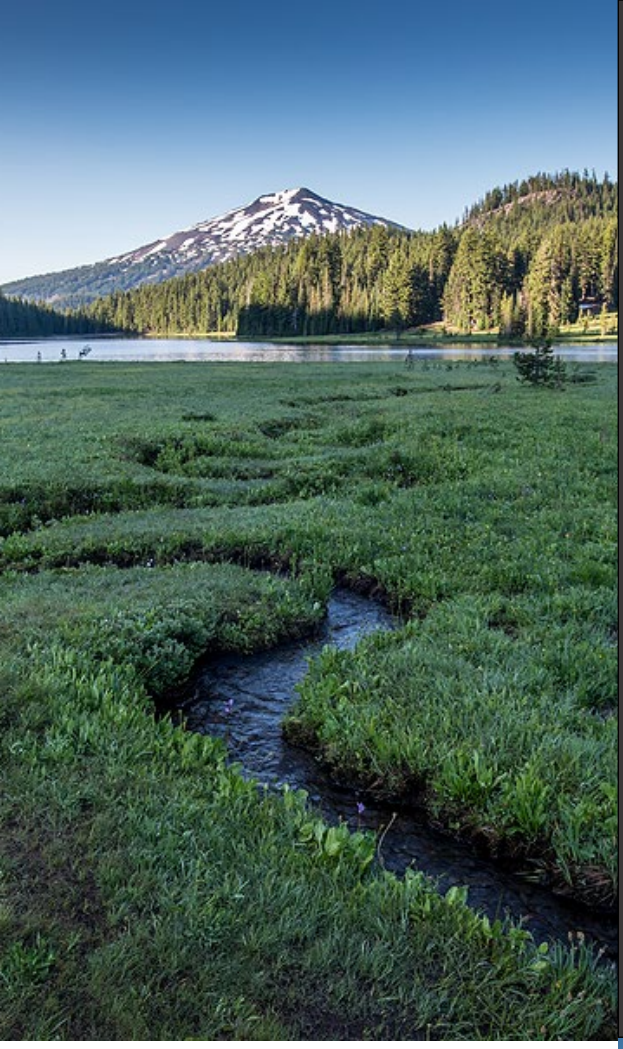

Instruction Manual

Tier 1 Simplified CI Calculator for Organic Waste Biomethane

December 2024

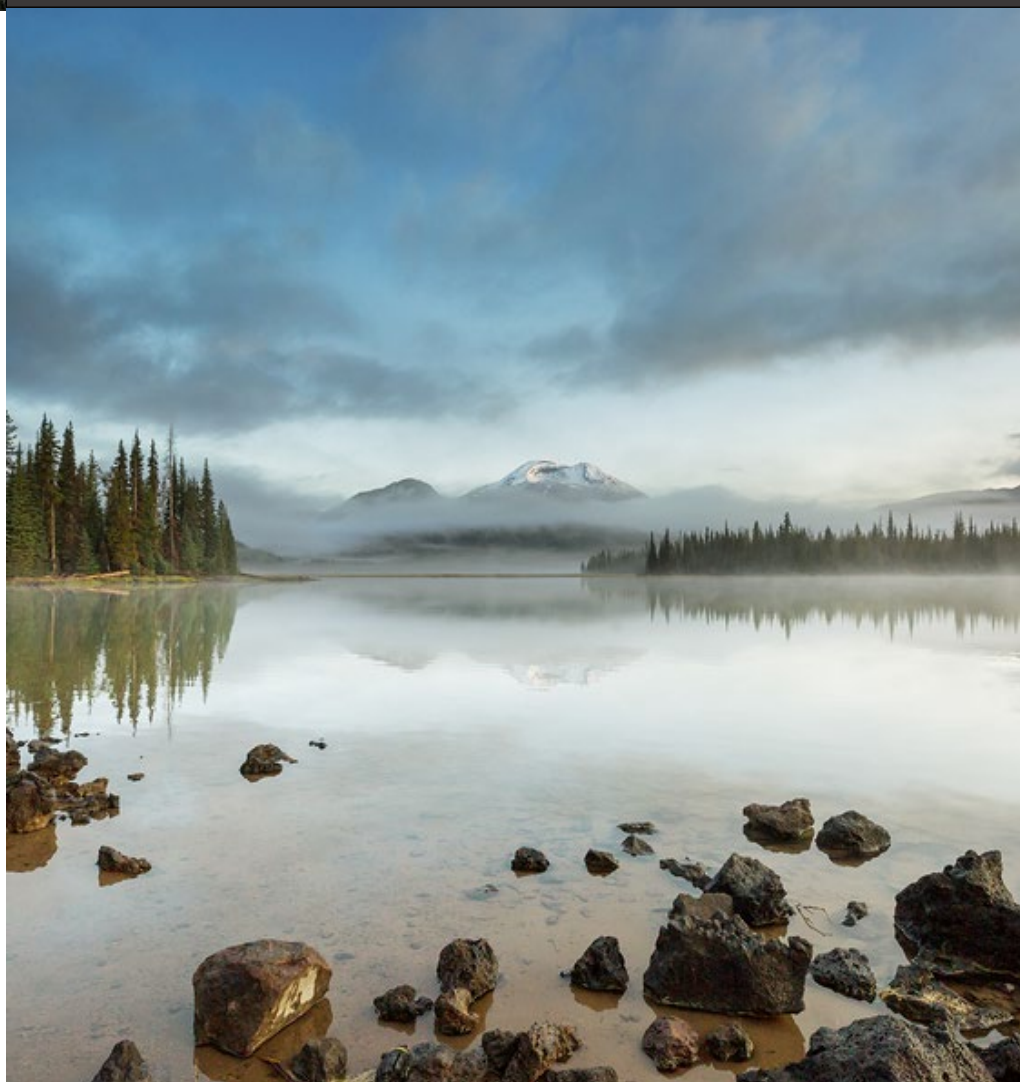

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Table of contents

Introduction

This document provides detailed instructions for the Tier 1 CI Calculator for Organic Waste Biomethane (T1 OW Calculator) to calculate the carbon intensity (CI) of biogas generated by the anaerobic digestion of organic wastes and upgraded to compressed biomethane (Bio-CNG), liquified biomethane (Bio-LNG), or liquified biomethane that has been gasified at the fueling station (Bio-L-CNG) for use as a transportation fuel in Oregon.

Click here to download the T1 OW Calculator

The T1 OW Calculator requires the applicant to enter monthly operational data for feedstock types and quantities, fuel production quantities, and transport distances.

T1 OW Calculator overview

Table 1 provides an overview of the worksheets used in the T1 OW Calculator.

Table 1: Worksheets Used in the T1 OW Calculator

Worksheet Name	Description
Introduction	Introduction to the Tier 1 OW Calculator.
Site-Specific Inputs	Worksheet for feedstock and fuel production data entry.
Pathway Summary	Worksheet that displays fuel production quantities, calculates CIs, and site-specific operating conditions.
OR-GREET4.0	Worksheet for predefined input values, emission factors, fuel specifications, and unit conversion values from the OR-GREET4.0 model.

The cells in the T1 OW calculator have various fill colors per the legend below:

User Input
Calculated Value
OR-GREET4.0

To calculate the fuel pathway CI, the user must enter site-specific data into “User Input” fields if that field is relevant to the fuel pathway. If the input field is not relevant to the fuel pathway, it may be left blank or hidden by deselecting the input checkboxes located in Section 2.

All User Inputs are subject to verification as part of initial pathway certification and annual fuel pathway reporting. If a fuel pathway has additional emissions inside the system boundary that are not captured in the User Input fields, a Tier 2 application is required to document and account for those emissions.

“Calculated Value” cells contain formula that provide a calculated value based on user input data or OR-GREET4.0. In some instances, a “Calculated Value” cell may display a blank value if that input is not relevant or insufficient user input data has been entered.

“OR-GREET4.0” cells contain input values from the OR-GREET4.0 model. Calculated Value formula and OR-GREET4.0 values cannot be modified without prior approval from DEQ and may elevate the pathway to a Tier 2 application.

