Thursday, April 27, 2017

Pierre Boucher
Interim Executive Director, Oil, Gas and Alternative Energy Division
Clean Fuel Standard
Energy and Transportation Directorate
Environment and Climate Change Canada
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Dear Mr. Boucher:

The Renewable Fuels Association (RFA), Growth Energy, and the US Grains Council (USGC) are pleased to submit joint written comments in response to Environment and Climate Change Canada's (ECCC) Discussion Paper relating to a Federal Clean Fuel Standard (CFS).

Renewable Fuels Association is a trade association, comprised of 181 member-companies, representing the United States (U.S.) ethanol industry. The RFA works to advance the development, production, and use of ethanol as a renewable fuel.

Growth Energy is a trade association of ethanol producers in the U.S., comprised of 86 members and 96 affiliated companies who serve the U.S. and Canada's need for renewable fuel.

The USGC works in more than fifty countries and the European Union to develop new markets for U.S. barley, corn, grain sorghum, and related products, including ethanol and distiller's dried grains with solubles (DDGS). The Council has 175 members, made up of American ethanol and DDGS producer organizations and agribusinesses.

Collectively, our organizations are the U.S.'s ethanol producers and supporters. We thank you for your consideration of the following comments regarding the benefits of a CFS and how to design such a program to best achieve Canada's goal of substantially reducing transportation sector greenhouse gas (GHG) emissions to combat global climate change.

I. Executive Summary

The U.S. ethanol industry:

- Supports the adoption of a CFS that will drive carbon reductions of up to 30 megatonnes (MT) by 2030;
- Believes that the current Renewable Fuels Regulations (RFRs) should be maintained, and that the content level should be increased to a blend rate of 10% ethanol; and
- Believes that regulatory barriers that prevent the free-flow of ethanol between Canada and the U.S. should be removed to better facilitate the ability of the Government of Canada to meet its CFS objectives.

Our organizations strongly support the Government of Canada's plans to implement a CFS. We recognize that robust clean fuel mandates are essential in helping to meet the growing transportation sector's need for lower GHG intensive fuels. Moreover, it is our considered opinion that ethanol, which provides demonstrably significant GHG emissions reduction benefits, is an essential product for meeting the Government of Canada's overall objective of achieving 30 MT of annual reductions in GHG emissions by 2030.

Ethanol is a proven and economically viable way to substantially reduce GHG emissions and the carbon intensity of transportation fuel. It also offers the benefit of reducing other air pollutants, including carbon monoxide and particulate matter.[1] Crucially, as a result of the existing wholesale fuel blending infrastructure in Canada, increased ethanol blending would be a low-cost tool to help the Government reach its 30 MT reduction goal, especially compared to many other forms of carbon reductions. As such, a well-designed CFS, incorporating sound science, support for consumer choice, and ambitious but achievable goals, must incorporate ethanol as part of the solution for lowering GHG emissions from transportation fuels.

Notwithstanding our firm support for Canada's CFS initiative, our submission makes several recommendations on the formulation of that policy. Generally speaking, and as elaborated upon below, we believe that an effective, transparent, and accountable CFS must have the following characteristics and elements:

- The CFS standard must be based on sound, peer-reviewed science that ensures that fuels that reduce GHG emissions are appropriately credited;
- The RFRs must remain in place and should be strengthened so that the mandated inclusion requirement for gasoline is ten percent ethanol (E10);
- The use of higher performance blends, anywhere between E15 and E85, by obligated parties should be permitted to meet the CFS performance standards;
- Canada should eliminate as many regulatory and legislative barriers as possible to allow for the ease of adoption in Canada of additional ethanol in gasoline, including ethanol produced in the U.S. That product is essential to realizing current GHG emissions reductions under the RFRs, and will only become more essential to the Canadian marketplace under the demands of a CFS; and
- To realize the full benefits of GHG emissions reductions from ethanol use, Canada should make investments in fuel pump and consumer distribution infrastructure for a wide variety

[1] Sobhani, S. (October 2016). "Air Pollution from Gasoline Powered Vehicles and the Potential Benefits of Ethanol Blending", Energy Future Coalition, United Nations Foundation.

of ethanol blends. The U.S. Department of Agriculture's (USDA) Biofuels Infrastructure Partnership (BIP) is a useful model to follow in that regard.

- Carbon Intensity (CI) models must be based on sound science and be available for public comment. U.S. ethanol and Canadian ethanol have comparable carbon intensity profiles under the leading CI assessment models, and that reality must be reflected by the CFS.

Additional ethanol blending in Canada, driven by the measures outlined above, would increase the annual 4.2 MT reduction of carbon dioxide emissions stemming from the current RFRs, thus achieving GHG emissions reductions that would go far in meeting Canada's 30 MT reduction goal.

As additional context, our organizations strongly encourage the Government of Canada to consider ethanol trade patterns (see below for more details on that topic) and the broader U.S.-Canada trade relationship during the development of the CFS. The program will have significant implications for U.S. ethanol producers and the farming economies that rely on the biofuels industry. Any measures that specifically target imported corn ethanol for exclusion through an adverse 'default value' for U.S. corn ethanol are not advisable. Such measures would not only increase costs for Canadian consumers and impede the Government of Canada's ability to realize GHG emissions reductions; they could also prove to be a trade irritant in the present North American geo-political environment.

II. The Benefits of Ethanol Use

As a framework for our submission, please consider the following brief overview of the benefits of ethanol use.

Ethanol is an advanced biofuel that offers substantial benefits to the environment, public health, and consumers. Most relevant to the development of a Canadian Federal CFS, it achieves substantial reductions in GHG emissions when compared to petroleum. According to a January 2017 USDA study, corn ethanol currently achieves an approximately forty-three percent reduction in lifecycle GHG emissions compared to gasoline on an energy equivalent basis, and ethanol's GHG performance is only improving.[2] Within the next five years, U.S. corn ethanol, on average, will comfortably exceed a fifty percent reduction in GHG emissions compared to gasoline. Overall, "the ongoing efficiency improvements along the corn ethanol production pathway have resulted in a continued reduction of ethanol's greenhouse gas life cycle emissions and widened its environmental advantage over petroleum."[3] The main drivers of those substantial GHG reductions are:

- Farmers are producing corn more efficiently and using conservation practices that reduce GHG emissions, such as reduced tillage, cover crops, and nitrogen management;
- Continued advancements in ethanol production technologies, such as the use of combined heat and power and using landfill gas for energy;
- Increased corn yields;

[2] ICF. (January 12, 2017). "A Life-Cycle Analysis of the Greenhouse Gas Emissions of Corn Based Ethanol", prepared for the United States Department of Agriculture. Attached as Exhibit A.

