
Required Supplemental Information		
Biomass CO ₂ Emissions from Stationary Sources	0 CO ₂ -e (metric tons)	
Biomass CO ₂ Emissions from Mobile Sources	0 CO ₂ -e (metric tons)	

Greene Valley Landfill - Stationary Combustion

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Scope 1 Emissions from Stationary Combustion Sources

Guidance
 (A) Enter annual data for each combustion unit, facility, or site (by fuel type) in ORANGE cells on **Table 1**. Example entry is shown in first row (**GREEN Italics**).
 - Select "Fuel Combusted" from drop down box.
 - Enter "Quantity Combusted" and choose the appropriate units from the drop down box in the unit column. If it's necessary to convert units, common heat contents can be found on the "Heat Content" sheet and unit conversions on the "Unit Conversion" sheet.
 (B) If fuel is consumed in a facility but stationary fuel consumption data are not available, an estimate should be made for completeness. See the "Items to Note" section of the Help sheet for suggested estimation approaches.
 (C) Biomass CO₂ emissions are not reported in the total emissions, but are reported separately at the bottom of the sheet.

Table 1. Stationary Source Fuel Combustion

Source ID	Source Description	Quantity Gas as CH ₄ (CFD)	Fuel Combusted	Fuel State (solid, liquid, gas)	Quantity Combusted	Units
2027	RNG Use - Avoidance of Fossil Nat. Gas	1,326,240	Natural Gas	Gas	(484,078)	MMBtu
2028	RNG Use - Avoidance of Fossil Nat. Gas	1,274,400	Natural Gas	Gas	(465,156)	MMBtu
2029	RNG Use - Avoidance of Fossil Nat. Gas	1,224,000	Natural Gas	Gas	(446,760)	MMBtu
2030	RNG Use - Avoidance of Fossil Nat. Gas	1,176,480	Natural Gas	Gas	(429,415)	MMBtu
2031	RNG Use - Avoidance of Fossil Nat. Gas	1,130,400	Natural Gas	Gas	(412,596)	MMBtu
2032	RNG Use - Avoidance of Fossil Nat. Gas	1,085,760	Natural Gas	Gas	(396,302)	MMBtu
2033	RNG Use - Avoidance of Fossil Nat. Gas	1,044,000	Natural Gas	Gas	(381,060)	MMBtu
2034	RNG Use - Avoidance of Fossil Nat. Gas	1,002,240	Natural Gas	Gas	(365,818)	MMBtu
2035	RNG Use - Avoidance of Fossil Nat. Gas	963,360	Natural Gas	Gas	(351,626)	MMBtu
2036	RNG Use - Avoidance of Fossil Nat. Gas	925,920	Natural Gas	Gas	(337,961)	MMBtu
2037	RNG Use - Avoidance of Fossil Nat. Gas	888,480	Natural Gas	Gas	(324,295)	MMBtu
2038	RNG Use - Avoidance of Fossil Nat. Gas	853,920	Natural Gas	Gas	(311,681)	MMBtu
2039	RNG Use - Avoidance of Fossil Nat. Gas	820,800	Natural Gas	Gas	(299,592)	MMBtu
2040	RNG Use - Avoidance of Fossil Nat. Gas	789,120	Natural Gas	Gas	(288,029)	MMBtu
2041	RNG Use - Avoidance of Fossil Nat. Gas	757,440	Natural Gas	Gas	(276,466)	MMBtu
2042	RNG Use - Avoidance of Fossil Nat. Gas	727,200	Natural Gas	Gas	(265,428)	MMBtu
2043	RNG Use - Avoidance of Fossil Nat. Gas	699,840	Natural Gas	Gas	(255,442)	MMBtu
2044	RNG Use - Avoidance of Fossil Nat. Gas	672,480	Natural Gas	Gas	(245,455)	MMBtu
2045	RNG Use - Avoidance of Fossil Nat. Gas	645,120	Natural Gas	Gas	(235,469)	MMBtu
2046	RNG Use - Avoidance of Fossil Nat. Gas	620,640	Natural Gas	Gas	(226,534)	MMBtu
2047	RNG Use - Avoidance of Fossil Nat. Gas	596,160	Natural Gas	Gas	(217,598)	MMBtu
2048	RNG Use - Avoidance of Fossil Nat. Gas	573,120	Natural Gas	Gas	(209,189)	MMBtu
2049	RNG Use - Avoidance of Fossil Nat. Gas	550,080	Natural Gas	Gas	(200,779)	MMBtu
2050	RNG Use - Avoidance of Fossil Nat. Gas	528,480	Natural Gas	Gas	(192,895)	MMBtu