Site-specific inputs worksheet

The Site-Specific Inputs worksheet contains the main CI calculation worksheet which consists of the following major components:

- Section 1. Applicant Information
- Section 2. Pathway Inputs
- Section 3. Static Operational Data
- Section 4: Monthly Operational Data

All relevant site-specific inputs must be entered in the respective input fields. Once all site-specific inputs for a given facility have been entered, the pathway CIs for the various streams will be displayed in the Pathway Summary worksheet.

Table 2: Table 2. Input Field Instructions for Section 1 of the T1 OW Calculator

Field Name	Instructions
1.1 Application Number	Enter the application number provided by the AFP.
1.2 Company Name	Enter the company name as entered in the AFP.
1.3 Company ID	Enter the company ID as generated by the AFP. If not available, contact DEQ staff.
1.4 Facility ID	Enter U.S EPA Facility ID. If not available, contact DEQ staff.

Section 2 (Table 3) provides the option to select only input fields that apply to a given pathway, which hides irrelevant inputs in Section 4 of the worksheet.

Table 3: Input Field Instructions for Section 2 of the T1 OW Calculator

Field Name	Instructions
2.1 Organic Waste Feedstocks	Select feedstock(s) used by the fuel pathway. "Food Scraps" (FS) is the portion of municipal solid waste (MSW) that consists of inedible or post-consumer food collected from residences, hospitality facilities, institutions, and grocery stores. Feedstocks that are not typically landfilled do not qualify as Food Scraps, which include: fats, oils, or greases (FOG), liquids, and materials from industrial food manufacturing or processing facilities. "Urban Landscaping Waste" (ULW) is organic MSW material collected from landscaping activities, including leaves, grass, branches, and stumps. "Recovered Organics" (RO) is the organic fraction of mixed MSW that is manually or mechanically separated from the waste stream, typically at a materials recovery facility, anaerobic digestion facility, compost facility, or transfer station. Any other organic waste feedstocks may be modeled as "Other Organic Waste" (OOW).
2.2 Process Energy	Select the type(s) of process energy used at the fuel production facility.
2.3 Blended Fossil Fuels	Select the type(s) of fossil fuels blended with biomethane prior to pipeline injection, if applicable.
2.4 Finished Fuels	Select the type(s) of finished fuels.

Table 4: Input Field Instructions for Section 3 of the T1 OW Calculator

Field Name	Instructions
3.1 Electricity Grid Region	If the OW biogas upgrading facility uses grid electricity, select the electricity mix corresponding to the region where the facility is located. A map of eGRID zones is provided in the "OR-GREET4.0" worksheet. The eGRID region may also be determined using the eGRID Power Profiler tool.[1]
3.2 Grid Electricity EF (gCO_2e/kWh)	The grid electricity CI will be displayed based on the selection for Field 3.1. If User-Defined is selected in Field 3.1, consult with DEQ to develop an emission factor for a user-defined grid electricity mix.
3.3 Low-CI Electricity CI (gCO_2e/kWh)	Consult with DEQ to develop an emission factor for the low-CI electricity used by the ethanol production facility. Low-CI electricity must be physically supplied directly to the production facility. The low-CI electricity source and all data sources used in calculating emission factors must be described in detail in the Supplemental Documentation submitted with the fuel pathway application.
3.4 Distance to CNG Station (miles)	Enter the distance for biomethane transport by pipeline to the CNG station(s) in California using a publicly available distance estimator tool that reflects the actual transport route. For distribution to multiple Oregon stations, use Salem as the endpoint in determining the Standard Station Centroid location..
3.5 LNG Facility ID	Enter the LNG's U.S EPA Facility ID. If not available, contact DEQ staff.
3.6 Distance to LNG Facility (miles)	Repeat instructions in Field 3.4 for biomethane transport by pipeline to an LNG facility.
3.7 Liquefaction EF ($gCO_2e/gallon$)	Enter the most recent validated/verified emission factor for the LNG facility, as calculated using a DEQ-approved LNG EF calculation template. Data sources must be documented in the Supplemental Documentation attached with the Simplified CI Calculator.
3.8 Bio-LNG Trucking Distance (miles)	Repeat instructions in Field 3.4 for liquified biomethane transport by truck.
3.9 Bio-LNG Truck Type	Enter the truck type used to transport Bio-LNG to dispensing station(s) in Oregon.
3.10 OOW Diverted from Landfill (%)	Enter the weighted average mass fraction (dry basis) of OOW feedstock(s) that would have otherwise been landfilled on a regional or industry-wide basis. Diversion rate calculations and literature

