B.C. Low Carbon Fuel Standard Avoided Emissions Policy: Intentions Paper for Consultation

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Introduction

This document is intended for the purposes of consultation only. The B.C. Renewable and Low Carbon Fuel Requirements Regulation requires that fuel carbon intensities are determined through a lifecycle assessment, which often includes a credit for the avoided emissions from co-product displacement and sometimes include the avoided emissions from waste inputs. The Ministry has identified concerns with the current policy of including a credit for 100% of the avoided methane emissions from utilizing waste inputs in the fuel lifecycle and is considering policy alternatives. These alternatives may affect the carbon intensity of certain fuels.

The purpose of this intentions paper is to inform stakeholders of relevant background information regarding this issue, to discuss the alternatives under consideration, and to solicit feedback. The Ministry is seeking feedback regarding the policy under consideration for determining emission avoidance credits. A response form for public comments is provided with this intentions paper. Feedback will be accepted until Friday, May 3, 2019.

This intentions paper and the accompanying response form can be accessed on the Ministry's website at: https://gov.bc.ca/lowcarbonfuels. Definitions of important terms are provided in Appendix A.

Background

The *B.C. Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* and the B.C. Renewable and Low Carbon Fuel Requirements Regulation are together referred to as the B.C. Low Carbon Fuel Standard (BC-LCFS). Under the Regulation, fuel suppliers must progressively decrease the average carbon intensity of their fuels to achieve a 10% reduction in 2020, and the Government has proposed requiring a 20% reduction in 2030. The carbon intensity of a fuel represents the greenhouse gas emissions associated with its production and use as determined by a lifecycle assessment, presented in terms of grams of carbon dioxide equivalent per mega joule (gCO_2eq/MJ) of the produced fuel. A lifecycle assessment considers the emissions associated with each stage of a fuel product's life and all materials and energy used from feedstock production or acquisition through fuel use. The number of low carbon fuel credits that can be obtained from the fuel is directly proportional to the difference in carbon intensity (CI) between the fuel class limit (81.09 gCO_2eq/MJ for gasoline and 87.18 gCO_2eq/MJ for diesel in 2019) and the low carbon fuel [1]. Low carbon fuel credits are used to cancel debits from obligated parties and are traded within the credit market.

There are three types of lifecycle assessment (LCA) that can be used to determine the carbon intensity of a fuel: attributional, consequential, and hybrid.

Attributional LCA

An attributional LCA accounts for only the direct emissions associated with the fuel lifecycle, including the emissions from production of energy and material inputs to the fuel lifecycle. Emissions are allocated between co-products based on a physical quantity and indirect impacts are not considered. Figure 1 gives an example of the processes and emissions considered within the LCA of a fuel pathway using an attributional approach.

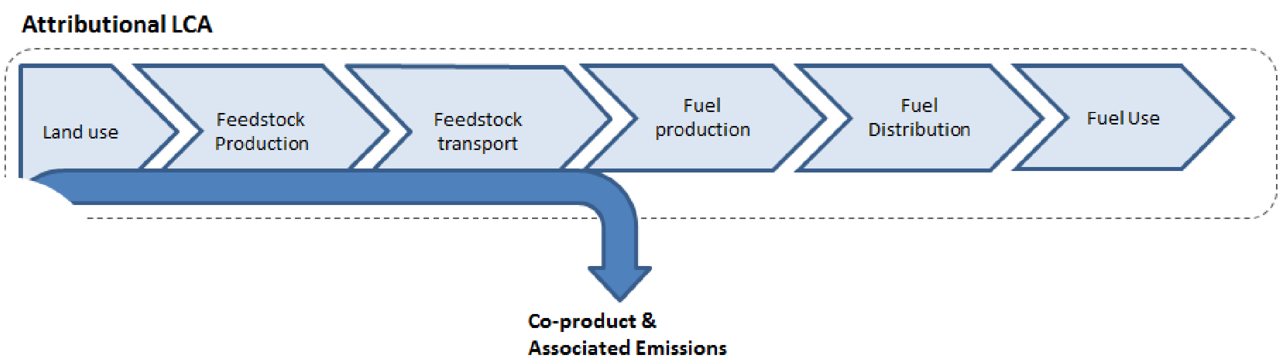

Figure 1: Attributional LCA system boundary: each arrow represents the emissions from this process and inputs to the process [2].

Consequential LCA

A consequential LCA determines the comprehensive greenhouse gas (GHG) emissions of a product by assessing the direct and indirect impacts of the fuel on external markets. A consequential LCA considers the market effects of a change in production, expands the system boundary to include non-fuel system impacts, and includes the indirect effects of the fuel production on the environment (e.g. indirect land use change) [2].

