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# Report Name: Biofuels Annual

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**Report Highlights:**

Canada's draft Clean Fuel Standard, published in December 2020, outlines the beginnings of a nationwide framework for adopting a carbon intensity approach for renewable fuels. The final regulation is expected to be published in Spring 2022. Reduced driving, brought on by pandemic-related lockdowns, lowered ethanol consumption and production in 2020. Biodiesel production neared record levels in 2020 after a drop in domestic demand was more than offset by record demand from the United States. Biodiesel production remains strong in 2021 with exports to the United States near-record levels and recovery underway for the domestic diesel pool. This report provides updated biofuel demand/supply tables and focuses on 2020.

**ACRONYMS**

AF alternative fuels[1]
ATJ alcohol-to-jet
BBD Biomass-Based Diesel
BECCUS Bio-Energy Carbon Capture Utilization and Storage
Btu British thermal unit(s)
CAAFI Commercial Aviation Alternative Fuels Initiative
CO2e Carbon dioxide equivalent
CC Compliance Category
CCS Carbon Capture and Sequestration
CFR Clean Fuel Regulation
CFS Clean Fuel Standard
CI Carbon Intensity
ECCC Environment and Climate Change Canada
IEA International Energy Association
FT Fischer-Tropsch
GHG greenhouse gas
HEFA hydro-processed esters and fatty acids
HS harmonized system
HTL hydrothermal liquefaction
ICAO International Civil Aviation Organization
J Joule
LCA life-cycle assessment
LCFS Low Carbon Fuel Standard
MFSP minimum fuel selling price
MLPY million liters per year
MSW municipal solid waste
Mt megatons
QM quantification methodology
R&D research and development
RDF Refuse derived fuel
RFR Renewable Fuels Regulations
SAF sustainable aviation fuel
SPK synthetic paraffinic kerosene
Syngas synthesis gas
toe tons of equivalent
UNFCCC United Nations Framework Convention on Climate Change
USDA U.S. Department of Agriculture
Wh Watt hour
ZEV zero emissions vehicles

[1] FAS/Ottawa adopts the term "alternative fuels" from the International Civil Aviation Organization (ICAO), a United Nations specialised agency, uses the term 'Alternative Fuels' to describe 'any fuel that has the potential to generate lower carbon emissions than conventional kerosene on a life cycle basis.'

## I. Executive Summary

Over the past year, the Canadian government released multiple plans to tackle climate change. These include:

- a draft of the Clean Fuels Standard (CFS) to reduce the lifecycle carbon intensity (CI) of fuels;
- a new climate plan that includes reducing emissions from fertilizer use[2];
- a carbon tax increase to CDN $170 per ton by 2030;
- a hydrogen strategy plan;
- an action plan on small modular reactors;
- legislation of net-zero greenhouse gas emissions (GHG) by 2050;
- a mandate that 100 per cent of new sales of light-duty vehicles be zero emission by 2035 (50 percent by 2030); and
- the roadmap for climate collaboration with the United States.

Of all these plans, the CFS is expected to have the greatest impact on U.S. agriculture.

In December 2020, the Government of Canada published the draft CFS in Canada Gazette Part I. The CFS outlines the beginnings of a switch to a carbon intensity approach from the volumetric approach currently in place under the federal Renewable Fuels Regulation (RFR). The objective of the CFS is to achieve 30 million tons of annual reductions in GHG emissions by 2030, making it an important aspect of Canada's plan to meet its Nationally Determined Contributions (NDC) under the Paris Agreement.

By reducing the lifecycle carbon intensity (CI) of fuels and all energy used in Canada, the draft CFS aims to stimulate investments and innovation in low-CI fuels and decouple GDP from emissions. It proposes CI limits for liquid fossil fuel, which will become more stringent over time, and requires a reduction of ten grams of carbon dioxide equivalent (CO2e) per megajoule (MJ) below the reference year (2016) carbon intensity by 2030.

The final Clean Fuels Regulation (CFR) is expected to be released in Spring 2022. The coming-into-force date for CI reduction requirements is December 1, 2022. The last compliance period for the RFR would be 2022, the final reporting and true-up period would be in 2023, and it will be repealed in 2024.

Since its publication, the draft CFS has undergone numerous revisions to sections related to land use and biodiversity (LUB) criteria, carbon capture and sequestration (CCS), and other aspects. Several of the proposed changes, as well as anticipated announcements (e.g. the release of the final lifecycle assessment tool), are outlined in this report.

[2] The plan outlines an intent to set a national emission reduction target of 30 percent below 2020 levels from fertilizers. Fertilizer Canada suggests that Canadian yield growth will be hampered if the Government of Canada proceeds with limiting absolute emissions from fertilizer by 30 percent. The industry association is lobbying instead for a focus on limitations on carbon intensity (ie. per corn bushel instead of per acre).

Canada's production of fuel ethanol has fulfilled about 61 percent of the domestic demand for the past eight years with U.S. ethanol fulfilling the remaining requirement. In 2020, Canada exported ethanol used as fuel for the first time (to Europe). Canadian ethanol plants produced 1.7 billion liters in 2020 and fuel ethanol consumption was 2.7 billion liters. No change in this situation is expected for 2021. The average national blend rate edged up to 6.3 and 6.5 percent in 2019-20 but is expected to fall slightly to 6.0 percent in 2021. Regardless, the five percent minimum blending requirement required under Canada's RFR was exceeded in 2012 and has remained above ever since. Peak gasoline use (including blended ethanol) near 51 billion liters may have been reached in 2018.

Incentivized by the value of U.S. Renewable Identification Numbers (RINs) attached to every gallon of biodiesel that meets mandates under the U.S. Renewable Fuel Standard (RFS) and the U.S. biodiesel blenders credit of USD $1 per gallon, Canada continues to export most of the biodiesel it produces to the United States. In turn, biodiesel and renewable diesel imports fulfill provincial blend mandates, which emerged from 2007 thru 2011, and imports modestly expanded thereafter to meet marginally greater domestic demand.