[3] Mueller, S., Unnasch, S. (August 2016). "Greenhouse Gas Life Cycle Analysis of US-Produced Corn Ethanol for Export to Global Markets", University of Illinois at Chicago.

- Trucking and other ethanol transportation efficiencies[4]; and
- Co-products of the ethanol refining process including distillers dried grains with solubles (DDGS) -- which are increasingly recognized as an extremely efficient feed source for cattle, swine, and poultry.[5]

In the future, if additional conservation practices and efficiency improvements are pursued, the January 2017 USDA study found that the GHG emissions reduction benefits of corn ethanol over gasoline will be even more pronounced – totaling about seventy-six percent. In the longer term, cellulosic ethanol (an extremely low carbon intensive fuel that is currently in the final stages of commercial development) will provide further benefits, since it has up to a one hundred and fifteen percent GHG emissions reduction below fossil fuels, depending on the cellulosic feedstock type and conversion process.[6] Already, millions of gallons of cellulosic ethanol are available in the U.S., and that supply will only grow in the future as that sector of the industry approaches commercial levels.

Additionally, ethanol, which burns cleaner and cooler than oil, is a low cost, high-oxygen octane enhancer. In fact, there is robust scientific literature regarding the benefits of a mid-level ethanol blend in the E20 to E30 range, in conjunction with a high compression ratio engine, on both fuel efficiency and tailpipe GHG emissions reductions. Multiple studies have shown that a high RON, mid-level ethanol blend (e.g., 96-RON E20 or 101-RON E30), when paired with various higher compression ratio engines (e.g., 11.9:1, 13.0:1), yields tailpipe CO_2 emissions reductions of at least five percent, which, in most instances, were also coupled with efficiency gains that offset the lower energy content of the high-octane fuel.[7] Those tailpipe emission reductions are *additional* benefits that go above and beyond the lifecycle GHG reductions of ethanol compared to petroleum described above. Furthermore, ethanol replaces benzene and other harmful aromatics in gasoline and would provide ancillary emissions benefits to the GHG emissions reductions.[8]

Meanwhile, the Canadian agriculture sector would also benefit from an increased blending mandate, due to the stabilizing effect ethanol has on commodity prices by ensuring demand for recent record corn crops. Since corn is an internationally traded commodity, the use of corn to make ethanol in the U.S. stabilizes international agricultural markets and benefits Canadian farmers. So, in addition to significant environmental benefits, farmers and rural economies in

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[4] ICF. (January 12, 2017). "A Life-Cycle Analysis of the Greenhouse Gas Emissions of Corn Based Ethanol", prepared for the United States Department of Agriculture. Attached as Exhibit A.
[5] Renewable Fuels Association. (January 12, 2017). "Fueling a Nation: The Role of the U.S. Ethanol Industry in Food and Feed Production". Available at: http://ethanolrfa.org/wp-content/uploads/2015/09/RFA-White-Paper-Fueling-a-Nation-Feeding-a-World.pdf.
[6] U.S. Department of Energy, Energy Efficiency & Renewable Energy, "Ethanol Vehicle Emissions". Available at: http://www.afdc.energy.gov/vehicles/flexible_fuel_emissions.html.
[7] West, B, McCormick, R., Wang, M. et al. (July 2016). "Summary of High-Octane, Mid-Level Ethanol Blends Study". ORNL/TM-2016/42 (Attached as Exhibit B); Leone, T., Anderson, J., Stein R. et al. (April 1, 2014). "Effects of Fuel Octane Rating and Ethanol Content on Knock, Fuel Economy, and CO2 for a Turbocharged DI Engine", SAE 2014-01-1228; AND Leone, T., Anderson, J. et al. (April 8, 2013). "Fuel Economy and CO2 Emissions of Ethanol-Gasoline Blends in a Turbocharged DI Engine", SAE 2013-01-1321.
[8] Sobhani, S. (October 2016). "Air Pollution from Gasoline Powered Vehicles and the Potential Benefits of Ethanol Blending", Energy Future Coalition, United Nations Foundation.

both Canada and the U.S. stand to gain from a CFS that incentivizes corn and cellulosic ethanol production. As such, an expansion of the blending mandate would support Canadian jobs and economic growth, which is a key component of the Pan-Canadian Framework on Clean Growth and Climate Change.

In summary, increased ethanol concentrations in fuel is an immediate, efficient, and cost-effective way to lower GHG emissions from transportation fuel. Increased ethanol concentrations also stand to lower levels of other pollutants, improve fuel properties, and benefit both the Canadian and U.S. economies.

III. The Market for U.S. Ethanol in Canada, the Global Ethanol Market, and Ethanol Trade Patterns

The Canadian Federal RFRs created a mandated market in Canada for approximately 2.1 billion liters of ethanol, which represents five percent of the domestic fuels market for gasoline, though that figure ebbs and flows based on fuel use trends. The Federal blending mandate cannot be met by domestic production alone. As such, year over year, approximately one billion liters of ethanol are imported into Canada. The shortfall between Canadian ethanol production and market demand has been met almost exclusively by imports from the U.S., which reflects the most economical trade corridors for ethanol trade in North America.[9]

There are mandated markets in all of the Western Canadian provinces. In Saskatchewan and Manitoba, the blending mandates, set at 7.5 percent and 8.5 percent respectively, are higher than the Federal standard. There is also a blending mandate in Ontario, which currently emulates the Federal standard. However, the Government of Ontario is currently reviewing its blending mandate, with a view to potentially increasing the standard and requiring a GHG emissions improvement similar to that of the Province's Greener Diesel mandate.

Where ethanol is blended for the Canadian market, it is normally blended at ten percent, and the oil companies have coordinated their logistics to determine which supply orbits are 'ethanolized'. As a result, the normal rates of inclusion can be significantly above the five percent Federal mandate, though some gasoline orbits that could sustain higher inclusions may currently have no ethanol in them at all. However, all of the gasoline orbits, except for Newfoundland, have wholesale blending infrastructure in place. This means that these provincial jurisdictions can accommodate a Federal blending mandate of ten percent.