The consequential approach to LCA essentially compares a scenario without the fuel to one with the fuel and attributes the resulting changes in affected markets to the fuel. The fuel baseline represents what would have occurred in the absence of the fuel production project. In

Consequential LCA

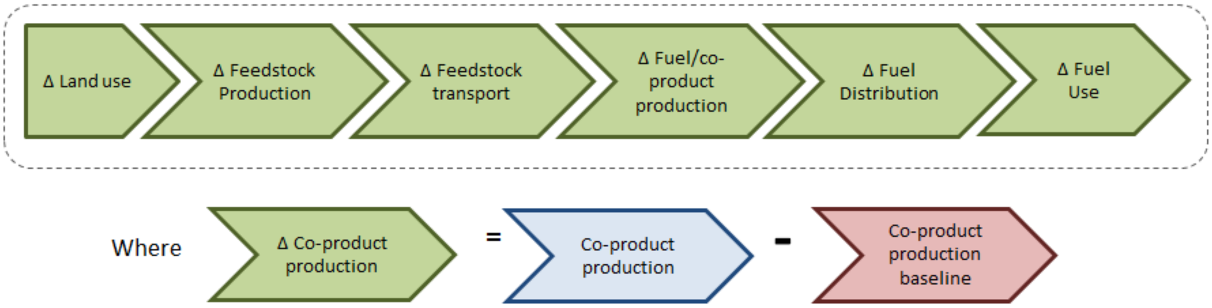

Figure 2: Consequential LCA system boundary; each element represents the emission difference between the fuel production scenario and its baseline

consequential assessments, a baseline is required for each element of fuel production. Each arrow in Figure 2 represents a separate consequential element and baseline. The emission difference between the fuel production scenario and its baseline represents the emissions that were caused or avoided by the production of the fuel. The 'avoided emissions' credited to the fuel system can be significant when the baseline is GHG-intensive. In a fully consequential LCA, these differences are measured on a global scale and include all indirect effects of fuel production.

As an example, a consequential LCA uses the displacement (i.e. system expansion) allocation method to include the impacts of co-product production on systems and markets outside of the fuel pathway. The displacement co-product allocation method expands the system boundaries to include the lifecycle of the co-product and its alternative (i.e. baseline) in the market. The lifecycle emissions associated with the production of the co-product baseline are subtracted from the total emissions of the pathway, acting as a credit.

To illustrate, canola meal is a co-product of biodiesel production. When using the displacement co-product allocation method, the emissions from soymeal production, which is what would have been used if the canola meal hadn't been produced, are subtracted from lifecycle emissions of canola biodiesel [3]. Each time a consequential element is used, the system boundary of the fuel is expanded to include direct or indirect impacts on markets external to the fuel pathway through a comparison with the baseline.

Hybrid LCA

Hybrid LCA is a blend of attributional and consequential LCA (Figure 3). The BC-LCFS utilizes the GHGenius LCA model which follows a hybrid approach. GHGenius is primarily attributional except for the consequential treatment of co-products, land use, and some aspects of feedstock production. The consequential aspects of land use included within the GHGenius model are soil organic carbon and above and below-ground biomass changes as a result of feedstock cultivation for fuel production. This element takes

Hybrid LCA

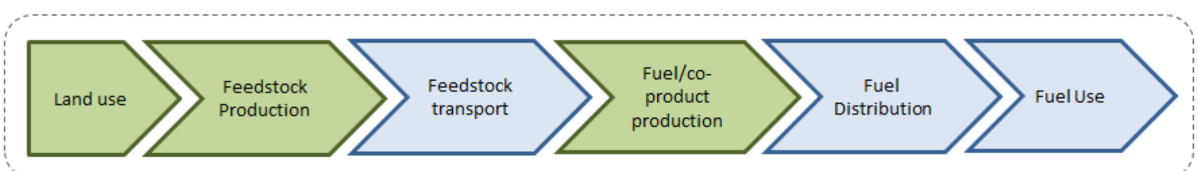

Figure 3: Hybrid LCA system boundary; mix of attributional and consequential approaches

into account the loss or gain in carbon due to land clearing or planting grasses on degraded lands.

GHGenius also includes consequential aspects of feedstock production, by including the emission difference between using the feedstock for fuel production and its alternative fate, or baseline. These differences are generally included for feedstocks that are otherwise considered wastes, specifically corn stover, municipal solid waste, and manure. In an attributional LCA, upstream emissions are not considered for waste feedstocks. They are essentially emission free. However, in consequential LCA, the system boundary around waste production is expanded to include the emission differential between using the waste for fuel production and its baseline. In the case of corn stover, fertilizer must be added to the field to replace the lost nutrients when corn stover is removed for use in fuel production. In this case, the emissions from the production of the additional fertilizer are attributed to the fuel pathway. In the case of municipal solid waste, organic waste, or manure, the baseline is GHG-intensive. Methane is released into the atmosphere from these wastes as they decay, so GHGenius provides a credit to the fuel pathway for avoiding these emissions from occurring.