Demand is fulfilled mostly with imports of U.S. biodiesel but also large imports (mainly from Singapore but also Europe) of renewable diesel. Domestic biodiesel production and exports to the United States have trended up long term. The average national blend rate of renewables in diesel has risen slightly above the federally mandated blend rate of two percent since 2017 and has recently approached an estimated three percent as use volumes rose from 760 million liters in 2020 close to an estimated one billion liters in 2021. Despite annual variations, the overall diesel pool has remained essentially flat for the past decade, and some analysts believe peak diesel use (including renewables) near 36 billion liters were reached in 2018.

Emerging technologies that would receive compliance credits under the draft CFS include co-processing biocrude, hydrogen in fuel cell vehicles, renewable natural gas in natural gas vehicles; renewable electricity at fossil fuel facilities, emerging low-CI fuels, and direct air capture according to ECCC. Future technological advances in Canada will be made in sustainable aviation fuel (SAF), green hydrogen, and stationary energy storage applications. All of these technologies are currently at a low technological readiness level.

## II. Policy and Programs

### Renewable Energy and Greenhouse Gas (GHG) Emission Goals

During the U.S.-hosted Leaders' Summit on Climate in April 2021, President Biden and Prime Minister Trudeau, alongside other nations, announced new ambitious targets for reductions in greenhouse gas emissions. Prime Minister Trudeau committed Canada to reduce emissions by 40 to 45 percent by 2030. Canada reports on GHG emissions and trends biannually as part of its international commitments under the United Nations Framework Convention on Climate Change (UNFCCC).

Also, in conjunction with President Biden's Leaders' Summit on Climate, the United States and Canada announced a new initiative to engage governments around the world to increase the use of renewables and lower dependence on fossil fuels in government operations. Leading by example, both countries also announced they will work together in their respective efforts towards the shared goal of net-zero emissions government.

According to a Government of Canada report, after hovering between 700 and 720 Mt CO2e in recent years, Canada's total GHG emissions increased to 729 Mt CO2e (1.5 percent of global emissions) in 2018 and by 2019 (the most recent data available) emissions were 730 Mt CO2e. These increases are attributed to higher transport fuel consumption, winter heating, and oil and natural gas extraction. Transportation emissions make up almost a third of GHG emissions in Canada.

The Government of Canada aims to meet its GHG emission reduction goals primarily through the adoption of two programs. Of importance to renewable fuels, the draft CFS aims to reduce the lifecycle CI of fuels and energy used in Canada, while the Greenhouse Gas Pollution Pricing Act (GGPPA) puts a tax on the carbon content of fossil fuels and establishes a credit trading system for large emitters, known as the Output-Based Pricing System (OBPS).

The objective of the CFS is to achieve 30 million tons of annual reductions in GHG emissions by 2030, making it a significantly important aspect of Canada's plan to meet its commitments under the UNFCCC. The CFS is described in detail in this report.

In addition to the CFS, the GGPPA also has the objective of helping Canada meet its emission reduction targets. The Act implements a carbon tax starting in 2019, which applies to provinces and territories that do not meet the federal benchmark stringency requirements. It also gives provinces the flexibility to enact emission reduction strategies, which meet provincial needs, as long as they also meet minimum federal government requirements. The second part of the GGPPA, the OBPS, establishes how credits will be created under the CFS for low-CI fuels produced and imported in Canada.

The GGPPA gave provinces and territories time to develop their own carbon tax plan before the federal government imposed a backstop on April 1, 2019. Currently, Alberta, Saskatchewan, Manitoba, Ontario, Nunavut, and the Yukon are subject to federal fuel charges and applicable rates,

which vary by fossil fuel type. Saskatchewan, Manitoba, and Ontario did not develop a provincial carbon tax that met the federal requirements by the April deadline, while Alberta terminated its compliance model after the deadline.

## 2. Emerging Federal Renewable Fuel Policy

### 2.1 Clean Fuel Regulation

The draft CFS sets an annually decreasing CI standard for gasoline and diesel that primary suppliers will have to meet for the fuels they supply in Canada. Under this market-based approach, fuels with a CI score above the annual standard generate compliance deficits, while fuels with scores below generate compliance credits. The draft CFS proposes that up to ten percent of an annual compliance requirement can be carried forward to the next compliance period, with a maximum carry-over of two years and a 20 percent annual interest penalty.

By setting CI limits and creating a debit/credit market, the CFS aims to stimulate investments and innovation in low-CI fuels and decouple GDP from emissions. It proposes CI limits for liquid fossil fuel starting in 2022, which will become more stringent over time, capping emissions with a CI reduction requirement of ten grams of CO2e per MJ from the 2016 reference year by 2030.

In December 2020, the Government of Canada published the draft CFS in Canada Gazette Part I. The draft CFS covers all fossil fuels used in Canada, but sets separate requirements for liquid, gaseous, and solid fossil fuels. The final CFR is expected to be published in the Canada Gazette Part II in Spring 2022. Part II contains all enacted regulations (passing both houses of Parliament). Part III contains public acts of Parliament once acts have received royal assent (the process by which a bill becomes an Act of Parliament and part of the law of Canada).

Previously, the final CFR was to be published in Canada Gazette II in December 2021; however, the 2021 federal election caused a delay in finalizing several aspects of the regulation. The coming into force date for CI reduction requirements remains December 1, 2022, as stated in the draft CFS. The first compliance period for CI reduction requirements is just one-month long, ending Dec 31, 2022. All other compliance periods will be a year in length.

Canada notified under the World Trade Organization's Agreement on Technical Barriers to Trade (TBT) on January 4, 2021 (G/TBT/N/CAN/632), providing a link to the draft CFS. U.S. Industry and FAS Ottawa responded to ECCC with comments.

Since its publication in Canada Gazette Part I, the draft CFS has undergone several revisions to sections including those especially relevant to the biofuels industry; namely, carbon capture and sequestration (CCS), and land use and biodiversity (LUB) criteria.

**Bio-Energy Carbon Capture Utilization and Storage (BECCUS)**

Section 28(1) of the draft CFS in Canada Gazette I limits compliance credits created from BECCUS to Canadian-located BECCUS projects. In effect, the draft CFS prevents imported renewable fuels from having BECCUS recognized.