While Ontario accounts for well over half of Canada's total ethanol production, its gasoline market also imports the most ethanol, due to the density of fuel use in the Greater Toronto Area. Ontario's market routinely blends well above the five percent Ontario mandate, sometimes reaching as high as nine percent inclusion. As a result, other gasoline orbits in Canada (including Quebec and Atlantic Canada) may not have five percent ethanol being blended locally. Similarly, Saskatchewan and Manitoba have higher blending mandates than the Federal standard, and therefore see increased blending compared to other jurisdictions. That speaks directly to the

[9] D. Dessureault. (August 2016). "Canada Biofuels Annual", prepared for the United States Department of Agriculture Foreign Agricultural Service. Available at: https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Ottawa_Canada_8-9-2016.pdf.

ability of ethanol to be blended at a higher rate, despite claims to the contrary by obligated parties. The wholesale infrastructure to blend a higher level of ethanol exists across Canada - the only issue is the political will to ensure that volumes are increased.

IV. Responses to Discussion Paper Questions – Scope

The following bulk of our submission will directly address the questions that were posed to stakeholders in the Clean Fuel Standard Discussion Paper, drawing on those questions to provide guidance on how Canada's proposed CFS can most effectively be designed, implemented, and enforced.

In response to questions:
1. *Are there any considerations that should be taken into account with respect to fuel suppliers being the regulated party*; and
2. *For liquid fuels, are producers and importers of fuel the appropriate point along the fuel supply chain to apply this regulation, and if not, why not?*

The importers of record (i.e. the fuel suppliers) are the appropriate point along the fuel supply chain to apply the proposed CFS, for all compliance and reporting requirements associated with the CFS. Placing the compliance and reporting requirements elsewhere would needlessly complicate the Canadian system.

In response to question:
4. *Are there cross-cutting barriers (e.g. feedstock supply, technology) to the production and use of lower carbon fuels and alternatives in Canada? If so, please describe.*

U.S. ethanol production processes and feedstocks are very competitive from a GHG perspective with Canadian ethanol. As noted by the USDA, long-term improvements to corn yields and reductions in the amount of fossil fuels energy used for corn production have reduced energy inputs in the U.S. ethanol production process, while advancements to procurement and distribution logistics have also boosted the energy efficiency of the industry.[10] As such, it is our considered view that U.S. ethanol should be treated comparatively to Canadian ethanol under whatever carbon intensity model is adopted by Canada.

A significant barrier to increased use of ethanol in Canada is the very narrow water specification for ethanol eligible under the RFRs to be included in Canadian gasoline. Specifically, the RFRs defines ethanol as "a liquid fuel that

(a) has a molecular formula of C_2H_5OH;

(b) is produced from one or more renewable fuel feedstocks;

(c) contains a denaturant;

[10] Gallagher, P.W., Yee, W.C., Baumes, H.S. (February 2016). "2015 Energy Balance for the Corn-Ethanol Industry", prepared for the United States Department of Agriculture. Available at: https://www.usda.gov/oce/reports/energy/2015EnergyBalanceCornEthanol.pdf.

(d) *may contain water the volume of which accounts for up to 1.0% of the volume of the fuel* (italics added by authors); and

(e) may contain substances, other than denaturants and water, that are not produced from renewable fuel feedstocks, the combined volume of which substances account for less than 1.0% of the volume of the fuel."[11]

As the Government of Canada's CFS is developed, ECCC should consider harmonizing the RFRs water specification with its U.S. counterpart.

A related barrier to ethanol adoption in Canada is the fact that the Canadian General Standards Board (CGSB) has not approved E15 and mid-level ethanol blends for consumer use. It is our considered view that E15 and mid-level blends, like E20 and E30, will be essential for ensuring that lower emissions targets for new vehicles will be met in the near future. As it currently stands, the absence of CGSB-approved ethanol content standards for blends between E10 and E50 will act as a barrier to the adoption of E15 and mid-level ethanol blends in Canada, which could impede the Government's ability to meet its 30 MT reduction target.

That is in stark contrast to the U.S., where great success has been achieved with E15. E15 is a less GHG-intensive, lower cost, higher-octane fuel option offered in hundreds of locations across the U.S., alongside regular and premium gasoline. E15 provides consumers with choice at the pumps and is being adopted by consumers who have made point-of-sale decisions on price and fuel quality. Based on U.S. experience, there are already millions of vehicles on the road in Canada that would accept an E15 blend, so there is no fleet-level barrier to the deployment of E15 in Canada.

Overall, ensuring that the CGSB approves higher level ethanol blends, including E15 and above, would allow Canada to attain substantial reductions of GHG emissions and other pollutants. The use of E15 and higher blends would provide for compliance flexibility in the event that the Government elects to double the current RFRs blending mandate, giving industry the needed flexibility to attain the Government's GHG emissions reduction targets. As such, we recommend that the Government allow for the use of E15 and other higher performance blends, when available, to the meet the CFS' performance targets. ECCC should use its membership at the CGSB to push for such a policy.

Lastly, with the incoming Corporate Average Fuel Economy (CAFE) standards, vehicle manufacturers have repeatedly noted that certain vehicle models will need higher octane fuels to drive smaller, high-compression engines to perform optimally.[12] As discussed above, increased ethanol levels add octane to fuel, meeting the very fuel conditions necessary for vehicle

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[11] "Renewable Fuels Regulations (SOR/2010-189)", Justice Laws Website, Government of Canada, available at http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-189/FullText.html.

[12] Markus, F. "High-Octane Fuels: The Key to Efficiency?", MotorTrend. Available at: http://www.motortrend.com/news/high-octane-fuels-key-to-efficiency-technologue/ AND Truett, R. (April 13, 2016). "Powertrain executives press for higher octane gasoline to help meet mpg, CO2 rules", Automotive News. Available at: http://www.autonews.com/article/20160413/OEM05/160419947/powertrain-executives-press-for-higher-octane-gasoline-to-help-meet.

manufacturers to develop more efficient engines. Thus, a stringent CFS that promotes ethanol use in gasoline has the added benefit of enabling more stringent CAFE standards in the future.