Issue

The Ministry of Energy, Mines, and Petroleum Resources has received an increasing number of applications utilizing the avoided emission credit for waste feedstocks. The baselines of these avoided emission credits are generally based on the circumstances at each waste facility, including any regional policies. The magnitude of the avoided emission credit, along with the differing baselines between jurisdictions, has brought into question whether expanding the system boundary of the feedstock LCA component is appropriate or whether this should be approached in an attributional manner. In some situations, the avoided emission credit obtained from expanding the system boundary significantly outweighs all other emissions in the fuel lifecycle, resulting in extremely low, negative carbon intensities. The CI reductions provided by the waste credits are much larger than those generally seen from the system expansion around other GHGenius consequential components, such as co-products and soil organic carbon.

If the system expansion around this component continues, an appropriate baseline needs to be established. The baseline is well established for many co-products, but there is little consensus on the appropriate baseline for waste feedstocks. Once the baseline is established, an LCA of the baseline scenario determines the avoided emissions that can be attributed to the fuel system as an avoided emission credit for waste feedstocks.

Options

Ministry staff are considering three approaches to including avoided emission credits for waste feedstocks in LCA. The benefits and drawbacks of each option are described below. Examples of how each option might impact the carbon intensity of a fuel are provided in Appendix B.

The protocols developed for the Quebec Offset Program and the California Low Carbon Fuel Standard by the California Air Resources Board provide some guidance to determining the baseline for avoided emissions, so are considered in the assessments of each option. Both of these programs consider the avoided emissions from projects across Canada. The B.C. Offset Protocol has a similar baseline approach to that of Quebec, but only considers projects within the Province so is not discussed further.

Option 1: Status Quo: System Expansion with Facility-Specific Baseline

Current practice among practitioners is to expand the system boundary of the fuel pathway to include the avoided emissions from the waste alternative and use the circumstances at the feedstock production facility prior to developing fuels as the baseline. GHGenius 4.03a currently follows this practice for several pathways. For example, if a landfill was not previously capturing methane gas, 100% of the methane avoided from the landfill would be credited to municipal solid waste fuels within the model.

However, many jurisdictions regulate methane capture or waste diversion. When regulations are in place within the operating jurisdiction, only the avoided emissions above the legislated requirements are recognized. For example, if the operating jurisdiction set a target to reduce methane emissions from manure storage by 30%, only avoided emissions above 30% would be counted toward an avoided emissions credit for the manure-based fuel.

Benefits:

- Represents additional emission reductions occurring at the waste handling facility.
- Incentivizes waste diversion projects.
- Aligns with the Quebec offset protocol, which considers the regulatory requirements within the Canadian operating jurisdiction as the baseline for determining eligible, additional emission reductions [4].

Drawbacks:

- Baseline differs for each proponent according to their operating jurisdiction.
- Allows companies to reduce the GHG emissions of fuels by moving to jurisdictions with less stringent environmental standards, rather than improving aspects of the fuel pathway.
- Could incentivize companies to lobby to maintain lower environmental standards in their operating jurisdiction.
- Decreases the competitiveness of companies operating in jurisdictions with strong environmental standards such as B.C., since they will receive a reduced credit.
- Administratively burdensome, since it requires Ministry staff to determine and monitor the emission and waste legislation within each jurisdiction.
- Increases the complexity of the LCA by including an additional consequential component.
- Does not align with the California Air Resources Board's (CARB) approach.

Option 2: No System Expansion

An alternative option is to follow an attributional approach for the feedstock production component of the fuel lifecycle. This would remove the consequential system expansion of this component and the associated avoided emission credit for wastes.

Benefits:

- Applied equally to all proponents.
- Reduces the attribution of non-fuel GHG reductions to fuels.
- Eliminates the incentive for lobbying to maintain lower environmental standards.
- Reduces administrative burden, since Ministry staff do not need to monitor the regulations of other jurisdictions.
- Encourages market transformation in the fuel sector, since low carbon intensities resulting from avoided emissions in other sectors are reduced.

Drawbacks:

- GHG emission reductions above legislated requirement are not captured.
- Does not align with the approaches of California Air Resources Board's (CARB).