As written, this provision would unduly disadvantage imports of U.S. biofuels into Canada, as Canadian producers would benefit from factoring CCS into the CI of Canadian biofuels, thereby making them more desirable to blenders and thereby creating preferential treatment for Canadian firms.

In response to concerns, ECCC advised FAS in June 2021 that the final CFR will remove the mention of "Canadian origin," and text will be added that will ensure some test of equivalency of stringency for storage regardless of geographic location. While this appears to be a positive development for U.S. industry, there is no certainty of the final text until the CFR is published.

Aside from concerns related to foreign treatment, there are also concerns by the renewable fuels sector about the treatment of fossil fuel versus renewable fuel. A series of CCS investment announcements by oil and gas led to a lobbying effort to revise the draft CFS. Some Canadian industry members are concerned that if compliance credits are created from the CCUS of fossil fuels, fossil fuels could then generate compliance credits based on the CI reduction from CCUS, and thereby destroy CFS' demand signal to use more biofuels. They state that the regulation puts too much emphasis on giving credits for emissions cut during the "upstream" oil production and refining process and does not incentivize fuel suppliers to switch to lower-carbon sources of energy like biofuels, hydrogen, and electricity.

BECCUS projects will not be included in the fuel LCA tool, at least not initially upon publication of the CFR in Canada Gazette Part II. This may change during a model update cycle in the future, or during the CFR mandated review period. All CCS projects (Canadian and foreign, fossil, and renewable) will have to qualify under compliance category one (CC1)[3].

While the current draft CFS recognizes CCS under CC1 instead of in the fuel LCA tool, compliance credits for CCS will be determined using a quantification methodology (QM) developed by ECCC in negotiation with an expert review panel. A draft of the general QM was made available by ECCC in November 2021. ECCC stated that it may bring BECCUS into the fuel LCA tool later.

**Land Use and Biodiversity (LUB) Criteria**

The CFS grants partial compliance for feedstock that is not harvested on excluded[4] land in the United States, and U.S. farmers will not need to demonstrate to the Canadian government that they

[3] CC1 captures "actions that reduce the carbon intensity of the fossil fuel throughout its lifecycle."
[4] Section 38 of the draft CFS defines excluded land as land that was converted to crop land from forest, wet land, grassland, or never-before-harvested, after July 1, 2020.

are not harvesting crops on excluded land. However, aggregate compliance under the CFS does not exclude participants from having to meet certification and verification requirements, nor does it prove the farmer complies with protected area and damaging agents (i.e. pests) legislation. ECCC will only consider formal applications of legislative recognition (at the federal, state, or even municipal level), *after* the CFR is published in Canada Gazette II.

ECCC has reviewed the various comments received from stakeholders and is taking those comments into account in developing the final CFR. On the LUB criteria, ECCC is considering the following changes:

> *(a). Update the protected areas and damaging agents criteria to account for jurisdictions without legislation.*
> *(b). Replace the term "old-growth" with a description of key characteristics of environmental importance to facilitate recognition of legislation and avoid contentious terminology.*
> *(c). Update the legislative recognition validity period to seven years or upon substantive changes to recognized legislation.*
> *(d). Alter the scope of legislative recognition to apply only to feedstock obligated under that recognized legislation.*
> *(e). Limit legislative recognition applications to national and sub-national jurisdictions, specifying that sub-national refers to one level below national (e.g., state, province).*
> *(f). Legislative recognition consultation processes will vary on a case-by-case basis (desk review, submitting body consultation, expert consultation, and/or public consultation).*
> *(g). Delay the LUB criteria's coming into force to January 2024(material balancing will come into force as of January 1, 2023).*
> *(h). Add agriculture and forest residues to the low land use concern material which are subject to only some of the LUB criteria.*
> *(i). Update declaration frequency to a per contract basis instead of a per-batch basis.*
> *(j). Remove requirement for foreign suppliers to provide importers with their material balance report.*

The updated LUB criteria include three criteria (no-palm; protected areas; damaging agents) that apply to all classes of feedstock in addition to one criterion (excluded land) that specifically applies to agricultural feedstock.

Among these criteria, protected areas and damaging agents would be eligible to benefit from an aggregate compliance at the national or state level should ECCC determine that legislation applicable at the national or state level effectively meets the criteria. One criterion (no-palm) will have to be met at the farm level by filling out a declaration. Agricultural feedstock from the United

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Section 39 states that if a feedstock is deemed compliant by the EPA under section 80.1457(a) of Subchapter C of Chapter I of Title 40 of the Code of Federal Regulations of the United States, then it is compliant by the CFS (i.e. it has been shown to not be grown on excluded land).

Section 39 means that feedstock that is not harvested on excluded land in the United States, because U.S. farmers will not need to demonstrate to the Canadian government that they are not harvesting crops on excluded land.

States is already deemed compliant with the excluded land criterion, provided it meets some conditions, as was announced with the publication of the draft CFS.

As noted, LUB requirements (including declarations) will come into force on January 1, 2024. This new date was established after industry noted that the initial coming into force date of January 2, 2023 did not allow farmers to make informed decisions because it did not take into account the timeline of on-farm activities and forward-contracts.

**Fuel Lifecycle Assessment (LCA) Tool**

The draft CFS requires that the carbon intensity values of low-carbon-intensity fuels must use either the fuel lifecycle assessment (LCA) tool to calculate facility-specific CI values using facility specific data, or the use of a set of disaggregated default values.

Fuel producers and foreign suppliers must use the fuel LCA tool to determine facility-specific CI values once they have 24 months of operating data. They could also use a provisional CI value using the model with only three months of data, until 24 months of data is available. Facilities with less than three months of operating data for a low CI fuel would need to use prescribed disaggregated default values.

ECCC opted against using GHGenius, a model used by Ontario, Alberta, and BC, similar to the GREET model used in the United Sates. Instead, an ECCC-hired consulting firm is developing an LCA tool/database.

The LCA tool has not yet been made public for comment. The decision to develop a new LCA tool and not release a draft until late fall to early winter 2022, and a final model in Spring 2022, injected uncertainty into how its application will impact industry. Negotiations for ethanol supply contracts for 2022 and 2023 began in early 2021 with no indication of what the LCA tool would look like.