In response to question:
6. *How would the supply of lower carbon fuels and alternatives affect the design of Canada's Clean Fuel Standard?*

To be enforceable, a CFS must be realistically achievable. In that sense, the supply of lower carbon fuels and alternatives must impact the design of Canada's CFS. That being said, increased imports of U.S. ethanol could easily and seamlessly satisfy the new demand for clean burning ethanol stemming from the proposed CFS.[13] An increased blending mandate would not only drive U.S. exports, but, if coupled with an open investment environment in Canada, would provide an avenue for the Canadian ethanol industry to expand, with U.S. exports filling any gap in supply. Thus, a properly designed CFS would support Canadian jobs and economic growth, which is a key component of the Pan-Canadian Framework on Clean Growth and Climate Change.

In response to questions:
7. *Should different carbon intensity reduction targets be set for different fuels? If so, on what basis (e.g. more stringent target for fuels that have a higher carbon intensity)? How do we best/affordably reach the 30 MT target*; and
8. *Should different carbon intensity requirements be set for the same fuel for use in different sectors or applications?*

The carbon intensity reduction target for all fuels, in all sectors and applications, should be the 30 MT target. Fuels should be evaluated for intensity reduction targets based on a scientifically rigorous lifecycle analysis that reflects production as well as in-use GHG benefits.

To most affordably achieve the overall reduction target, where fuels are used over and above levels mandated in a Provincial or Federal market, they should be afforded additional credits to be distributed within the model, meaning that voluntary over-blending (i.e. blending to between E15 and E85) should be rewarded by the Federal CFS (please see our response to Question 35 of the Discussion Paper for more information on that topic). Such credit generation and trading will result in the lowest cost GHG emissions reductions.

V. Responses to Discussion Paper Questions – Transportation Sector

In response to questions:
10. *What is the technology-readiness for possible lower carbon fuels and alternatives in this sector*; and
11. *What barriers to the use of lower carbon fuels and alternatives are there in the transportation sector?*

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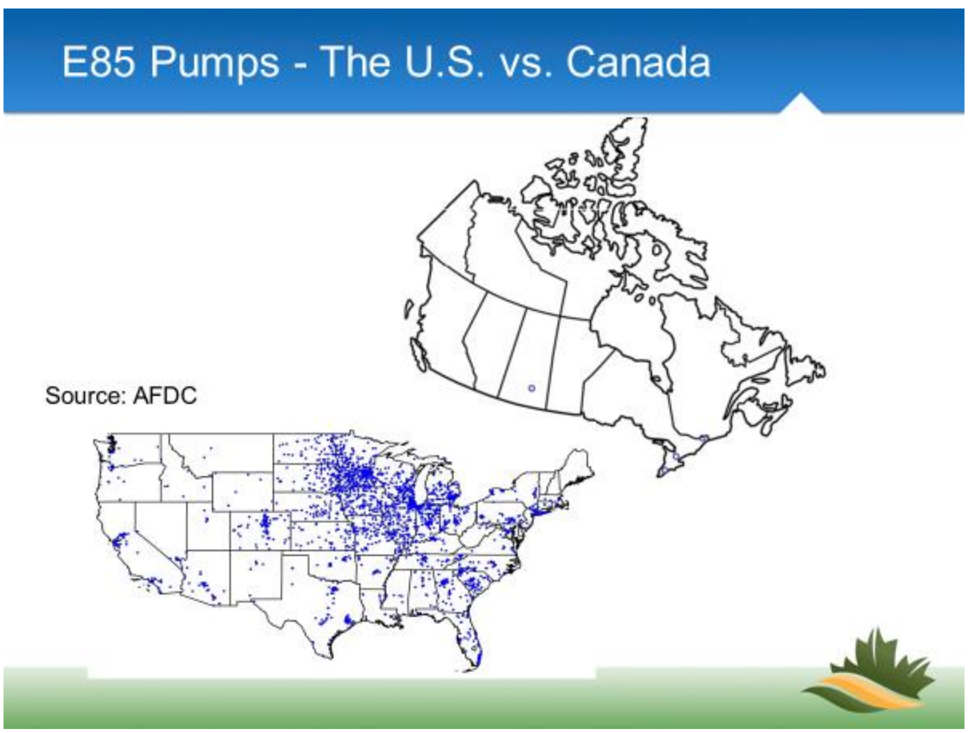
[13] D. Dessureault. (August 2016). "Canada Biofuels Annual", prepared for the United States Department of Agriculture Foreign Agricultural Service. Available at: https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Ottawa_Canada_8-9-2016.pdf.

The wholesale technology-readiness for increased use of ethanol in Canada is high. The vast majority of the infrastructure to blend a higher level of ethanol at a wholesale level exists across Canada. Thus, the major barriers to the use of more ethanol in the Canadian transportation sector, and the realization of the attendant reductions in GHGs and other emissions, are the wording of the water specification in the RFRs and the absence of CGSB-approved blends (which effectively acts as a barrier to E15 and mid-level blends). Please see our response to Question 4 of the Discussion Paper for more information on that topic.

However, at the consumer infrastructure level, there is a need for investment in pump turnover, dispensing infrastructure, and fuel delivery systems for higher-octane fuel. Canada is considerably behind the U.S. in the availability of alternative blend ratios for consumers. These blends are a viable mechanism that can significantly contribute to reducing GHG emissions beyond the stated assumptions about an E5 or E10 blending requirement. For example, Canada lacks even the most basic E85 pump infrastructure, which holds Canada back from realizing substantial GHG emissions reduction benefits. By recent estimates, there are approximately 3.6 million vehicles in Canada that are capable of fueling with gasoline made up of as much as 85 percent ethanol, but, as demonstrated by the below chart, there are only a handful of E85 pumps in the country. The same is true regarding pumps offering anything beyond an E10 blend. Closing that infrastructure gap would spur GHG emissions reductions. There are specific programs that have been deployed in the U.S., including the USDA BIP, that could facilitate that technological deployment, and those programs could be emulated in Canada.



Aside from traditional ethanol, cellulosic ethanol is an ideal fuel for the proposed CFS program, and should be incentivized. Extremely low carbon intensity cellulosic ethanol (which may have up to a one hundred and fifteen percent GHG reduction below fossil fuels, depending on the cellulosic feedstock type and conversion process)[14] is currently available at substantial volumes in the U.S. and is in the final stages of commercial development. ECCC should consider emulating Ontario's regulations that incentivize cellulosic ethanol blending through affording every liter of cellulosic ethanol a 2.5 liter credit in its blending program.