GHG Emissions

Total Organization-Wide Stationary Source Combustion by Fuel Type

Fuel Type	Quantity Combusted	Units
Gaseous Fuels		
Natural Gas	-7,426,533,330	scf
Propane Gas	0	scf
Landfill Gas	0	scf

Total Organization-Wide CO₂, CH₄ and N₂O Emissions from Stationary Source Fuel Combustion

Fuel Type	CO ₂ (kg)	CH ₄ (g)	N ₂ O (g)
Gaseous Fuels			
Natural Gas	-404,300,474.5	-7,649,329.3	-742,653.3
Propane Gas	0.0	0.0	0.0
Landfill Gas	0.0	0.0	0.0
Total Fossil Fuel Emissions	-404,300,474.5	-7,649,329.3	-742,653.3
Total Emissions for all Fuels	-404,300,474.5	-7,649,329.3	-742,653.3

Total CO₂ Equivalent Emissions (metric tons) - Stationary Combustion
-404,713.0

Total Biomass CO₂ Equivalent Emissions (metric tons) - Stationary Combustion
0.0

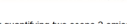
Mallard Lake Landfill - Electricity

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Help - Market-Based Method

Scope 2 Emissions from Purchase of Electricity



U.S. Environmental Protection Agency

Guidance

The Indirect Emissions from Purchased Electricity Guidance document provides guidance for quantifying two scope 2 emissions totals, using a **location-based method** and a **market-based method**. The organization should quantify and report both totals in its GHG inventory. The location-based method considers average emission factors for the electricity grids that provide electricity. The market-based method considers contractual arrangements under which the organization procures electricity from specific sources, such as renewable energy.

- Enter total annual electricity purchased in kWh and each eGRID subregion for each facility or site in ORANGE cells of **Table 1**.
- If electricity consumption data are not available for a facility, an estimate should be made for completeness.
 - See the "Items to Note" section of the Help sheet for suggested estimation approaches.
- Select "eGRID subregion" from drop box and enter "Electricity Purchased."
 - Use map (Figure 1) at bottom of sheet to determine appropriate eGRID subregion. If subregion cannot be determined from the map, find the correct subregion by entering the location's zip code into EPA's Power Profiler: <https://www.epa.gov/eGRID/power-profiler/>
- See the market-based emission factor hierarchy on the market-based method Help sheet. If any of the first four types of emission factors are applicable, enter the factors in the yellow cells marked as "<center factor>". If not, leave the yellow cells as is, and eGRID subregion factors will be used for market-based emissions.

Example entry is shown in first row (*GREEN Illinois*) for a facility that purchases RECs for 100% of its consumption, and therefore has a market-based emission factor of 0.

Help - Market-Based Method

Tips: Enter electricity usage by location and then look up the eGRID subregion for each location. If you purchase renewable energy that is less than 100% of your site's electricity, see the example in the market-based method Help sheet.

Table 1. Total Amount of Electricity Purchased by eGRID Subregion

Source ID	Source Description	Source Area (sq ft)	eGRID Subregion <i>where electricity is consumed</i>	Electricity Purchased (kWh)	Market-Based									Location-Based		
					Use these cells to enter applicable market-based emission factors											
					Emission Factors			Emissions			Emissions			Emissions		
					CO ₂ Emissions (lb/MWh)	CH ₄ Emissions (lb/MWh)	N ₂ O Emissions (lb/MWh)	CO ₂ Emissions (lb)	CH ₄ Emissions (lb)	N ₂ O Emissions (lb)	CO ₂ Emissions (lb)	CH ₄ Emissions (lb)	N ₂ O Emissions (lb)	CO ₂ Emissions (lb)	CH ₄ Emissions (lb)	N ₂ O Emissions (lb)
RNG	RNG Equipment @ 1000 kW oper.(RFCW (RFC West)			8,760,000	<center factor>	<center factor>	<center factor>	9,163,836.0	832.2	122.6	9,163,836.0	832.2	122.6	9,163,836.0	832.2	122.6
Total Emissions for All Sources				8,760,000				9,163,836.0	832.2	122.6	9,163,836.0	832.2	122.6			