**Sustainable Aviation Fuel (SAF) and Sustainable Marine Fuel (SMF)**

The draft CFS does not indicate that SAF is an obligated fuel, nor is it an eligible credit generator as an opt-in. However, the Canadian government states it will be considering each of these options in the future. While Canada's renewable fuel regulations mandate the use of low carbon and renewable fuel in gasoline and diesel, they have no conditions on the use of aviation fuels (kerosene-type fuel for commercial and private jet aircraft or aviation gasoline used by small aircraft and helicopters) or heavy marine distillates.

As stated in the CFS:

> *The Government of Canada supports the International Civil Aviation Organization as the appropriate forum to address international aviation emissions, and the work it has undertaken to address these emissions. Therefore, jet fuel that is used for international flights would not be subject to the proposed Regulations. The treatment of domestic aviation*

*fuels and credit creation for low CI aviation fuels is still under consideration and is being examined in conjunction with carbon pollution pricing policies.*

Fuel sold or delivered for use in a marine vessel with an international port destination would be excluded from the primary supplier's pool under the CFS.

Industry generally views the shift to SAF as too risky for the required level of investment without strategic and financial support from the public sector. This is due to the prevailing uncertainty around the CFS (in provinces and territories outside of British Columbia, where the Low Carbon Fuel Standard (LCFS) remains the driver) and the cost differential between fossil jet fuel and SAF. See the GARDN White Paper on SAF in Canada for an overview and assessment of real and perceived risks.

**Soil Carbon Changes**

The CFS would take into account soil carbon changes due to changes in agricultural practices. Producers who take summer fallow out of their rotations, or adopted no-till or reduced till practices, have built or continue to build soil carbon. There is a potential to monetize those soil carbon benefits along the supply chain.

**The CFS and the United States**

The CFS is comparable with market-based California and Oregon's Low Carbon Fuel Standard (LCFS). The CFS incentivizes the introduction of lower-carbon fuels through a market mechanism that allows the private sector (acting in the aggregate) to choose the optimum mix of fuels sold in any given time period. Profit-maximizing obligated parties would need to determine their optimal mix of fuels placed on the market based on market prices and any adjustment to those prices tied to fuel lifecycle carbon-intensities. Canada's CFS would not have any linkage to the RFS. Conversely, the United States' RFS is a command-and-control system which each year defines volumetric obligations by fuel category with minimum GHG savings requirements. The RFS, as managed by EPA in the U.S. political context, is heavily burdened by continuous litigation efforts to dismantle it or conversely protect its integrity. In contrast, California and Oregon's LCFSs are currently free of administrative uncertainty, resulting from litigation having cleared all legal threats in their early years.

Canada's CFS regulates those who produce or import fuels[5] and refers to them as "regulated parties." U.S. companies can become voluntary credit creators for actions taken in the following compliance categories:

1. Taking actions throughout the lifecycle of a fossil fuel that reduce its carbon intensity;

[5] Primary suppliers who produce or import less than 400 m3 of liquid fossil fuel will not be subject to the regulations.

2. the supply of low-carbon-intensity fuels; and
3. specific end-use fuel switching in transportation.

There is no requirement that feedstocks or fuels coming into Canada meet LUB requirements; it is only necessary if U.S. exporters wish to participate in credit creation under the CFR.

**Revisions and Releases**

In addition to ECCC's proposed revisions to the text of the CFS outlined above, dozens of other revisions and minor adjustments were announced by ECCC at various stakeholder engagement meetings. They are too extensive to list in this report.

ECCC stated that the following information will not be published until the CFR is published in Spring 2022:

- Final QM & Guidance Document: CCS/BECCUS, Enhanced Oil Recovery with CO2, Capture and Permanent Storage (EOR), Low-Carbon-Intensity Electricity Integration, Co-Processing in Refineries
- Method for Verification and Certification
- Formal publication of Fuel LCA Tool
- RIAS (Regulatory Impact Analysis Statement)

Unlike British Columbia, Canada does not have a federal Bioeconomy Act.[6] Recently, the biofuels sector has been lobbying the Canadian government to develop one.

**Sustainability**

Similar to the United States,[7] over the years there has been a significant decrease in CI of ethanol produced in Canada, due to several factors. Using the 25-year time frame of 1993 to 2018:

- The intensity of fertilizer inputs has decreased. Canada has seen a 50 percent and two percent reduction in nitrogen and potash use per bushel of corn grain harvested, respectively, according to data provided by Plant Nutrition Canada and calculations by FAS Ottawa.
- Corn grain yield has increased continuously, reaching 163 bushels per acre (a 53 percent increase over 1993 average yields).
- Similar to the United States, ethanol yield has also increased since 2018. Improved seed varieties and production technology changes are slowly raising corn ethanol yield rates.

[6] Canada has a Forest Bioeconomy Framework.
[7] *Retrospective analysis of the U.S. corn ethanol industry for 2005-2019: implications for greenhouse gas emissions*. Available here.

## PROVINCIAL POLICY

Some provinces have regulated blending rates above the federally mandated rates, as described in this section.

Furthermore, provinces and territories that did not develop their own carbon tax plan before April 1, 2019, were required by the federal government to adopt a federal backstop. Currently, Alberta, Saskatchewan, Manitoba, and Ontario are subject to federal fuel charges and applicable rates, which vary by fossil fuel type. Saskatchewan, Manitoba, and Ontario did not develop a provincial carbon tax that met the federal requirements by the April deadline, while Alberta terminated its compliance model after the deadline.

Ontario, Alberta, Saskatchewan and Manitoba challenged the federal carbon taxation framework (the GGPPA) in court in 2020. In March 2021, the Supreme Court of Canada ruled the federal government has a legal right to implement the federal backstop on the provinces.

The benchmark carbon price for 2020 for explicit price-based systems is CDN $30 per ton CO2e. The price is scheduled to rise by CDN $10 per ton per year until it reaches CDN $50 in 2022, then by CDN $15 per ton per year until it reaches CDN $170 in 2030.