VI. Responses to Discussion Paper Questions – Determining Carbon Intensity

In response to question:
24: *What lifecycle analysis method should be used under Canada's Clean Fuel Standard to assess lifecycle carbon intensity?*

Broadly speaking, the lifecycle analysis method used under the CFS to assess lifecycle carbon intensity should be science-based and peer reviewed, with an accountable third party mechanism where the assumptions can be stress tested by informed and affected stakeholders. It should be updated periodically - as science and the realities of farming practices, electricity mixes, and the like dictate. The model should also ensure fairness by being consistently applicable across fuel types, so, for example, ethanol emissions are measured on a lifecycle basis by considering all the inputs and processes in the ethanol value chain, and the same criteria should be applied to petroleum.

More specifically, we believe that ECCC should adopt an attributional lifecycle analysis (LCA) methodology for assessing the lifecycle carbon intensity of fuel pathways. Attributional LCA methods focus on attributing energy use and resultant carbon emissions to the various activities related to producing, distributing, and using transportation fuels. The sum of energy use and emissions related to these activities represents a fuel's overall carbon intensity rating. There are a number of important benefits associated with using an attributional approach to lifecycle assessment, rather than a consequential approach.

First, attributional LCA focuses on activities that are, to a large degree, controllable by operators in the fuel supply chain. In essence, attributional LCA holds the supply chain accountable for energy use and emissions related to producing, delivering, and using the fuel. Thus, supply chain actors have a greater ability to respond and adapt to programs that use attributional LCA, and there is greater incentive to take actions that reduce the carbon intensity of fuels. In contrast, consequential LCA approaches assign emissions impacts to fuels based on the predicted sector- or economy-wide 'consequences' of increased demand for a specific transportation fuel. In many cases, these predicted consequential emissions are uncontrollable by the supply chain responsible for producing and distributing the fuel. As a result, programs using consequential LCA approaches offer little incentive to supply chain actors to reduce the carbon intensity of their actions.

Second, attributional LCA is typically driven by empirical data, rather than speculative predictions. Attributional LCA relies on real-world data regarding the actual energy use and emissions related to fuel production, distribution, and use. For policymakers and regulators, this

[14] "Ethanol Vehicle Emissions". U.S. Department of Energy, Energy Efficiency & Renewable Energy. Available at: http://www.afdc.energy.gov/vehicles/flexible_fuel_emissions.html.

enhances the certainty and reliability of lifecycle carbon intensity estimates for various fuels and provides a consistent framework for comparison.

Third, attributional LCA is verifiable and adheres to the concept that "if it is measurable, it is manageable." Because attributional LCA is data-driven and supply chain-oriented, it is easier for regulatory bodies to verify the actual performance of fuel pathways and validate carbon intensity ratings. In contrast, it is far more difficult to verify whether the emissions predicted as a theoretical consequence of increased demand are actually occurring. Thus, attributional LCA is particularly useful for low carbon fuel programs that require regular validation or verification of carbon intensity ratings.

Finally, the existing tools available for attributional LCA are scientifically robust and broadly accepted. The GHGenius and GREET models, for example, primarily use attributional LCA principles to estimate lifecycle carbon intensity for various fuel pathways. Meanwhile, consequential LCA approaches typically rely on tools, such as partial and general equilibrium econometric models, that were not expressly developed for the purposes of estimating lifecycle carbon emissions for transportation fuels.

For those reasons, we recommend that ECCC utilize an attributional approach to LCA for the Clean Fuel Standard.

<u>In response to question</u>:
25. *What system boundaries should be considered for raw materials and finished products?*

We believe ECCC should use system boundaries that capture the direct emissions impacts related to producing, distributing, and using a fuel. Typically, this means drawing the boundary around the supply chain directly responsible for producing and distributing the fuel, as well as upstream suppliers who provide key inputs into the production process. For example, in the case of wheat-based ethanol, the system boundary likely would include producers of the seed, fertilizer, and equipment needed to produce the wheat feedstock, and the emissions related to producing those inputs would be included in the fuel pathway carbon intensity rating.

Regardless of where ECCC ultimately decides to place system boundaries for LCA, it is crucial that consistent boundary conditions be used for *all* fuel pathways. Unfortunately, some low carbon fuel programs in other jurisdictions have adopted asymmetrical boundaries for different fuel pathways. This results in disparate treatment of co-products and indirect emissions for various fuels, which can lead to distorted comparisons and misinformed decision-making.

<u>In response to question</u>:
26. *What tools are best suited to conduct the lifecycle analysis under Canada's Clean Fuel Standard for the various fuels (liquid, gaseous and solid)? What gaps exist, if any, in existing tools like GHGenius or GREET to address these fuel types?*

We believe that the GHGenius model is best suited to inform LCA under the proposed CFS. GHGenius is already widely in use in Canada, and is based largely on Canadian data, while GREET is used predominantly in the U.S.

While the GHGenius model is broadly accepted, and used for LCA around the world, it has unrivaled specificity for the Canadian market. The model includes robust data for feedstocks and fuel pathways that are somewhat unique to Canada, but is also robust with regard to pathways for fuels imported into the Canadian market. The GHGenius model includes pathways for all transportation fuels that are commercially available in Canada today, as well for emerging fuels that are not broadly commercially available. In addition, developers of the GHGenius model continually modify and improve the model to incorporate new feedstocks and fuels as technology evolves. Further, many of the stakeholders who would be affected by the proposed CFS are already familiar with GHGenius.

GHGenius applies very similar co-product allocation credits to the corn ethanol life cycle emissions using the displacement method. The allocation method can also be changed, for example, to enable energy allocation. The thermal and electricity use for U.S. ethanol plants in GHGenius is consistent with the U.S. values used in GREET (net of GHGenius' bundling with upstream energy inputs for chemicals used at the ethanol plant).

The GHGenius model does not include indirect land use emissions, presumably because of the extreme uncertainty in predicting those emissions. We agree with that approach. However, GHGenius does include carbon adjustments from direct land use change. We agree with that approach also, as it encourages conservation management practices and in many geographic regions can properly credit agriculture for soil carbon sequestration. GHGenius allows credit for permanent sequestration of CO2 and the model can be parameterized to also provide credit for the processing energy differential when CO2 is recovered for other uses. However, recent data suggests the increasing dependence of the U.S. food and beverage industry on fermentation CO2 from ethanol plants, indicating that, absent that clean CO2 source, much higher polluting and often fossil-based carbon sources would be employed.[15] A mechanism should be set up within GHGenius to provide proper credit as has been done in other markets.[16]

<u>In response to question</u>:
27. What are the needs for users of these tools?

