Instruction Manual
Tier 1 CI Calculator for Corn or Sorghum Ethanol

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State of Oregon
DEQ Department of Environmental Quality

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Table of contents

Introduction

This document provides detailed instructions for the Tier 1 CI Calculator for Corn or Sorghum Ethanol (T1 CSE Calculator) to calculate the carbon intensity for ethanol produced from corn and/or sorghum feedstocks.

[Download the T1 CSE Calculator](#)

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

T1 CSE Calculator overview

Table 1 provides a summary of the worksheets present in the Tier 1 CSE Calculator.

Table 1: T1 CSE Calculator Worksheet Overview

Worksheet Name	Description
Introduction	Introduction to the Tier 1 CSE 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 CSE calculator have various fill colors per the legend below:

User Input
Calculated Value
OR-GREET4.0 Value

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 following sections:

- 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: Instructions for Section 1 - Applicant Information

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 for LCFS Company ID.
1.4 Facility ID	Enter U.S EPA Facility ID. If not available, contact DEQ.

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: Instructions for Section 2: Pathway Inputs

Field Name	Instructions
2.1 Pathway CIs	Select composite or allocated pathway CIs. A composite CI provides a single fuel pathway for each feedstock. An allocated CI provides multiple fuel pathways for the fraction of each feedstock associated with the DGS coproducts.
2.2 Feedstocks	Select the feedstocks used by the fuel production facility.

Field Name	Instructions
2.3 Feedstock Transport	Select transport mode(s) used to deliver feedstock from stack to fuel production facility.
2.4 Process Energy	Select the type(s) of process energy used at the fuel production facility.
2.5 Coproducts	Select co-products produced at the fuel production facility.
2.6 Ethanol Sold	Select the type(s) of ethanol sold by the fuel production facility.
2.7 Ethanol Transport	Select the transport mode(s) used to deliver ethanol sold by the fuel production facility.

Table 4: Instructions for Section 3 - Static Operational Data

Field Name	Instructions
3.1 Feedstock Transport Data	Select either a default or site-specific feedstock transport mileage value from the drop-down menu. A site-specific value requires entry of monthly weighted average mileages to be entered in Section 4 of the Site-Specific Inputs worksheet. The "Default for 9 Midwest States" option may be selected for ethanol production facilities located in South Dakota, Minnesota, Iowa, Nebraska, Illinois, Michigan, Ohio, Indiana or Wisconsin. This option applies a default value of 40 miles for corn transport or 80 miles for sorghum transport by Heavy Heavy-Duty Truck (HHDT). The "Default for Oregon" option may be selected for ethanol plants located in Oregon. This option applies a default value of 40 miles by HHDT and 1,900 miles for rail transport for corn or sorghum transport to Oregon.
3.2 Grid Electricity Region	If the ethanol production facility uses grid electricity, select the electricity mix corresponding to the eGRID 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]
3.3 Grid CI (gCO2e/kWh)	The grid electricity CI will be displayed based on the selection for Field 3.2. If User-Defined is selected in Field 3.2, consult with DEQ to develop an emission factor for a user-defined grid electricity mix.
3.4 Alternative Fuel Type	Specify fuel type if another fuel source is used for fuel production. Alternate fuel source must be described in detail in the supplemental documentation submitted with the fuel pathway application.
3.5 Alt. Fuel EF (gCO2e/MMBtu, HHV)	Consult with DEQ to develop an emission factor for the alternate fuel. Alternate fuel sources and data sources used in calculating emission factors must be described in detail in the Supplemental Documentation submitted with the fuel pathway application.
3.6 Biomethane CI (gCO2e/MJ, LHV)	Consult with DEQ staff to develop an appropriate emission factor for the biogas or biomethane used as process fuel. Biogas or biomethane must be physically supplied directly to the production facility; indirect accounting ("book-and-claim") is not permitted for ethanol pathways. The biogas or biomethane 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.

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[1] United States Environmental Protection Agency, *eGRID Power Profiler tool.* (Updated June 5, 2023).