### British Columbia

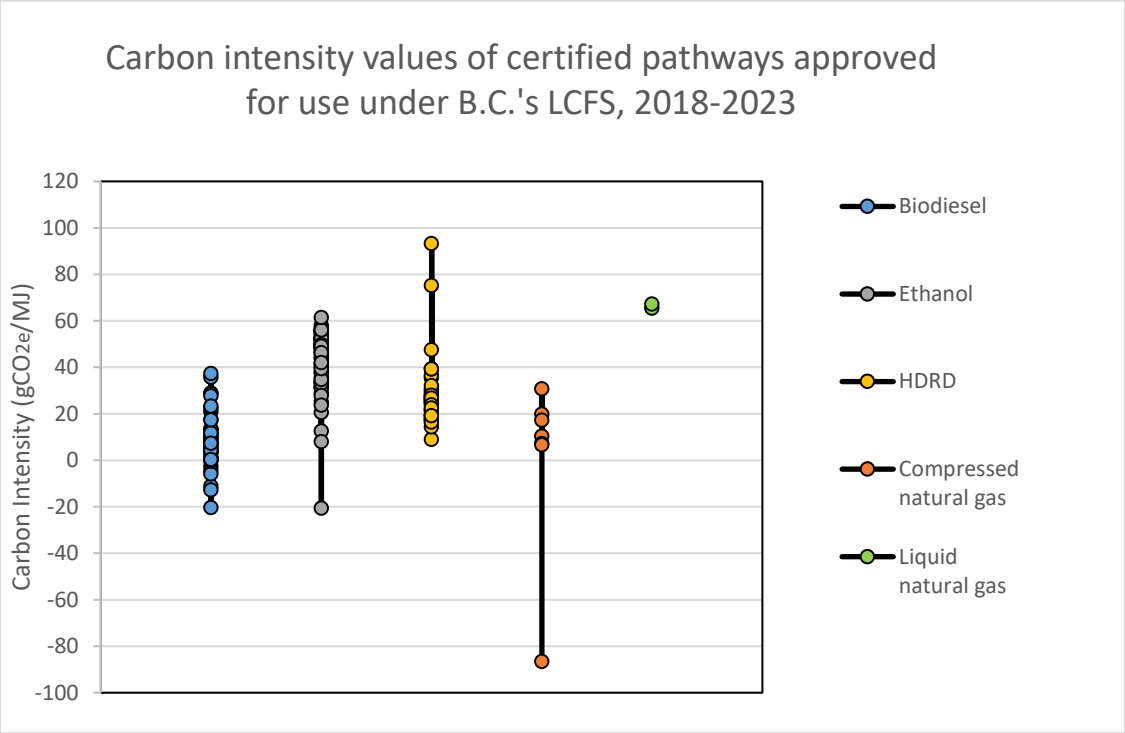
Similar to Canada's CFS, BC's LCFS sets CI targets that decline each year. Fuel suppliers generate credits for fuels with a CI below the targets and receive debits for fuels with a CI above the targets. Debits and credits are proportional to the emissions a fuel generates over its full life cycle. Credits can be traded between fuel suppliers or banked for future use. However, unlike Canada's proposed CFS, at the end of each compliance period, suppliers must have a balance of zero or more credits to avoid non-compliance penalties. If a company does not meet balance requirements, it receives a black mark on its history and may pay a penalty option of about CDN $200/ton. CI values under BC-LCFS is calculated using the GHGenius model.

In July 2020, the provincial government announced a ten-year extension of its LCFS and related renewable fuel regulations. The current reduction targets are 10.2 percent in 2021, 11.3 percent in 2022, 12.4 percent in 2023, 13.5 percent in 2024, 14.5 percent in 2025, 15.6 percent in 2026, 16.7 percent in 2027, 17.8 percent in 2028, 18.9 percent in 2029 and 20 percent in 2030.

In October 2021, the province announced it will raise the 2030 CI reduction target to 30 percent, consistent with advice from British Columbia's Climate Solutions Council. It has yet to announce how the targets between now and then will be revised.

British Columbia's LCFS credit average prices in July 2021 hit an all-time high of CDN $467.49 per credit on six transfers for a total volume of 22,529 credits with transfer price levels ranging from CDN $425 per credit to CDN $495/credit. In the years 2017 through 2019, there were insufficient credits created to cover CI deficits.

The graph below illustrates the carbon intensity values of certified pathways approved for use under British Columbia's LCFS during the years 2018 to 2023. Not all approved pathways necessarily represent an actual sale of fuels into the market.




*Source: FAS/Ottawa; B.C. Ministry of Energy, Mines and Low Carbon Innovation*
*Notes: HDRD = Hydrogenation-derived renewable diesel, or hydrogenated vegetable oil; CNG = compressed natural gas; LNG = liquid natural gas*

The British Columbia government announced its intention to modernize the legislation governing the LCFS, including an expansion to cover marine and aviation fuels beginning in 2023. British Columbia has in the past considered adding jet fuel classes as an eligible credit generation, an action Oregon's and California's LCFS programs took in 2019, but in 2020 it decided not to. British Columbia will also consider new compliance options such as negative emissions technologies, while increasing the financial implications of failing to comply.

British Columbia's LCFS allows companies supplying less than 75 million liters of fuel in 2020 to apply for exemption from the renewable or low carbon fuel requirements. The limit is reduced to 25 million liters for the 2021 compliance period, and 200,000 liters starting in 2022.

In July 2020, the 2020 CI reduction target was reduced to 9.1 percent from ten percent "to take some of the pressure off the oil and gas sector as it deals with the significant economic impacts resulting from an unprecedented global drop in crude oil prices combined with lower demand due to the COVID-19 pandemic."

In addition to the LCFS, British Columbia has a carbon tax on fuels that applies the same rate to biofuels as it does to petroleum fuels, unlike the federal carbon tax on fossil fuels. The tax reached CDN $45 per ton of CO2e in April 2021 and will reach CDN $50 per ton of CO2e in 2022. The biofuel sector has criticized the tax for being a volumetric fuel taxation instead of an energetic taxation, meaning that fuels are taxed more as the level of renewable fuel blended in fossil fuel increases (e.g. E85 fuel is taxed higher than E0). Industry is lobbying for an amendment to British Columbia's Tax Act.