In order to effectively meet the needs of affected parties under the proposed CFS, we believe the LCA tool ultimately selected by ECCC should offer the following features:

- Public availability, transparency, reproducibility: The LCA tool should be easily accessible to the public and transparent. Default input data in the model should come from reputable sources and must be well-documented. All data interactions, calculations, equations, etc. must be clearly explained. Further, the tool must allow users to easily reproduce LCA results generated by ECCC.
- Reflective of Canadian market conditions: The LCA tool should be robust with regard to data and assumptions about the Canadian market. Certain feedstock and fuel pathways

[15] Mueller, S. (February 2017). "Ethanol Industry Provides Critical CO2 Supply", *Ethanol Producer Magazine*. Available at: http://ethanolproducer.com/articles/14122/ethanol-industry-provides-critical-co2-supply
[16] "ISCC Case Study Sweden", International Sustainability and Carbon Certification. Available at: http://www.iscc-system.org/en/iscc-system/iscc-trailer/iscc-case-study-sweden/

are relatively unique to Canada and any LCA tool adopted by ECCC should include the best available data and information regarding those feedstocks and fuels.

- Flexibility to respond to changes in the marketplace and improvements in data: The LCA tool adopted by ECCC should be flexible enough that it can be easily updated and modified to reflect changes in the marketplace (such as new feedstocks or fuels) and/or improved data. ECCC should ensure that the tool allows for new pathways to be added in an efficient and timely manner.
- Ease of use: The LCA tool should be user-friendly and simple to navigate. We believe that the LCA tool should use a software platform (such as Microsoft Excel) that is widely available and familiar to users.

In addition to the features listed above, ECCC should conduct training sessions for prospective users of the LCA tool. ECCC should also consider assembling an advisory group to periodically assess the effectiveness of the tool and discuss potential modifications or improvements.

<u>In response to question</u>:
28. *Should emissions related to indirect land-use change be considered in the lifecycle analysis? If so, what basis should be used to assess these emissions? If not, are there alternative methods that could be employed to address significant carbon intensity values along the lifecycle?*

We strongly recommend that ECCC exclude indirect effects from the CFS carbon intensity scoring framework until such time as there is broad scientific agreement on the best methodology for estimating the indirect effects for <u>*all fuels*</u>. So far, such consensus and agreement on appropriate methods remains elusive.

ILUC theories about the production of ethanol are simply not credible. ILUC models dramatically exaggerate indirect emissions from ethanol production, and thus underestimate the GHG emissions reductions in the ethanol lifecycle. More current data on actual patterns of changes and innovation within the farm sector show that such indirect emissions have not occurred at the magnitude anticipated.

The principles of lifecycle analysis require that consistent analytical boundaries are used when evaluating and comparing the attributes of various competing products.[17] Thus, if ECCC decides to penalize biofuels for predicted ILUC emissions, it must also include penalty factors for other fuels based on their potential to induce additional emissions through indirect economic effects at the resource margin. It is inarguable that all forms of energy have associated indirect economic effects, many of which have implications for the fuel's lifecycle carbon intensity. The challenge for policymakers and regulators is isolating and quantifying those effects in a manner that is scientifically defensible and driven by consensus-based methodologies.

There remains a substantial void of research on the potential indirect effects of transportation fuels other than crop-based biofuels. Indeed, in its January 2011 final report, the California Air Resources Board (CARB) - appointed Expert Work Group identified a number of potential indirect emissions sources from other fuels and recommended that CARB should, in the short-term:

[17] See ISO 14040:2006.

> "…conduct analysis, including but not limited to economic modeling, of the impact of the marginal barrel of oil[,]…the marginal supply of natural gas[,]…the potential market-mediated effect on electric power markets of using increased quantities of natural gas in the transportation sector[,]…reevaluation of marginal electricity[,]…[and] the impact of petroleum substitutes on refinery operations."[18]

To our knowledge, CARB has disregarded that recommendation to date and has not conducted any research on indirect emissions effects associated with fuels other than certain biofuels. However, the scant body of existing research on indirect effects for other fuels does indicate the potential for significant indirect emissions. For example, Liska & Perrin (2010) estimate that assigning military emissions related to protecting access to Persian Gulf oil would result in a CI value increase of 8.1 grams CO2e/megajoule (g/MJ) (a roughly 8.5 percent increase in the overall CI value of gasoline and diesel fuel derived from Persian Gulf oil under the California LCFS).[19] Similarly, Unnasch *et al*. (2009) identified a number of direct and indirect emissions sources that are excluded from most lifecycle analyses of petroleum-based fuels. According to the study:

> "…to the extent that economic effects are considered a part of the life cycle analysis of alternative fuels, as is the case with iLUC for biofuels, their effect vis-à-vis petroleum is also of interest. The effect of changes in petroleum supply and price will affect global goods, their movement, and the use of resources and their related GHG emissions."[20]

As an example, Allred *et al.* (2015) found that higher crude oil prices induced significant land use change and loss of ecosystem services in the Great Plains region as drilling activity increased. The land area occupied by oil and gas development in the region expanded from less than 0.25 million hectares in 2000 to approximately 3 million hectares by 2012, leading to substantial losses in rangeland, forest, wetlands, and cropland. This land use response to higher crude oil prices is no different in theory than the land use response to higher grain prices driven, in part, by biofuel expansion. And, the *observed* land use change in the Great Plains region resulting from oil and gas activities is higher than the *predicted* corn ethanol-related land use change results from popular economic models.[21] Yet, Oregon Department of Environmental

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[18] Heirigs et al. (2011). "Final Recommendations: Subgroup on Indirect Effects of Other Fuels". Air Resources Board Expert Working Group. Available at: http://www.arb.ca.gov/fuels/lcfs/workgroups/ewg/010511-final-rpt-alternative-modeling.pdf