[1] United States Environmental Protection Agency, eGRID Power Profiler tool. (Updated June 5, 2023). https://www.epa.gov/egrid/power-profiler#/

Field Name	Instructions
	sources must be described in detail in the Supplemental Documentation submitted with the fuel pathway application.
3.11 OOW Diverted from Composting (%)	Enter the weighted average mass fraction (dry basis) of OOW feedstock(s) that would have otherwise been composted on a regional or industry-wide basis. Diversion rate calculations and literature sources must be described in detail in the Supplemental Documentation submitted with the fuel pathway application.
3.12 OOW TDOC (% dry basis)	Enter the weighted average total degradable organic carbon (TDOC) value for the OOW feedstock. TDOC values from DEQ's Greenhouse Gas Emissions Inventory may be used,[2] or a site-specific TDOC value based on independent laboratory analysis may be approved by DEQ using the EPA equations TT-7 or TT-8.[3]
3.13 OOW DANF (%)	Enter the weighted average decomposable anaerobic fraction (DANF) value for the OOW feedstock. To determine the DANF value for a feedstock, the most recent edition of DEQ's Greenhouse Gas Emissions Inventory list of DANF values for common OOW feedstocks may be referenced, or a default value of 0.5 may be approved by DEQ.
3.13 OOW Decay Rate	Enter the weighted average decay rate for the OOW feedstock. To determine the decay rate, U.S. EPA (2020) Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM)[4] Exhibit 6-8 may be referenced, or an alternate value may be approved by DEQ.

Site-specific data must be entered in Section 4 (see Table 5) for each month of the operational data period. Fields that do not apply to the fuel pathway may either be hidden by deselecting the fields in Section 2 or may be left blank. Any gaps in data reporting must comply with the Missing Data Provisions in OAR 340-253-0450(13).

Quantities entered should be inclusive of the entire fuel production facility; quantities used by the facility that are outside the fuel pathway system boundary may only be excluded with written permission from DEQ.

[2] https://www.oregon.gov/deq/ghgp/pages/ghg-inventory.aspx

[3] https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-TT

[4] https://www.epa.gov/sites/default/files/2020-12/documents/warm_management_practices_v15_10-29-2020.pdf

Biogas and biomethane measurements must be recorded at minimum every 15 minutes with instrumentation capable of electronic archival.

Table 5: Input Field Instructions for Section 4 of the T1 OW Calculator

Field Name	Instructions
4.1 Reporting Month (MM/YYYY)	Enter the 24 consecutive months that reflect the most recent operational data available for the Bio-CNG production facility. Applications must not have an interval of greater than 3 months between the end of the operational data month and the date of submission. For fuel production facilities that have been in operation less than 24 months, or that have had a major modification, the operational data submitted is permitted to range from 3 to 24 months.
4.2 ULW Received (wet short tons)	Enter the quantity of ULW received by the fuel production facility, as measured at the fuel production facility's weigh-in station.
4.3 ULW Inerts Rejected (short tons)	Enter the quantity of inert material that is removed from the ULW feedstock after being received by the fuel production facility and prior to being loaded into the digester.
4.4 ULW Moisture Content (%)	Enter the as-received, weighted average moisture content of the ULW feedstock. Sampling and analysis protocols will be determined by DEQ as a pathway-specific operating condition.
4.5 ULW Transport Distance (weighted average miles)	Enter the transport distance from the point of collection to the fuel production facility for ULW feedstock(s) using a publicly available distance estimator tool that reflects the actual transport route. If ULW is transported from multiple collection points, a weighted average distance may be calculated, or the mileage of the farthest route may be applied.
4.6 FS Received (wet short tons)	Repeat instructions in Field 4.2 for FS.
4.7 FS Rejected (short tons)	Repeat instructions in Field 4.3 for FS.
4.8 FS Moisture Content (%)	Repeat instructions in Field 4.4 for FS.
4.9 FS Transport Distance (weighted average miles)	Repeat instructions in Field 4.5 for FS.
4.10 RO Received (wet short tons)	Repeat instructions in Field 4.2 for RO.
4.11 RO Rejected (short tons)	Repeat instructions in Field 4.3 for RO.
4.12 RO Moisture Content (%)	Repeat instructions in Field 4.4 for RO.