- Does not align with the additionality concept within the Quebec carbon offset protocol.
- May cause a large increase in the carbon intensity values of some fuels that currently include a credit for methane emission avoidance (see Appendix B, Examples 1 &2).

Option 3: System Expansion with B.C. Baseline

This alternative expands the system boundary of the fuel lifecycle to include the avoided emissions from the waste alternative, but uses the B.C. regulatory environment as the baseline. This baseline would be applied equally to all proponents regardless of their operating jurisdiction.

As an example, B.C. has a performance objective of 75% methane capture from all medium-large landfills as part of the Landfill Gas Management Regulation [5]. Under this approach, the avoidance credit for fuels produced from municipal solid waste would be 25% of the total potential methane regardless of where the landfill is located, as 75% is assumed to be captured under the Regulation.

<u>Benefits:</u>

- Equivalent baseline for all proponents.
- High B.C. environmental baseline minimizes the additional non-fuel related avoided emissions included in the fuel LCA [5] [6].
- Ensures that the BC-LCFS policy is not affected by lobbying efforts for reduced environmental standards outside its jurisdiction.
- Aligns with the California Air Resources Board's (CARB) approach.
- Reduces administrative burden, since Ministry staff do not need to monitor the regulations of other jurisdictions.
- Encourages market transformation in the fuel sector, since low carbon intensities resulting from avoided emissions in other sectors are reduced.
- Maintains the competitiveness of companies operating in jurisdictions with strong environmental standards such as B.C.

<u>Drawbacks:</u>

- Reduces the reward for companies that provide an alternative use for wastes.
- Does not represent emission reductions taking place when waste-to-fuel production is operating in jurisdictions without methane capture requirements.
- Does not align with the Quebec offset protocol, which considers the regulatory requirements within the Canadian operating jurisdiction as the baseline for determining eligible, additional emission reductions [4].
- May cause a large change in the carbon intensity of fuels that currently include a credit for methane avoidance. Could increase the perceived risk of low carbon fuel investments.
- Requires Ministry staff to monitor regulatory changes within other ministries (e.g. waste management or manure regulations).

Examples of pathways that may be affected by the selected option are provided in Appendix B, including details regarding how these options may affect the pathway carbon intensities.

Appendix A - Definitions

Carbon intensity – the greenhouse gas emissions attributable to the fuel under the regulations proportionate to the energy provided by the fuel in its expected use for transport, expressed as grams of carbon dioxide equivalent emissions per megajoule of energy (gCO_2eq/MJ).

Co-product – the additional products that are produced during a fuel's lifecycle that are not the primary fuel or fuel intermediates.

Baseline – the situation that would have occurred if the low carbon fuel were not produced.

System boundary – the boundary around the fuel lifecycle that describes the processes and flows that are included in the lifecycle assessment.

Avoided emission credit for wastes– the greenhouse gas emissions avoided by diverting a waste material from a GHG-intensive fate for fuel production; these emissions are credited to the fuel LCA.

Direct impact/effect – the greenhouse gas emissions associated with all material and energy flows into and out of the fuel lifecycle system boundary.

Indirect impact/effect – the greenhouse gas emissions associated with marginal changes in other economic sectors as a result of the fuel product's production, e.g. indirect land use change.

Indirect land use change – the greenhouse gas emissions associated with land use changes in one region of the world as the result of agricultural land displacement for fuel production in another region of the world.

Appendix B – Examples

This section presents several fuel pathways that may be impacted by the policy decision regarding avoidance emission credits for wastes. Each example provides a brief overview of the affected fuel pathway and how the options considered within the intentions paper for determining the avoidance emission credit for wastes would impact the magnitude of the credit provided to this pathway. Figures are also provided that indicate how the carbon intensity changes based on the percentage of avoided emissions from the waste baseline attributed to the pathway. The carbon intensity that would be expected from each option considered within the intentions paper is also included in the graph.

Example 1: Liquid fuels from municipal solid waste

Municipal solid waste (MSW) is typically disposed of in a landfill where the organic portion decays to methane due to the anaerobic environment. When MSW is diverted for fuel production, this decay is avoided. In this case, the status-quo baseline, or alternative, of using the MSW for fuel production is: *"MSW is placed in a landfill where 100% of the organic portion decays anaerobically and releases methane into the atmosphere."*

Option 1

Landfills are regulated in some jurisdictions to limit the amount of methane that is released to the atmosphere. When the GHG reduction regulations within the waste sector are taken into account, the MSW baseline becomes: *"MSW is placed in a landfill where 100% of the organic portion decays anaerobically and releases methane into the atmosphere. These emissions are reduced by any operating or capture requirements imposed by regulations in the jurisdiction in which the landfill is operated."*

Legislated methane capture requirements at certain landfills are in place in Quebec [4] and Ontario [7], but are not as rigorous as the regulation in B.C [5]. If each jurisdiction were to produce fuel from MSW, the MSW baseline would change according to the jurisdiction and its regulations. This translates into an avoided emission credit for wastes equal to 100% of the avoided landfill emissions in jurisdictions with no regulations to an avoided emission credit for wastes equal to 25% of avoided landfill emissions when the production facility is located in B.C. In Figure 4, the facility is assumed to be located in a jurisdiction with no regulatory requirements for Option 1.