British Columbia also sets an average five percent renewable content in gasoline and four percent in diesel fuels.

The province announced in 2021 that it will double its commitment to "develop production capacity for made-in-British Columbia. renewable fuels to 1.3 billion liters per year by 2030, creating new jobs and economic opportunities across the province."

In October, the government of British Columbia. released its GHG emissions-reductions goals in its Roadmap to 2030. Among other things, the report proposes bringing marine and aviation fuels into the LCFS program starting in 2023

**Ontario**

Ontario is the most populous Canadian province and leads the country in gasoline, and often diesel, consumption. Ontario's Greener Gasoline regulation came into effect in 2007.

As of January 1, 2020, the *Greener Gasoline Regulations* required that fuel suppliers maintain at least an annual average of ten percent renewable content in the gasoline they sell in Ontario. Further, the *Greener Diesel Regulations* required that, as of 2017, a minimum four percent of the total volume of diesel fuel must be bio-based. Both regulations were repealed in November 2020 and replaced with the O. Reg. 663/20: Cleaner Transportation Fuels: Renewable Content Requirements For Gasoline And Diesel Fuels.

*The Cleaner Transportation Regulation* sets gasoline blend rates at ten percent for the years 2020 through 2024, 11 percent for years 2025 through 2027, 13 percent in 2028 through 2029, and 15 percent in 2030. It also maintains the four percent blend rate for diesel.

Prior to 2020, a minimum of five percent renewable content was required in gasoline; however, Ontario regularly blended upwards of eight percent renewable content in gasoline.

**Quebec**

Quebec currently has no blending requirements. In May 2021, the government of Québec released a draft regulation that would set minimum low-carbon renewable fuel blend rates of 15 percent in gasoline and ten percent in diesel sold in the province by 2030. The regulation, which was included

in the proposed *Petroleum Products Act*, would set a blend rate ten percent for gasoline in 2023 increasing to 12 percent in 2025 and 14 percent in 2028 before reaching 15 percent in 2030.

Québec passed legislation introducing a cap-and-trade system (excluding transport biofuels) in 2012 and held its first carbon allowance auction in December 2013. The first joint California-Québec carbon allowance auction was held in November 2014.

A minimum auction price of CDN $10.75 per ton was set for 2013 and it was expected to increase at a rate of five percent plus inflation every year until 2020. In February 2020 (the first auction of the year), the minimum price was set at a record CDN $22.11 (USD $16.68). per ton of CO2e. The average price in 2020 was CDN $22.76 (USD $16.97) per ton of CO2e. For joint auctions with California, the minimum price is set by retaining the higher of the two system's minimum prices at the exchange rate prevailing at the time of the auction.

**Saskatchewan**

Saskatchewan maintains gasoline blend mandate of 7.5 percent and diesel blend mandate of two percent.

**Financial Support for Biofuel Producers**

In the 2021 Budget , the Canadian government earmarked CDN $1.5 billion over five years to be used beginning in 2021 for Natural Resources Canada to establish a Clean Fuels Fund. The Fund is intended to support the production and distribution of low-carbon and zero-emission fuels, such as hydrogen and biomass, both in Canada and internationally. The fund launched June 2021 with a call for proposals. No projects have officially been announced, although several industry sources have suggested the government has committed an unspecified amount of funds to the development of renewable fuel facilities.

A University of Alberta research project to create jet fuel from biowaste received a CDN $2.89 million funding boost from Natural Resources Canada. It was announced in March 2021.

In 2018, Canada launched two challenges under The Sky's the Limit Challenge. These challenges expanded the SAF network in Canada and contributed to cross-sectoral consortia building, helping industry identify existing expertise and capacities to help further scale up SAF in Canada.

The Sky's the Limit Challenge, Stream 1, is the Green Aviation Fuels Innovation Competition. It was an open call for proposals where up to four finalists will receive up to CDN $2 million each over 18 months to support their efforts to develop the best way to scale up sustainable aviation fuel in Canada. A CDN $5 million prize will be awarded to the finalist with the most economically and environmentally sustainable approach for commercial-scale sustainable aviation fuel production in Canada. The objective is to accelerate the affordability and availability of sustainable aviation fuel. The results will be announced spring 2022.

The Sky's the Limit Challenge, Stream 2, is a Cross-Canada Flight Competition. One million dollars will be awarded to the first producer with a made-in-Canada biojet fuel that meets the criteria for a major Canadian airline to purchase and use for a flight across Canada (ten percent minimum blend). Again, the objective is to accelerate the affordability and availability of sustainable aviation fuel. The results were expected to be announced in December 2021.

To support the long-term development of low-emission marine and aviation fuels, the Government of Canada will provide CDN $227.9 million over eight years, starting in 2023-24, to the Treasury Board Secretariat to implement a Low-Carbon Fuel Procurement Program within the Greening Government Fund. No projects have been announced yet.

To advance carbon capture, utilization, and storage technologies, the Government of Canada will provide CDN $319 million over seven years, starting in 2021-22, with CDN $1.5 million in remaining amortization, to Natural Resources Canada to support research, development, and demonstrations that would improve the commercial viability of carbon capture, utilization, and storage technologies.

Tax incentives for carbon capture and storage were announced in the federal government's 2021 budget and reiterated in December 2021 in the 2021 Economic and Fiscal Update. Details are forthcoming.

See FAS Ottawa's 2020 Biofuels Annual Report for information on previously announced federal and provincial financial support programs.