Field Name	Instructions
4.13 RO Transport Distance (weighted average miles)	Repeat instructions in Field 4.5 for RO.
4.14 OOW Received (wet short tons)	Repeat instructions in Field 4.2 for OOW.
4.15 OOW Rejected (short tons)	Repeat instructions in Field 4.3 for OOW.
4.16 OOW Moisture Content (%)	Repeat instructions in Field 4.4 for OOW.
4.17 OOW Transport Distance (weighted average miles)	Repeat instructions in Field 4.5 for OOW.
4.18 Biogas Collected (ft^3 @ 60°F, 1 atm)	Enter the volume of OW biogas collected at 1 atm pressure and 60°F.
4.19 Methane Content (%v/v CH_4/biogas)	Enter the weighted average methane content of the OW biogas.
4.20 Biogas Sent to Boiler (ft^3 @ 60°F, 1 atm)	Enter the volume of biogas that is combusted on-site in a boiler to produce heat or power for the fuel production facility.
4.21 North American Natural Gas (MMBtu, HHV)	Enter the quantity of natural gas (NG) used by the fuel production facility sourced from a common carrier NG pipeline in North America, excluding natural gas used for blending prior to injection.
4.22 Grid Electricity (kWh)	Enter the quantity of grid electricity used by the fuel production facility.
4.23 Low-CI Electricity (kWh)	Enter the quantity of low-CI electricity supplied directly to the biomethane production facility.
4.24 LPG or Propane (Gallons)	Enter the quantity of liquified petroleum gas (LPG) or propane used by the facility, excluding any quantity used for blending prior to injection.
4.25 Diesel (Gallons)	Enter the quantity of diesel fuel used by the fuel production facility.
4.26 Flared Gas (MMBtu, HHV)	Enter the quantity of biogas or biomethane that is destroyed on-site in a flare or thermal oxidizer.
4.27 Natural Gas Blended (MMBtu, HHV)	Enter the metered quantity of fossil natural gas blended with biomethane and injected into the common carrier pipeline.
4.28 LPG / Propane Blended (gallons)	Enter the metered quantity of LPG or propane blended with biomethane and injected into the common carrier pipeline.
4.29 Total Gas Injected	Enter the total metered quantity of gas injected into the common carrier pipeline, including any blended gas reported in 4.27 and 4.28. Quantities should match financial transaction records between the injecting party and the pipeline operator.

Pathway Summary worksheet

The Pathway Summary worksheet calculates the CI of each fuel pathway from operational data and user selections in the Site-Specific Inputs worksheet.

The top section of this worksheet provides application identification information and a summary of the total fuel produced by the facility. This section also provides a summary of the avoided emissions associated with diverting feedstocks from their alternate fates. The quantity of avoided landfilling emissions is proportional to the feedstock's anaerobically degradable organic carbon (ANDOC) content.

The Carbon Intensity Calculations section provides a summary of each fuel production stage inputs along with its calculated emissions and stage-specific CI contributions. The CIs are then summed to provide a CI for each ethanol pathway. The applicant may opt to apply a conservative margin of safety to the fuel pathway CI to ensure that the pathway remains compliant with certified CIs.

The final section of this worksheet provides a space for DEQ staff to publish Operating Conditions associated with the pathway. A completed version of this worksheet is shared with the applicant for review and approval prior to pathway certification.

OR-GREET4.0 worksheet

The OR-GREET4.0 Worksheet contains predefined input values from the OR-GREET4.0 model. These input values cannot be modified without written permission from DEQ, which will elevate the application to a Tier 2 pathway.

Avoided Emissions worksheet

The Avoided Emissions Worksheet is comprised of two sections. Section 6 provides references for feedstock characteristics used to model their avoided emissions. Section 7 provides a first-order decay model designed to calculate the annual emissions for selected landfilled organic wastes. The tool was adapted from CARB's Landfill Gas Tool.[5]

[5] CARB Landfill Gas Tool. (Updated Sept. 24, 2021).