Option 2

Eliminating the credit entirely makes the situation at the landfill irrelevant. With this approach, the avoided emissions from diverting the MSW from the landfill for fuel production are not considered. Only the emissions from the fuel lifecycle are included (with the exception of co-product system displacement).

Option 3

British Columbia requires all landfills with over 100,000 m^3 MSW of waste in place (or receiving more than 10,000 m^3 MSW per year) and emitting more than 1000 m^3 of methane per year to capture the landfill gases reaching 75% efficiency under the Landfill Gas Management Regulation [5]. CARB uses the same approach. Given that California requires that 75% of all methane is captured at landfills regardless of size, CARB has chosen to allow a universal avoided emission credit for wastes which accounts for 25% of the avoided methane from MSW landfill decay regardless of the operating jurisdiction [8]. With a 75% methane capture performance objective in place in B.C. under the Landfill

Gas Management Regulation, using this baseline would allow an avoided emission credit for wastes equal to 25% of the total landfill methane produced.

Figure 4 indicates the impact that the options under consideration could have on the carbon intensity of a MSW-based fuel.

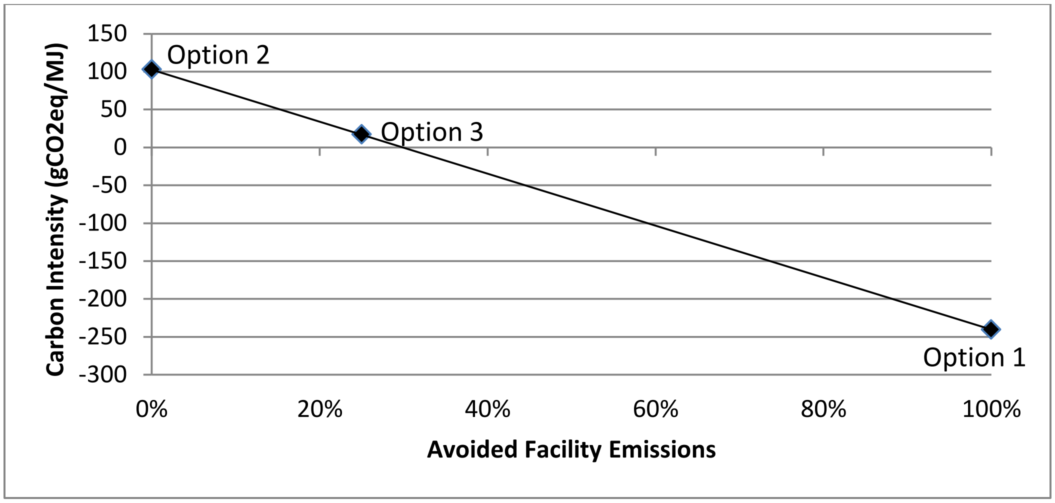

Figure 4: Carbon Intensity of MSW fuel utilizing each methane avoidance option; Pathway assumptions are for ethanol fuel, 80% organic MSW content, Canadian average, no prior methane capture system in place, GHGenius defaults

Example 2: Renewable natural gas (RNG) from manure, organic wastes, and landfills

Renewable natural gas (RNG) is comprised mainly of methane and is produced from the decay of organic substances such as manure, food waste, and other organic materials. It can also be produced from the gasification and subsequent upgrading of biomass. To produce RNG from organic decay, methane must be captured from decay processes and upgraded to bring the RNG to pipeline specifications for natural gas. The methane capture is generally accomplished through the use of an anaerobic digester, in the case of manure and organic wastes, or methane capture systems in the case of landfills.

As long as not previously captured for other uses, the alternative to capturing these gases for RNG production is release into the atmosphere. Manure is generally applied to land as a fertilizer. Until the fertilizer is needed, the manure is often stored in an open lagoon or other holding facility where it decays anaerobically and releases methane into the atmosphere. The fate of food waste and other organics is generally the landfill unless regional composting facilities exist. As described earlier, organics decompose while in the landfill and produce methane gas due to the anaerobic conditions. Since these gases are predominantly methane (landfill gas is comprised of 50% methane and 50% CO_2), the global warming impact of their release is high for even small amounts.