Field Name	Instructions
3.7 Low-CI Electricity CI (gCO2e/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.
3.8 Denaturant Blended	Select either a default or site-specific denaturant reporting option from the drop-down menu. The default option models a 2.5% (%v/v) blend of CBOB denaturant in the sold quantity of denatured ethanol.
3.9 Ethanol Transport – Truck (miles)	Enter the distance for ethanol transport by truck using a publicly available distance estimator tool that reflects the actual transport route. If ethanol is transported to multiple destinations, a weighted average distance may be calculated, or the mileage of the farthest route may be applied.
3.10 Ethanol Transport – Rail (miles)	Repeat instructions in Field 3.9 for ethanol transported by rail.
3.11 Ethanol Transport – Barge (miles)	Repeat instructions in Field 3.9 for ethanol transported by barge.

Site-specific data must be entered in Section 4 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.

Table 5: Instructions for Section 4 - Monthly Operational Data

Field Name	Instructions
4.1 Reporting Month (MM/YYYY)	Enter the 24 consecutive months that reflect the most recent operational data available for the ethanol 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.

Field Name	Instructions
4.2 Beginning Corn Inventory (bushels)	Enter the quantity of corn stored at the ethanol production facility at the beginning of each month of the operational data period.
4.3 Corn Delivered (bushels)	Enter the quantity of corn received at the ethanol production facility, without moisture correction.
4.4 Ending Corn Inventory (bushels)	Enter the quantity of corn stored at the ethanol production facility on the first day of the month.
4.5 Corn Delivered by Truck (bushels)	Enter the quantity of corn delivered by truck.
4.6 Transport Distance by Truck (weighted av. miles)	This input is required if "Site-Specific Data" is selected in Field 3.1. If "Default for Oregon" or "Default for 9 Midwest States" this Field will be hidden, and no user input is required. The weighted average transport mileage must be calculated based on the feedstock quantity from each supplier and its transport distance to the ethanol production facility. Applicants should include supplemental calculations to support weighted average distances.
4.7 Corn Delivered by Rail (bushels)	Enter the quantity of corn transported by rail.
4.8 Transport Distance by Rail (weighted av. miles)	Repeat instructions for Field 4.6.
4.9 Beginning Sorghum Inventory (bushels)	Repeat instructions for Field 4.2 with sorghum as a feedstock.
4.10 Sorghum Delivered (bushels)	Repeat instructions for Field 4.3 with sorghum as a feedstock.
4.11 Ending Sorghum Inventory (bushels)	Repeat instructions for Field 4.4 with sorghum as a feedstock.
4.12 Sorghum Delivered by Truck (bushels)	Repeat instructions for Field 4.5 with sorghum as a feedstock.
4.13 Transport Distance by Truck (weighted av. miles)	Repeat instructions for Field 4.6 with sorghum as a feedstock.
4.14 Sorghum Delivered by Rail (bushels)	Repeat instructions for Field 4.7 with sorghum as a feedstock.
4.15 Transport Distance by Rail (weighted av. miles)	Repeat instructions for Field 4.8 with sorghum as a feedstock.
4.16 North American Natural Gas (MMBtu, HHV)	Enter the quantity of natural gas (NG) used by the entire ethanol production facility sourced from a common carrier NG pipeline in North America, including gas used for coproduct drying or sent to a combined heat and power (CHP) unit. For alternate NG sources, use Field 4.18.

