B.C. Low Carbon Fuel Standard: Proposed Changes in Allocating Biodiesel Co-Product Emissions Using GHGenius 5.02b: Intentions Paper

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1. Introduction

This intentions paper is intended to outline changes in allocating co-product emissions using GHGenius 5.02b for biodiesel pathways.

- **Scope:**
    - Updating the emissions factors for glycerine co-products in biodiesel pathways,
    - Adding new co-products to biodiesel pathways, and
    - Correcting methanol combustion emissions (applied if energy or mass is chosen in the model as the allocation method).
    - The changes discussed in this intentions paper will not affect fuel codes which are already approved, CI applications which have been submitted and are under review, and the CI applications which will be submitted before the end of consultation period.

- **Next steps:**
    - Following public consultation, Ministry staff will collaborate with the developer of the GHGenius model $(S\&T)^2$ to develop a guidance document for the biodiesel pathway.
    - Feedback received will be incorporated into the development of emissions factors for co-products and will be used to update the GHGenius model.
    - The completed guidance document will be published on the BC Low Carbon Fuels Standard (LCFS) website.

    Implementation timeline:
    - Regulation updates for the next version of GHGenius are targeted for the second quarter of 2025.
    - Temporary solutions will be implemented as soon as the above guidance document is published.

The Ministry is accepting feedback on these changes. Responses must be in writing and must be submitted by email or mail before 5 p.m. on September 23rd, 2024 to one of the following addresses:

Email: lcfs@gov.bc.ca

Mail: Low Carbon Fuels Branch
B.C. Ministry of Energy, Mines, and Low Carbon Innovation
P.O. Box 9314 Stn Prov Govt
Victoria, B.C. V8W 9N1

2. Issues

Three opportunities for improvements have been identified in GHGenius regarding biodiesel pathways: (1) Additional Co-products, (2) Glycerine Market Shift, and (3) Methanol Combustion.

2.1 Additional Co-products

Some biodiesel plants have co-products other than glycerine. The two main ones are **distillation bottoms** and **free fatty acids (FFAs)**.

Distillation bottoms are typically long chain methyl esters and are from plants that distill the biodiesel to improve its quality. They are most often used as a fuel in stationary applications.

Some feedstocks have FFAs that cannot be converted to methyl esters through the transesterification process. These materials pass through the process, are separated from the biodiesel and are then sold as fuel or feed applications.

Distillation bottoms and FFAs are generally added to the produced glycerine in GHGenius. This causes some plants to have a greater mass of co-products than would be indicated by the stoichiometric production of glycerine.

2.2 Glycerine Market Shift

The structure of the glycerine market has changed significantly in the past 20 years since the biodiesel pathway was introduced in GHGenius. At that time there was still significant synthetic glycerine production in North America and in Europe. The standard practice in many of the biodiesel LCA studies that were being published in Europe was to provide a displacement credit for the glycerine co-product from biodiesel plants assuming that it displaced synthetic glycerine.

Twenty years later the production of synthetic glycerine has ceased in North America, although there is still one plant operating in Europe and there may still be some production in India, although to is difficult to confirm this.

The current version of GHGenius is still using emissions factor for glycerine products which are associated with synthetic glycerine, when the displacement allocation method is selected. This issue is overestimating the emissions of the co-products which results in inaccurate carbon intensity of biodiesel.

2.3 Methanol Combustion

The energy displacement factor in GHGenius considers that there is some fossil methanol input into the system and this fossil methanol is accounted for in the glycerine co-product treatment. This was fine when only the displacement approach was included in early

versions of GHGenius, but it would probably be appropriate to treat this as most other models do and use the emissions from the production and combustion of methanol instead of just the production of methanol in the biodiesel production emissions.

3. Model update

To address the above issues, the following changes are proposed to be made in the GHGenius model for biodiesel pathways, resulting in a new revision of the model.

3.1 Additional Co-products

Free fatty acids (FFA) will be explicitly added as a co-product for biodiesel in “Coprods” tab. The material could be used as a feedstock for renewable diesel plants or other biodiesel plants that can convert FFAs to biodiesel or it can be used as animal feed.

Distillation Bottoms will be explicitly added as a co-product in “Coprods” tab. This would be ten-fold increase from the value that is currently in the model, but this is due to the combustion emissions now being included in the fuel production emissions.