Option 1

As described in Example 1, many Canadian jurisdictions have regulations surrounding organic diversion from landfills or methane capture at landfills. RNG produced from the anaerobic digestion of organic material would receive a credit for the emissions avoided above the regional regulatory requirement if the regional baseline were used.

Regulations requiring methane capture from manure storage are much less common. A preliminary investigation of Canadian regulations did not find any limitations or restrictions on methane release from manure storage. If this option is selected, more research would be needed to identify the regulatory requirements for manure storage across Canada. In Figure 4, the facility is assumed to be operating in a jurisdiction with no regulatory requirements to capture methane from manure storage for Option 1.

Option 2

Eliminating the credit entirely makes the regulatory environment regarding manure and landfills irrelevant. With this approach, the avoided emissions from diverting the organics from the landfill/compost or manure from storage in order to use for fuel production are not considered. Only the emissions from the fuel lifecycle are included (with the exception of co-product system displacement).

Option 3

The B.C. Landfill Gas Management Regulation requires B.C. landfills to work toward a 75% methane capture performance objective [5]. The Regulation expects each obligated landfill to reach the highest methane capture efficiency possible for their topography and conditions. As a result, any methane capture that occurs at landfills would already be required by the legislation and would not be additional unless the landfill size was below the legislated requirement. Therefore, no avoided emission credit for wastes would be provided for RNG from landfill gas fuels when using a B.C. baseline.

B.C. does not currently have regulations that require the capture of methane from manure storage. Therefore, using a B.C. baseline would result in allowing an avoided emission credit for wastes of 100% of the avoided methane emissions from manure storage.

Figure 5 indicates the general effect that the considered options could have on the carbon intensity of an RNG pathway using landfill gas or gas from anaerobically-digested manure.

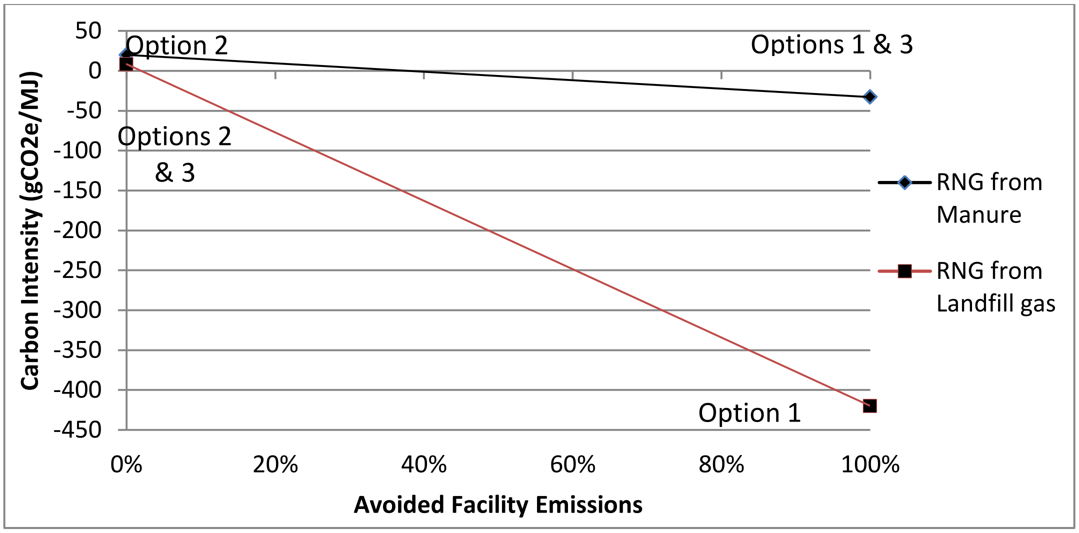

Figure 5: Carbon Intensity of RNG fuels (landfill gas- & manure-based) utilizing each methane avoidance option; Pathway assumptions for manure: Dairy manure at 25°C, Canadian average, GHGenius defaults; Pathway assumptions for Landfill gas: Canada average, 10% pneumatic venting, insertion into NG grid, GHGenius defaults

Example 3: Gas-to-liquid fuels from associated gas

Associated gas, or associated petroleum gas, is a form of natural gas that is found within petroleum deposits either as a gas cap above the oil in the reservoir or dissolved in the oil. Associated gas generally has a number of impurities, such as CO_2 and H_2S that must be removed before it can be sold as natural gas, but it is a valuable commodity and is generally captured and purified [9]. However, in areas where natural gas pipelines and infrastructure are not available to transport the natural gas product, or where a natural gas market does not exist, it may not be worthwhile to capture the gas so it is continuously flared instead [9]. Flaring is the practice of combusting hydrocarbon gases, generally in a large stack, to avoid the release of potentially harmful gases to the environment. As the associated gas is predominantly methane, which has a 25 times greater global warming effect than CO_2, combusting the gas into CO_2 prior to release minimizes the global warming impact of the gas.