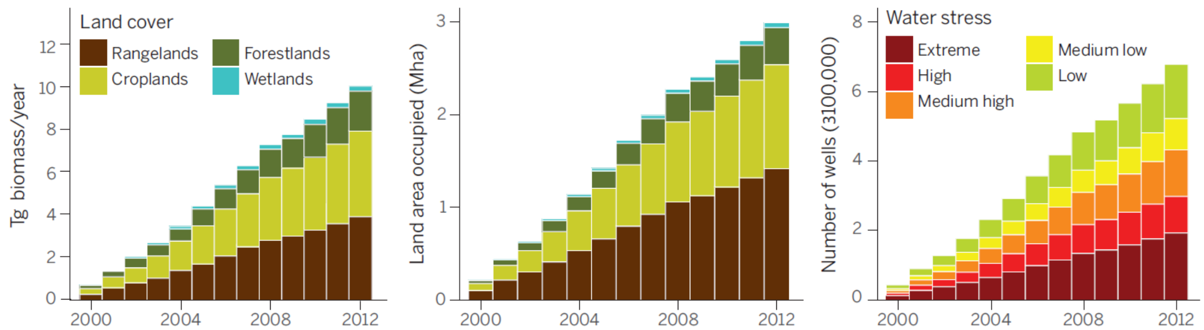
[19] A.J. Liska & R.K. Perrin (2010). "Securing Foreign Oil: A Case for Including Military Operations in the Climate Change Impact of Fuels". *Environment* 52:4 (July/August 2010), pp. 9–22. Available at: http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1175&context=biosysengfacpub

[20] Unnasch. S., et al. (2009). "Assessment of Life Cycle GHG Emissions Associated with Petroleum Fuels". Life Cycle Associates Report LCA-6004-3P. Prepared for New Fuels Alliance. Available at: http://www.newfuelsalliance.org/NFA_PImpacts_v35.pdf

[21] For example, CARB's latest GTAP analysis (which uses arbitrarily selected elasticity values for key parameters) predicts that an increase in ethanol production of 11.59 billion gallons (2004 to 2015) leads to less than 2 million

Quality and CARB have made no serious effort to quantify the CI effects of those market responses for petroleum.

Oil and gas development impacts on ecosystem services



Cumulative impacts of oil and gas development on ecosystem services in central North America 2000–2012. (Left) Reduction in NPP (biomass), per land cover type. (Middle) Land area occupied, per land cover type. (Right) Number of wells in water-stressed regions (**22**). See SM.

Source: Allred *et al.* (2015)

Similarly, the indirect effects of emerging alternative fuels and vehicles have been omitted from most lifecycle analyses, because those effects are not well understood and have not been rigorously scrutinized. However, where research does exist on these effects, potentially significant indirect (and overlooked direct) effects are revealed. For example, the limited research available on the direct and consequential effects of increased reliance on electric vehicles (EVs) shows that widespread use of EVs could be worse for the climate than continued reliance on gasoline and diesel. According to Hawkins *et al.* (2012), when the impacts of EV production, battery production, battery disposal, and expansion of electricity demand are properly included in lifecycle emissions inventories, some EV pathways perform worse than gasoline and diesel. The authors concluded:

> "EVs are poised to link the personal transportation sector together with the electricity, the electronic, and the metal industry sectors in an unprecedented way. Therefore the developments of these sectors must be jointly and consistently addressed in order for EVs to contribute positively to pollution mitigation efforts."[22]

Further, Tahil (2007) found that resource constraints for certain rare earth minerals used in EV battery production will present economic and environmental challenges not currently considered in lifecycle analyses of EV emissions. Tahil writes:

> "Analysis of Lithium's geological resource base shows that there is insufficient economically recoverable Lithium available in the Earth's crust to sustain Electric Vehicle manufacture in the volumes required…Depletion rates would exceed current oil

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Ha of land conversion in the U.S., with 85%+ coming from cropland-pasture. See http://www.arb.ca.gov/regact/2015/lcfs2015/lcfs15appi.pdf

[22] Hawkins, T. R., et al. (2013). "Comparative Environmental Life Cycle Assessment of Conventional and Electric Vehicles". *Journal of Industrial Ecology*, 17: 53–64, available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1530-9290.2012.00532.x/full

> depletion rates and switch dependency from one diminishing resource to another. Concentration of supply would create new geopolitical tensions, not reduce them."[23]

Clearly, all fuels have associated indirect effects. If ECCC opts to include ILUC penalties for biofuels, it must also analyze and include economically-derived indirect effects penalties for all other fuels as well.

In California and Oregon, jurisdictions that are comparable to Canada and which have developed clean fuel standards, the lifecycle analysis methods used, which purport to reflect ILUC, have proven inadequate and led to faulty policy-making. Recent research shows that "land use intensification has been widely underestimated in land use modeling resulting in overstated native land conversions by earlier land use models."[24] As a result of faulty assumptions about ILUC, the California LCFS uses a lifecycle analysis method that is scientifically indefensible. That is an outcome that the Government of Canada will obviously want to avoid. As such, our organizations support the decision of the Government of British Columbia to not include indirect land use change (ILUC) considerations in the Province's LCFS, and strongly recommend that the Federal CFS likewise not include ILUC considerations.

We would welcome an opportunity to consult and collaborate with technical experts at ECCC and the broader Government of Canada on this issue.

VII. Responses to Discussion Paper Questions – Compliance Mechanisms

In response to questions:
29. *Should there be any limitation in the trading of credits? If so, on what basis (e.g., by fuel)*; and
30. *Should all credits be generated through lowering emissions within the fuel lifecycle (i.e., in the full supply chain and use of the fuel) or should the Clean Fuel Standard consider credits from other types of projects?*

There should not be a limit on the creation of or the trading of compliance credits. Carbon reductions are carbon reductions, and other sectors should be able to reach their goals in an economically efficient manner. For example, an industry which is unable to reduce the carbon intensity of its production process should be eligible to generate compliance credits by using higher ethanol blend fuels to distribute that industry's product. The Government of Canada's goal is a 30 MT reduction in GHG emissions, and ethanol is an efficient, rapid, and inexpensive way to achieve a substantial portion of that goal. In that light, should other sectors want to encourage additional ethanol blending into the gasoline pool or higher ethanol use in fleets/vehicle pools, there should not be an artificial limitation on how many credits can be created through such initiatives. For every additional litre of ethanol that is blended into the fuel orbits in Canada, the parties that voluntarily elect to blend that fuel should be rewarded for it in the form credits that can be sold or traded to other obligated parties.