## III. Ethanol

| Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Calendar Year | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021f |
| **Beginning Stocks** | 127 | 130 | 131 | 131 | 131 | 131 | 131 | 131 | n/a | n/a |
| Fuel Begin Stocks | 127 | 130 | 131 | 131 | 131 | 131 | 131 | 131 | 169 | 191 |
| **Production** | 1,780 | 1,815 | 1,820 | 1,820 | 1,860 | 1,890 | 1,990 | n/a | n/a | n/a |
| Fuel Production | 1,695 | 1,717 | 1,756 | 1,721 | 1,739 | 1,728 | 1,748 | 1,891 | 1,689 | 1,690 |
| **Imports** | 839 | 1,080 | 1,161 | 1,224 | 1,192 | 1,251 | 1,346 | 1,274 | 1,258 | 1,280 |
| Fuel Imports | 805 | 1,079 | 1,139 | 1,088 | 1,113 | 1,216 | 1,233 | 1,220 | 1,166 | 1,200 |
| **Exports** | 54 | 58 | 63 | 68 | 76 | 88 | 73 | 83 | 143 | 178 |
| Fuel Exports | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 26 | 106 | 115 |
| **Consumption** | 2,562 | 2,836 | 2,918 | 2,976 | 2,976 | 3,053 | 3,263 | n/a | n/a | n/a |
| Fuel Consumption | 2,497 | 2,795 | 2,895 | 2,809 | 2,852 | 2,944 | 2,971 | 3,047 | 2,727 | 2,766 |
| **Ending Stocks** | 130 | 131 | 131 | 131 | 131 | 131 | 131 | n/a | n/a | n/a |
| Fuel Ending Stocks | 130 | 131 | 131 | 131 | 131 | 131 | 131 | 169 | 191 | 200 |
| **Refineries Producing Fuel Ethanol (Million Liters)** | | | | | | | | | | |
| Number of Refineries | 14 | 15 | 15 | 15 | 14 | 13 | 12 | 12 | 12 | 12 |
| Nameplate Capacity | 1,815 | 1,760 | 1,800 | 1,800 | 1,750 | 1,653 | 1,822 | 1,841 | 1,881 | 1,881 |
| Capacity Use (%) | 93.4% | 97.6% | 97.6% | 95.6% | 99.4% | 104.5% | 95.9% | 102.7% | 89.8% | 89.8% |
| **Co-product Production (1,000 MT)** | | | | | | | | | | |
| DDGS | 1,075 | 1,100 | 1,100 | 1,100 | 1,100 | 1,100 | 1,100 | n/a | n/a | n/a |
| WDG | 635 | 650 | 650 | 650 | 425 | 425 | 425 | n/a | n/a | n/a |
| Corn Oil | 3 | 6 | 6 | 6 | 10 | 10 | 10 | n/a | n/a | n/a |
| **Feedstock Use for Fuel Ethanol (1,000 MT)** | | | | | | | | | | |
| Corn | 3,285 | 2,172 | 3,371 | 3,405 | 3,577 | 3,411 | 3,884 | 4,102 | 3,560 | 3,550 |
| Wheat and other grains 1 | 890 | 2,063 | 891 | 766 | 630 | 778 | 370 | 459 | 552 | 540 |
| **Market Penetration (Million Liters)** | | | | | | | | | | |
| Fuel Ethanol Use | 2,497 | 2,795 | 2,895 | 2,809 | 2,852 | 2,944 | 2,971 | 3,047 | 2,727 | 2,766 |
| Gasoline Pool 2/ | 46,181 | 47,412 | 46,688 | 47,620 | 49,149 | 49,605 | 51,085 | 48,445 | 42,277 | 46,165 |
| Blend Rate (%) | 5.4% | 5.9% | 6.2% | 5.9% | 5.8% | 5.9% | 5.8% | 6.3% | 6.5% | 6.0% |

Note: 1/ "Other grains" generally represents less than one percent of total feedstocks.
Note: 2/ Covers gasoline and all biocomponents (biofuels) like ethanol and ETBE as well as MTBE if used; Source: IEA, March 2021
f = forecast

See 'Notes on Statistical Data.'

## Production

The COVID-19 pandemic negatively impacted Canadian ethanol production in 2020 with a collapse in gasoline demand as long-term lockdown provisions, which began in March 2020, restricted personal mobility, including commuting for work. In 2020, ethanol production reached its lowest level in at least eight years. Despite the partial recovery in the gasoline pool expected in 2021, little year-over-year change is anticipated for ethanol production as the average blend rate slips from a record 6.5 percent to an estimated 6 percent.

There was an increase in the production of denatured ethanol for industrial use in 2020, likely related to COVID-19. In April 2020, for example, Greenfield announced that the Johnstown, Ontario facility, which produced fuel, would begin supplying up to 260 million liters per year (mlpy) of technical grade alcohol, which has fewer impurities than ethanol used as fuel. The Johnstown plant was the first fuel plant to receive approval from Health Canada to convert its

production. In October, Greenfield announced that it would produce 100 mlpy of U.S. Pharmacopeia Grade (USP) alcohol at its facility in Johnstown, Ontario before the end of 2021.

| Operational Commercial-Level Ethanol Fuel Facilities, 2020 - 2021 | | | |
|---|---|---|---|
| **Ethanol Plant** | **Location** | **Feedstock** | **Capacity (mmly liters)** |
| **Co-op Ethanol Complex** | SK | Wheat | 150 |
| **Enerkem Alberta Biofuels** | AB | MSW | 38 |
| **GreenField Global - Varennes** | QC | Corn | 190 |
| **GreenField Glboal - Johnstown** | ON | Corn | 260 |
| **Husky Energy - Lloydminister** | SK | Wheat, Corn | 150 |
| **Husky Energy - Minnedosa** | MB | Wheat, Corn | 150 |
| **IGPC Ethanol Inc** | ON | Corn | 380 |
| **Kawartha Ethanol Inc** | ON | Corn | 80 |
| **North West Bio-Energy Ltd.** | SK | Wheat | 25 |
| **Permolex** | AB | Wheat | 48 |
| **Pound-Maker Agventures Ltd** | SK | Wheat | 14 |
| **Suncor** | ON | Corn | 396 |
| **Total Nameplate Capacity** | | | 1,881 |

*NOTE: The Production, Supply, and Disposition Table includes all facilities in full operation as well as partially/fully idled whereas the above table lists only facilities that are operational.*

In November 2019, national capacity rose after IGPC Ethanol Inc. nearly doubled capacity of their southern Ontario plant to 378 mlpy. Media reported that the expanded plant could consume 2,500 metric tons of locally produced corn per day.