Option 1

Flaring was once commonplace but is now generally avoided or prohibited for environmental reasons. However, despite efforts by the 2004 World Bank Global Gas Flaring Partnership (GCFP), 3.5% of natural gas worldwide continues to be flared [10]. Russia flares the greatest volume of gas, accounting for approximately 18% of worldwide flares, followed by Iraq, Iran, and Nigeria [10]. In these countries, the associated gas could be considered a waste since it is flared for disposal and its capture is not required. In these cases, the baseline for the associated gas is flaring. If a fuel were produced in one of these jurisdictions or another where associated gas flaring was not regulated, a credit equal to 100% of the avoided flaring emissions could be applied to the fuel system. For illustration purposes, this situation is assumed for Option 1 in Figure 6.

In Canada, flaring is regulated both at the Provincial and National level. In 2016, Canada committed to eliminate continuous, routine flaring from operations nation-wide by 2030 when it endorsed the World Bank's 'Zero Routine Flaring by 2030' initiative [6]. It is difficult to eliminate all flaring, as flaring is still a safety mechanism employed during system upsets, emergencies, drilling, and maintenance, but a 95%

flaring reduction from continuous levels is deemed reasonable and commonly set as a policy target [5]. Facilities operating in Canada would therefore only receive credit for emission avoidance above 95% using this baseline.

Option 2

Eliminating the credit entirely makes the situation at the oil well and its operating jurisdiction irrelevant. With this approach, no avoided emissions from flaring are considered. Only the emissions from the fuel lifecycle are included (with the exception of co-product system displacement).

Option 3

The Flaring and Venting Reduction Guideline [11] provides regulatory requirements in B.C for the elimination of all routine flaring. Similar regulations are in place in all provinces with substantial oil and gas activities [6]. A 95% reduction from continuous flaring is generally required by these regulations, allowing 5% flaring for system upsets, emergencies, etc. Using Option 3, a credit for 5% emission avoidance would be included in fuel pathways from associated gas, assuming that the flaring from emergencies and upsets is avoided when the gas is captured for fuel. This is the situation assumed for Option 3 in Figure 6. If emergency and maintenance flaring is still occurring when the associated gas is collected for fuel production, then no credit would be included since no reductions above the baseline are occurring.

Figure 6 indicates the general effect that the considered options could have on the carbon intensity of Fischer-Tropsch diesel produced from associated gas.

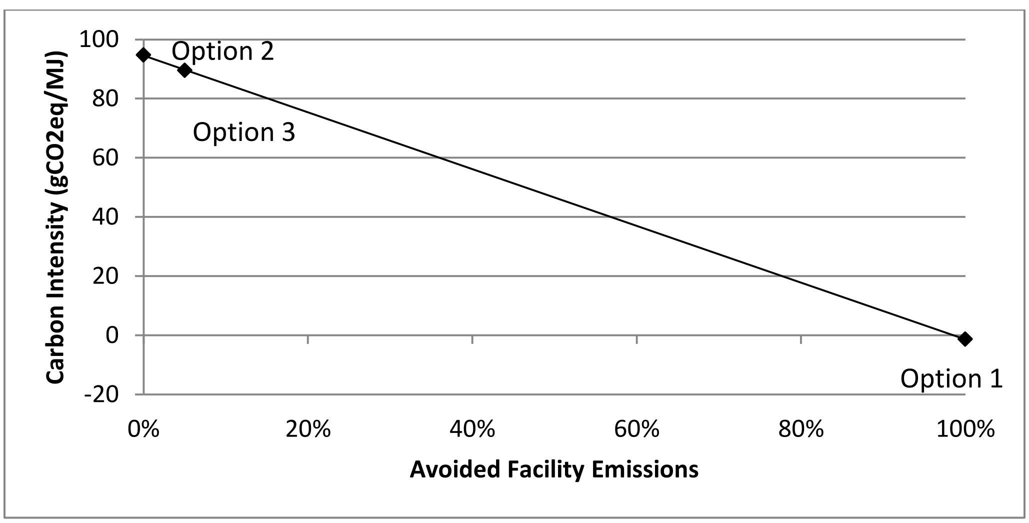

Figure 6: Carbon Intensity of Fischer-Tropsch Diesel from Natural gas using each methane avoidance option; Pathway assumptions for Option 1 International are US Central electricity/NG mix, 18,000 km by marine vessel, 98% flare efficiency, GHGenius defaults; Pathway assumptions for other options is Canada average electricity/NG mix, No credit or 95% flaring avoidance, GHGenius defaults.