[23] Tahil, W. (2007), "The Trouble with Lithium: Implications of Future PHEV Production for Lithium Demand", Meridian International Research, available at: http://www.meridian-int-res.com/Projects/Lithium_Problem_2.pdf
[24] Mueller, S. (March 2016), "Updated Life Cycle Greenhouse Gas Data for Corn Ethanol Production", University of Illinois at Chicago Energy Resource Center

Notably, the current Canadian Federal RFRs include provisions that govern the creation of compliance units, allow for the trading of those units among participants, and require recordkeeping and reporting to ensure compliance. A similar system should be implemented for the CFS.

VIII. Responses to Discussion Paper Questions – Other Considerations

In response to question:
33. *Could other policies facilitate the deployment of lower carbon fuels and technology to markets?*

Fuel pump turnover programs would greatly facilitate the deployment of lower carbon ethanol fuels. In the U.S., Federal funding through the USDA's BIP has been critical in facilitating the rollout of higher ethanol blends for consumers and enabling consumers to purchase cleaner and lower cost ethanol blends. Given the widely-acknowledged success of the BIP, we suggest that Canada consider accompanying a CFS program with investments in deferring costs related to infrastructure upgrades, such as the installation of fuel pumps, tanks, and other retail fuel equipment that is needed to store, handle, and dispense higher blends of ethanol.

In response to question:
34. *Are there regional considerations that should be considered in the design of the Clean Fuel Standard?*

Regional exemptions to the CFS should only be considered in the most extreme conditions. Ethanol has been exported to dozens of jurisdictions, including overseas markets, and the barriers to ethanol adoption and use are very low. In that light, the fact that the Newfoundland and Labrador fuel orbit is currently excluded from the current gasoline pool for the purpose of the RFRs is not logical, and that could be corrected in the Federal CFS.

In response to question:
35. *How could Canada's Clean Fuel Standard be harmonized with measures from provinces and territories?*

The CFS should be coupled with an increase in the Federal RFRs blending mandate to E10. To maximize the efficiency of the Federal RFRs, the Provincial RFRs would need to be harmonized as much as possible with one another and with the increased Federal RFRs. As such, the blending mandates in certain Provincial jurisdictions would also need to be increased to E10. Notably, the Government of Ontario is currently considering increasing its blending mandate.

In response to question:
36. *Should the Renewable Fuels Regulations be maintained or phased-out? If maintained, how should the two instruments work together? If phased-out, should volume requirements for renewable fuels be included in the Clean Fuel Standard?*

As elaborated on throughout this submission, the RFRs should be expanded. It is our considered view that increasing the inclusion requirement to E10 will considerably improve the GHG intensity of Canadian gasoline. Indeed, ethanol is the most immediate, impactful, and cost-effective way for obligated parties to meet Canada's 30 MT GHG emissions reduction target under the CFS. As such, maintaining and strengthening the existing RFRs is an essential tool for realizing the full environmental and public health benefits of ethanol use. Increasing the current ethanol blending requirements from five to ten percent or greater, and allowing for over-blending above and beyond the mandatory blending standard, would be an impactful, fast, and non-administratively burdensome contribution to achieving Canada's 30 MT reduction target.

According to estimates from Renewable Industries Canada, the current five percent Federal blending mandate is equivalent to removing one million cars from the road.[25] Stated in another way, during the first compliance periods for the RFRs (commencing December 15, 2010), seven megatons of GHG emission reductions are estimated to have accrued – the equivalent of an annual average reduction of approximately 3.7 MT per year.[26] A 10% blending requirement would build on that success. Additional blending to E15 or mid-level blends could only further contribute to the overall 30 MT reduction goal. Those figures demonstrate that, while it's not the only answer, increased blending requirements under a maintained RFRs program would go a long way to meeting the Government of Canada's 30 MT GHG emissions reduction target.

From an implementation standpoint, an E10 blending requirement is easily achievable in Canada. As mentioned throughout this document, the necessary wholesale blending and retail infrastructure is already in place in Canada, and only moderate investments would be needed for the expansion of retail infrastructure. Additionally, Canadian consumers have a high awareness of ethanol and the Canadian vehicle fleet is equipped to use E10, and even E15, blends. If Canada were to establish an ethanol blending requirement of ten percent, the Government could also make policy changes to allow for E15 as a choice for consumers. Higher E15 levels would in turn further lower the carbon intensity of gasoline consumed in Canada, and could be used to offset any residual consumer demand for lower concentration ethanol products (or E0), thereby allowing obligated parties additional compliance flexibility.

In response to question:
38. *Fuel production and use can have impacts, both positive and negative, on sustainability. What are these key impacts for fuels used in Canada? Are these impacts different for fuel produced domestically than for imported fuels? Should these impacts be addressed in Canada's Clean Fuel Standard*?

As noted earlier in this paper, ethanol achieves substantial GHG emissions reductions, reduces other tailpipe emissions, and creates better clean air and water sustainability outcomes by reducing particulate matter and carbon monoxide. U.S. and Canadian ethanol are produced using similar processes, and ILUC concerns are not scientifically sound. As such, it is our considered view that U.S. ethanol should be treated comparatively to Canadian ethanol under the proposed CFS.

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[25] "30 Years of Renewable Fuels", The International Resource Journal, available at http://www.internationalresourcejournal.com/30_years_of_renewable_fuels/

[26] "Renewable Fuels Regulations" (February 2017), Environment and Climate Change Canada, available at http://www.ec.gc.ca/energie-energy/default.asp?lang=En&n=0aa71ed2-1

IX. Conclusion

The RFA, the USGC, and Growth Energy appreciate the Government of Canada's stakeholder engagement as it develops a Federal CFS. In summary, our organizations support the adoption of a CFS that will drive carbon reductions of up to 30 MT by 2030. A CFS to achieve those reductions must:

- Maintain the current RFRs and increase the mandated blend rate to 10% ethanol;
- Be coupled with the elimination of regulatory barriers that prevent the free-flow of ethanol between Canada and the U.S.; and
- Use a carbon intensity model that is based on sound science and available for public comment. U.S. ethanol and Canadian ethanol have comparable carbon intensity profiles under the leading carbon intensity assessment models, and that reality must be reflected by the CFS.

Should you have any questions arising from these comments, or should you wish to discuss any other related matters, please do not hesitate to contact us at your convenience. We look forward to participating in the ongoing consultation process for the formulation of Canada's Federal CFS.

Kind Regards,

Emily Skor Growth Energy	Bob Dinneen Renewable Fuels Association	Tom Sleight U.S. Grains Council