Field Name	Instructions
4.17 Direct Supply Biomethane (MMBtu, HHV)	Enter the quantity of biomethane or biogas used by the entire ethanol production facility. Biogas or biomethane must be physically supplied directly to the production; indirect accounting ("book-and-claim") is not permitted for ethanol pathways.
4.18 Alternate Fuel (MMBtu, HHV)	Enter the quantity of alternate fuel used by the entire ethanol production facility.
4.19 Grid Electricity (kWh)	Enter the quantity of grid electricity used by the ethanol production facility.
4.20 Direct Supply Low-CI Electricity (kWh)	Enter the quantity of low-CI electricity supplied directly to the ethanol production.
4.21 Beginning DDGS Inventory (short tons)	Enter the quantity of DDGS stored at the ethanol production facility the first day of each month.
4.22 DDGS Sold (short tons)	Enter the quantity of DDGS sold each month by the ethanol production facility.
4.23 Ending DDGS Inventory (short tons)	Enter the quantity of DDGS stored at the ethanol production facility the last day of each month.
4.24 DDGS Moisture Content (%)	Enter the DDGS weighted average moisture content.
4.25 DDGS Metered Drying Energy (MMBtu, HHV)	Enter the submetered quantity of North American natural gas used for DDGS drying.
4.26 Beginning MDGS Inventory (short tons)	Repeat instructions for Field 4.21 for MDGS.
4.27 MDGS Sold (short tons)	Repeat instructions for Field 4.22 for MDGS.
4.28 Ending MDGS Inventory (short tons)	Repeat instructions for Field 4.23 for MDGS.
4.29 MDGS Moisture Content (%)	Repeat instructions for Field 4.24 for MDGS.
4.30 MDGS Metered Drying Energy (MMBtu, HHV)	Repeat instructions for Field 4.25 for MDGS.
4.31 Beginning WDGS Inventory (short tons)	Repeat instructions for Field 4.21 for WDGS.
4.32 WDGS Sold (short tons)	Repeat instructions for Field 4.22 for WDGS.
4.33 Ending WDGS Inventory (short tons)	Repeat instructions for Field 4.23 for WDGS.
4.34 WDGS Moisture Content (%)	Repeat instructions for Field 4.24 for WDGS.
4.35 Beginning Syrup Inventory (short tons)	Repeat instructions for Field 4.21 for syrup.
4.36 Syrup Sold (short tons)	Repeat instructions for Field 4.22 for syrup.
4.37 Ending Syrup Inventory (short tons)	Repeat instructions for Field 4.23 for syrup.
4.38 Syrup Moisture Content (%)	Repeat instructions for Field 4.24 for syrup.
4.39 Beginning Distiller's Oil Inventory (lbs)	Repeat instructions for Field 4.21 for distiller's oil.

Field Name	Instructions
4.40 Distiller's Oil Sold (lbs.)	Repeat instructions for Field 4.22 for distiller's oil.
4.41 Ending Distiller's Oil Inventory (lbs.)	Repeat instructions for Field 4.23 for distiller's oil.
4.42 Natural Gas Combusted in CHP (MMBtu, HHV)	Enter the submetered quantity of natural gas (NG) used by the combined heat and power (CHP) unit sourced from a common carrier NG pipeline in North America.
4.43 Electricity Produced (kWh)	Enter the submetered quantity of electricity produced by the CHP.
4.44 Electricity Exported (kWh)	Enter the submetered quantity of electricity exported outside the fuel pathway system boundary by the CHP.
4.45 Steam Produced (MMBtu, HHV)	Repeat instructions for Field 4.43 for steam.
4.46 Steam Exported (MMBtu, HHV)	Repeat instructions for Field 4.44 for steam.
4.47 Beginning Cellulosic Enzyme Inventory (lbs.)	Enter the quantity of cellulosic enzyme stored at the ethanol production facility the first day of each month.
4.48 Cellulosic Enzyme Purchased (lbs.)	Enter the total cellulosic enzyme purchased. Quantities should be reported on an as-received basis without moisture correction.
4.49 Ending Cellulosic Enzyme Inventory (lbs.)	Enter the quantity of cellulosic enzyme stored at the ethanol production facility on the last day of each month.
4.50 Fiber Ethanol Allocation (%)	Enter the average percentage of ethanol derived from fiber, as tested monthly using DEQ-approved lab analytics.
4.51 Beginning Undenatured Ethanol Inventory (gallons @ 60˚F)	Repeat instructions for Field 4.21 for undenatured ethanol.
4.52 Undenatured Ethanol Sold (gallons @ 60˚F)	Repeat instructions for Field 4.22 for undenatured ethanol.
4.53 Denaturant Added (gallons @ 60˚F)	If "Site-Specific Data" is selected in Field 3.8, enter the quantity of denaturant blended at the ethanol facility.
4.54 Denatured Ethanol Sold (gallons @ 60˚F)	Repeat instructions for Field 4.22 for denatured ethanol.
4.55 Ending Undenatured Ethanol Inventory (gallons @ 60˚F)	Repeat instructions for Field 4.23 for undenatured ethanol.

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.

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.

This report uses Arial font consistently for titles, headings and body text. Use the style settings above in the ribbon to apply the proper headings.

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