3.2 Displacement Factors

The displacement of glycerine driven from renewable feedstocks, rather than synthetic glycerine, would be used in the model. This update would recognize that the prevailing source of glycerine is palm-derived with some percentages of other feedstocks such as soybean oil and canola oil. Therefore, a weighted average displacement of glycerine derived from crops would be the commodity displaced by glycerine produced as a co-product from biodiesel production in the model. Emissions factors for biodiesel co-products in the new version of GHGenius will be as following:

Co-product	**Existing Emission Factor**	**New Emission Factor**
Glycerine (feed)	400 grCO2e/Kg Glycerine	400 grCO2e/Kg Glycerine
Free Fatty Acids	N/A	400 grCO2e/Kg Glycerine
Glycerine (fuel)	300 grCO2e/Kg Glycerine	Note 1
Distillation Bottoms	N/A	Note 1
Glycerine (crude)	6,590 grCO2e/Kg Glycerine	1,975 grCO2e/Kg Glycerine (Note 2)
Glycerine (refined)	13,180 grCO2e/Kg Glycerine	3,950 grCO2e/Kg Glycerine (Note 2)

Note 1: The displaced emissions will be the emissions for heating oil in the model. This would be cell AC27 on the “Equip Emis Factors” tab adjusted by the difference in energy between a kilogram of heating oil and a kg of distillation bottoms.

Note 2: The emission factors for crude and refined glycerine are still under review. Currently, emission factor of synthetic glycerine made in petrochemical plants is used in the model. The baseline emission factors in the above table are based on glycerine produced from palm oil. The ministry recognizes that glycerine produced as a co-product of biodiesel may replace various other products, including glycerine derived from sources such as canola and soybean, synthetic glycerine, propylene glycol, sorbitol, and other sweeteners. We are working to establish a weighted average emission factor that more accurately reflects the market. The ministry invites interested parties to share any relevant information, studies, reports, or other documents that could aid in understanding the market dynamics and carbon intensity of such products.

3.3 Methanol combustion

On the “Alt Fuel Prod” tab, cell J127, which is zero now, will be changed to (='Exhaust Emissions'!F96*'Fuel Char'!B103/1000). This will add the fossil combustion emissions to the biodiesel production emissions. This will result in a more correct value if allocation by energy or mass is chosen in the model.

4. Temporary solution

The Low Carbon Fuels (Technical) Regulation (technical regulation) mandates the use of GHGenius version 5.02b for life cycle assessments (LCAs) of transportation fuels. The Director can authorize minor corrections to the model that have minimal impact on carbon intensity (CI) calculations. However, significant changes affecting CIs require a model revision and a corresponding regulatory update.

The corrections outlined in section 3 are considered substantial, requiring a regulation update. This process can take several months, and due to the current election year, it cannot be initiated until the new government is established.

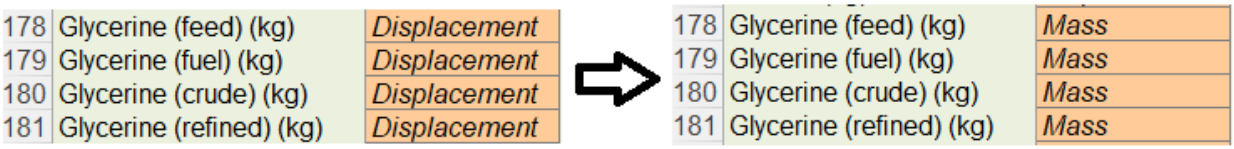
In the meantime, the Ministry has identified two temporary solutions to make sure the most accurate CIs are allocated to biodiesel pathways.

4.1 Mass allocation

GHGenius generally uses the displacement approach for co-products as that is the preferred option in ISO 14040 compliant LCA standards. The displacement method expands the boundary of LCA to include the actual impact of the product which is being displaced. GHGenius has the option for using mass and energy allocation where these are determined to be more appropriate than displacement. In the case of glycerine in current

version of the model, using displacement allocation is not accurate because of data limitations and some co-products being physically linked together.

Using mass allocation will limit the boundary of the LCA to the production plant, but it would be more accurate than current default method of allocation by displacement. Applicants can continue to use GHGenius 5.02b, but they should switch cells B178 to B181 of the "Coprods" tab from displacement to mass as shown in figure 1 below.



4.2 Alternative Method

The developer of GHGenius, (S&T)[2], is working on fixing the above issues and will release a new revision of the model on their webpage. However, this new version of the model will not be the official and approved version of the model for CI determination purposes, until the technical regulation update is performed.

Section 21(3)b of the *Low Carbon Fuels Act* stipulates that a CI using an alternative method may be published, provided the director accepts the method as a more precise determination of the carbon intensity of the fuel and the method is developed and proposed in accordance with the technical regulation. Please see RCLF-025 for more details about alternative method.

Fuel suppliers can use a newer version of GHGenius (5.02c) and apply for an alternative method for biodiesel pathways, if they prefer to use displacement as their method of allocating co-product emissions.