California Low Carbon Fuel Standard Carbon Intensity Applied to New York State Dairies

Part 1: What is the carbon intensity (CI) score and how is it used?

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The carbon intensity (CI) score is used to appropriately value a unit of transportation fuel under California's Low Carbon Fuel Standard (LCFS) policy. This fact sheet series will cover the CI score related to biomethane, also known as renewable natural gas (RNG), produced from the anaerobic digestion of dairy manure, as applicable to New York State (NYS) dairy farms.

Background

The California Air Resources Board (CARB) established a LCFS program in 2011 as part of the measures put in place to achieve greenhouse gas (GHG) reductions in CA of 20% by 2030 and 80% by 2050. This LCFS program provides an opportunity for dairy farms across the country to monetize the production of pipeline quality RNG delivered via a theoretical path to CA from captured biogas generated from the anaerobic digestion of dairy manure.

The CI score quantifies the life cycle GHG emissions per unit of transportation fuel energy produced so that an appropriate monetary value can be applied. The CI is calculated using the CA-GREET3.0 model, which is applied in a set of Tier 1 fuel pathways that each have a simplified CI calculator offered by CARB. The Tier 1 Simplified CI Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure is a downloadable Microsoft® Excel® spreadsheet[1] that can be useful for project planning purposes and was referenced in the development of these fact sheets. Most projects will vary in one or more aspects from the Tier 1 pathway and will require a Tier 2 application.

> The CI quantification is updated annually based on actual input data collected. LCFS benchmarks become more stringent over time and the CI methodology may be updated, making the credits issued variable in the future.

Terminology

Anaerobic Storage/Treatment Systems: Manure management/treatment systems under anaerobic conditions without a biogas control system (see definition below). For example, the long-term storage of liquid manure, whether separated or raw dairy manure, is an anaerobic storage system.

Baseline Methane Emissions: The "baseline" condition for a dairy farm refers to its historical manure management/treatment systems, and specifically those that release methane. These systems will be replaced either in full or in part by the "project" biogas control system (see definition below). It is ultimately CARB's decision what constitutes the historical baseline (i.e., how many years the system(s) have been used). Note: dairies with existing anaerobic digestion of manure have had the baseline condition that existed prior to the digester installation accepted by CARB.

Biogas Control System (BCS): The BCS is considered to be the "project", typically an anaerobic digester, that is installed to capture and ultimately destroy the methane in biogas produced from livestock manure. The BCS replaces all or part of the baseline manure management/treatment systems.

BCS Effluent Pond: Where the effluent liquid from the BCS is held. This is assumed to be the uncovered long-term storage of liquid/slurry after anaerobic digestion has occurred.

Biomethane: Often referred to as renewable natural gas (RNG), it is the upgraded methane derived from biogas (the raw gas primarily comprised of methane and carbon dioxide generated from anaerobic decomposition of organic matter) that meets vehicle or pipeline standards.

Non-Anaerobic Storage/Treatment Systems: Manure management/treatment systems that are NOT under anaerobic storage conditions, such as daily spread and composting. Separated manure solids can be categorized as non-anaerobic treatment, although their exact classification within this category is not always straightforward (refer to Part 2).

Upgrading: Refers to the conditioning of raw biogas to produce biomethane by removing unwanted compounds (i.e., hydrogen sulfide, water, and carbon dioxide) and compressing the gas to the desired pressure for **compressed natural gas (CNG)** vehicle fueling, direct pipeline injection or truck transport to pipeline injection point or CNG fueling station.

CI score components

The baseline methane emissions that are replaced by the project GHG emissions yields the CI score. Baseline methane emissions will be negative because they are offset by the project. Project GHG emissions will be positive. Typically, and ideally, the baseline emissions are greater than the project emissions, yielding a negative CI score. The CI score is in units of grams of carbon dioxide equivalent (g CO_{2e}) per megajoule (MJ) of net fuel (biomethane) produced by the project.

Baseline methane emissions from existing manure management practices

- Specify each practice by population of livestock category

Project digester-related methane emissions

- Venting events
- Digestate (digester effluent) long-term storage
- Digester methane leakage*

*Leakage of methane from enclosed vessel anaerobic digestion is set to 2% of raw biogas production.
**Methane leakage during upgrading is set to an additional 2% of raw biogas at upgrading inlet.

Project energy and biogas upgrading GHG emissions

- Digester electricity use (net over baseline manure mgmt.)
- Diesel for manure hauling (net)
- Digester natural gas / propane use (e.g., for heating)
- Upgrading electricity use
- Upgrading natural gas use
- Biomethane flared
- Fugitive methane leakage during upgrading**

Project biomethane transport and use GHG emissions

- Trucking tailpipe
- Pipeline transport from injection point to CNG plant (standard station centroid: Bakersfield, CA)
- Compression of CNG at fueling station
- CNG vehicle tailpipe

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Part 2: Guidance on Tier 1 CI score computation

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[1] https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation.

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