Example 4: Fuels from forest residues

Forest harvesting operations produce many types of non-merchantable fiber, such as tree tops, branches, and stumps. These residues, called slash, are often piled by the roadside after harvesting and burned to reduce fire hazard risk.

Forest residues produce a significant quantity of emissions when burned. The majority is CO_2, which is considered biogenic (produced by living organisms, so it does not contribute to additional atmospheric CO_2), but some methane (1.1 – 5.7 gCH_4/kg wood) is also produced due to incomplete combustion [12]. The exact amount of methane produced depends on the moisture content of the wood, with the highest methane emissions occurring with wet, uncovered slash piles [12].

Option 1

Many jurisdictions require forest slash burning in fire-prone areas. In Alberta, the Forest and Prairie Protection Regulations Part II [13]requires the burning or chipping of all slash resulting from clear cut logging, while in B.C. the Wildfire Regulation [14] requires slash burning whenever it is deemed to pose a fire risk. In jurisdictions with regulations in place that require the burning of forest residues, the baseline for using the forest residue as a transportation fuel feedstock is burning. When Option 1 is used, 100% of the avoided emissions from slash burning are attributed to the fuel production pathway as a credit in these jurisdictions. This is the situation represented in Figure 7.

Option 2

Eliminating the credit entirely makes the situation at the cutblock and its operating jurisdiction irrelevant. With this approach, no avoided emissions from slash pile combustion are considered. Only the emissions from the fuel lifecycle are included (with the exception of co-product system displacement).

Option 3

In B.C., the *Wildfire Act* [15] and Wildfire Regulation [14] require that forest residues be assessed for fire hazard risk before the harvesters leave the site. If a fire risk is determined, the risk must be mitigated. Mitigation generally involves the removal of the forest residues, either through transportation off site for other purposes (e.g. wood pellet production) or through controlled burning. Slash burning is the most common practice in B.C. and occurs at approximately 50% of inland timber supply blocks and 15% of coastal supply blocks according to survey conducted in 2010 by the B.C. Ministry of Forests, Lands, Natural Resource Operations, and Rural Development [16].

When deemed a fire risk, the alternative to using forest residues for fuel is burning. Fuels using forest residues from fire-prone sites would therefore be eligible to receive a credit for 100% of the avoided emissions from burning when using the Option 3 baseline.

Figure 7 indicates the general affect that the considered options could have on the carbon intensity of Fischer-Tropsch Diesel produced from forest residues.

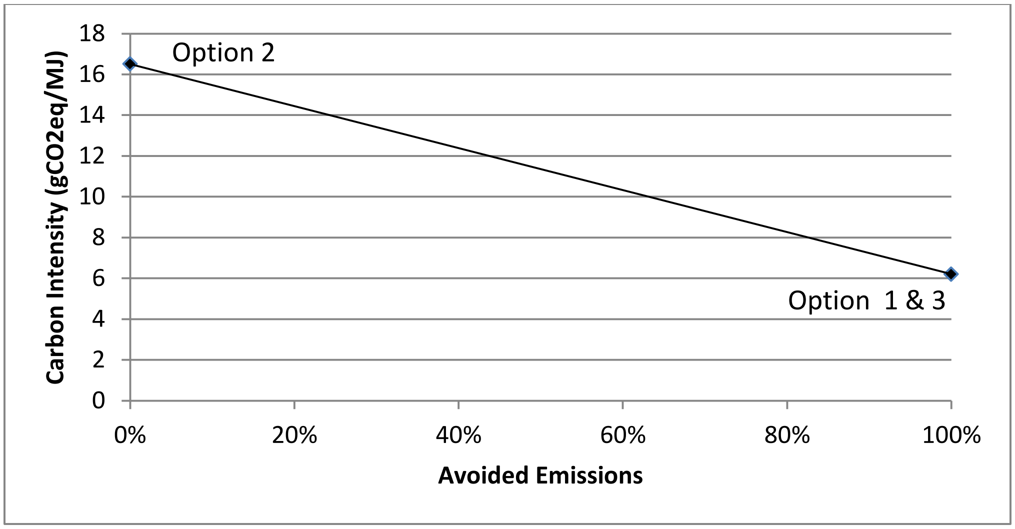

Figure 7: Carbon Intensity of RNG from forest residues utilizing each methane avoidance option; Pathway assumptions are for Canada average, wet residues, GHGenius default conditions

Appendix C – References

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