GHG Emissions

CO ₂ Equivalent Emissions (metric tons)	
Location-Based Electricity Emissions	4,182.7
Market-Based Electricity Emissions	4,182.7

Notes:

- CO₂, CH₄, and N₂O emissions are estimated using methodology provided in EPA's Center for Corporate Climate Leadership Greenhouse Gas Inventory Guidance
- Indirect Emissions from Purchased Electricity (January 2016).


Greene Valley Landfill - Electricity

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Help - Market-Based Method



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Scope 2 Emissions from Purchase of Electricity

Guidance

The Indirect Emissions from Purchased Electricity Guidance document provides guidance for quantifying two scope 2 emissions totals, using a **location-based method** and a **market-based method**. The organization should quantify and report both totals in its GHG inventory. The location-based method considers average emission factors for the electricity grids that provide electricity. The market-based method considers contractual arrangements under which the organization procures electricity from specific sources, such as renewable energy.

(A) Enter total annual electricity purchased in kWh and each eGRID subregion for each facility or site in ORANGE cells of **Table 1**.

(B) If electricity consumption data are not available for a facility, an estimate should be made for completeness.

See the "Items to Note" section of the Help sheet for suggested estimation approaches.

(C) Select "eGRID subregion" from drop box and enter "Electricity Purchased."

- Use map (Figure 1) at bottom of sheet to determine appropriate eGRID subregion. If subregion cannot be determined from the map, find the correct subregion by entering the location's zip code into EPA's Power Profiler:
<https://www.epa.gov/eGRID/power-profiler/>

(D) See the market-based emission factor hierarchy on the market-based method Help sheet. If any of the first four types of emission factors are applicable, enter the factors in the yellow cells marked as "center-factor". If not, leave the yellow cells as is, and eGRID subregion factors will be used for market-based emissions.

Example entry is shown in first row (*GREEN Tinted*) for a facility that purchases RECs for 100% of its consumption, and therefore has a market-based emission factor of 0.

Help - Market-Based Method

Tips: Enter electricity usage by location and then look up the eGRID subregion for each location.
If you purchase renewable energy that is less than 100% of your site's electricity, see the example in the market-based method Help sheet.

Table 1. Total Amount of Electricity Purchased by eGRID Subregion

Source ID	Source Description	Source Area (sq ft)	eGRID Subregion <i>where electricity is consumed</i>	Electricity Purchased (kWh)	Market-Based							Location-Based		
					Emission Factors			Emissions			Emissions			
					CO ₂ Emissions (lb/MWh)	CH ₄ Emissions (lb/MWh)	N ₂ O Emissions (lb/MWh)	CO ₂ Emissions (lb)	CH ₄ Emissions (lb)	N ₂ O Emissions (lb)	CO ₂ Emissions (lb)	CH ₄ Emissions (lb)	N ₂ O Emissions (lb)	
RNG	RNG Equipment @ 600 kW operator RFCW (RFC West)			5,256,000	center-factor	center-factor	center-factor	5,498,301.6	499.3	73.6	5,498,301.6	499.3	73.6	
Total Emissions for All Sources				5,256,000				5,498,301.6	499.3	73.6	5,498,301.6	499.3	73.6	

GHG Emissions

CO ₂ Equivalent Emissions (metric tons)	
Location-Based Electricity Emissions	2,509.6
Market-Based Electricity Emissions	2,509.6

Notes:

- CO₂, CH₄, and N₂O Emissions are estimated using methodology provided in EPA's Center for Corporate Climate Leadership Greenhouse Gas Inventory Guidance
- Indirect Emissions from Purchased Electricity (January 2016)