Husky Energy's Lloydminster, Alberta facility increased capacity from 130 mlpy to 150 mlpy in 2020 due to investments in infrastructure.

In 2020, 86 percent of ethanol production was derived from corn and 14 percent from wheat, according to data available from ECCC. This represents a four-percentage point decrease in wheat use over the previous year. However, the long-term trend points to a continued increase in the use of corn, given the greater ethanol yield it provides compared to wheat. Feedstock choice for ethanol plants is somewhat driven by differences in geography, with wheat being part of the feedstock mix only in the prairie provinces and corn being the primary feedstock elsewhere.

There is ongoing interest in developing new corn varieties that can be grown in Western Canada. As more corn varieties are developed with lower heat unit requirements, corn use for ethanol production in Saskatchewan and Alberta has increased. There has also been increased research into wheat varieties for industrial uses. Wheats tailored to the needs of the bioethanol industry are varieties with high-starch, low-protein content.

Corn oil extraction rates at Canadian ethanol plants remain low compared to U.S. plants due to Canada's Feeds Regulations and feeding practices requiring that dried distiller grain (DDG) have a

minimum energy content for cattle due to colder environmental conditions. This means that buyers require more oil remain in DDGs consumed in Canada. Guidance on these regulations is available on the Canadian Food Inspection Agency's web site.

**Consumption**

The average national blend rate increased 0.2 percentage points to 6.5 percent in 2020 from 2019, which is higher than the five-year average of 5.9 percent. The national average blending rate remains above the five percent blending requirement under Canada's RFR. Ontario, the largest importer and producer of ethanol, has mandated a blend rate of ten percent since 2020 and thus offsets lower blending elsewhere. Data for 2021 is not yet available but is expected to remain near 2020 levels.

**Imports**

Imports fell in 2020 due to COVID-related lockdown provisions and the subsequent reduction in personal and commercial activities but dependency on imports increased as domestic production declined.

Looking ahead, ECCC estimates that Canada could import additional volumes of ethanol needed (about 2.8 billion liters) to achieve the equivalent of E15 under the CFR.

**Exports**

Generally, Canada has negligible exportable ethanol supply; however, exports reached an average annual record high in 2020. Exports of undenatured ethanol in 2020 rose with the export of fuel ethanol to Europe. The price of European-bound ethanol was higher than the ethanol price in North America and the average price also went down when this volume doubled, indicating that a significant amount of European-bound volume was used for fuel. 2020 was the first year that exports to the Netherlands from Canada occurred. It is likely that this production is not captured in Statistics Canada's facility survey, as explained in this report's statistical notes.

While we typically think of denatured ethanol as fuel and undenatured as other industrial including medical grade, this is not always the case and has diverged a lot in certain markets. Europe is known to use undenatured for fuel, which is what Canada ships to Europe.

The lower transport fuel demand resulting from the pandemic lock-down allowed ethanol producers in Canada to direct a share of ethanol to produce hand sanitizers; however, demand attributed to this market is small and will never offset lost demand for fuel.

Canada collects a CDN $0.0492 per liter tariff on denatured ethanol imported from most favored nation (MFN) status countries under the 2207.20 HS line, including Brazilian denatured ethanol. Products imported under 2207.20 from the United States, the European Union and other free trade

agreement partners enter Canada duty free. Undenatured ethanol imported under 2207.10 from all sources enter Canada duty-free.

## IV. Biodiesel / Renewable Diesel

| Biodiesel (FAME) & Renewable Diesel (HDRD), Million Liters | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Calendar Year | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021f |
| **Biodiesel (Million Liters)** | | | | | | | | | | |
| **Beginning Stocks** | 19 | 4 | 20 | 20 | 20 | 20 | 20 | 20 | 11 | 9 |
| **Production** | 102 | 159 | 351 | 397 | 464 | 397 | 308 | 359 | 457 | 460 |
| **Imports** | 256 | 301 | 264 | 281 | 262 | 300 | 391 | 409 | 384 | 497 |
| **Exports** | 102 | 156 | 327 | 267 | 455 | 350 | 308 | 342 | 451 | 435 |
| **Consumption** | 268 | 288 | 287 | 410 | 270 | 348 | 391 | 436 | 392 | 482 |
| **Ending Stocks** | 4 | 20 | 20 | 20 | 20 | 20 | 20 | 11 | 9 | 9 |
| **Renewable Diesel (Million Liters)** | | | | | | | | | | |
| **Production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Imports** | 260 | 289 | 346 | 224 | 261 | 411 | 358 | 380 | 500 | 480 |
| **Exports** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Consumption** | 260 | 289 | 346 | 224 | 261 | 411 | 358 | 380 | 500 | 480 |
| **Biodiesel + Renewable Diesel (Million Liters)** | | | | | | | | | | |
| **Beginning Stocks** | 19 | 4 | 20 | 20 | 20 | 20 | 20 | 20 | 11 | 9 |
| **Production** | 102 | 159 | 351 | 397 | 464 | 397 | 308 | 359 | 457 | 460 |
| **Imports** | 516 | 590 | 610 | 505 | 523 | 711 | 749 | 789 | 884 | 977 |
| **Exports** | 102 | 156 | 327 | 267 | 455 | 350 | 308 | 342 | 451 | 435 |
| **Consumption** | 528 | 577 | 633 | 634 | 531 | 759 | 749 | 816 | 892 | 962 |
| **Ending Stocks** | 4 | 20 | 20 | 20 | 20 | 20 | 20 | 11 | 9 | 9 |
| **Biodiesel Production Capacity (Million Liters)** | | | | | | | | | | |
| Number of Plants | 8 | 8 | 8 | 9 | 9 | 9 | 11 | 13 | 12 | 12 |
| Nameplate Capacity | 223 | 400 | 400 | 400 | 550 | 591 | 728 | 931 | 912 | 912 |
| Capacity Use (%) | 46% | 40% | 88% | 99% | 84% | 67% | 42% | 39% | 50% | 50% |
| **Renewable Diesel Production Capacity (Million Liters)** | | | | | | | | | | |
| Number of Plants | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nameplate Capacity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capacity Use (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Feedstock Use for Biodiesel + Renewable Diesel (1,000 MT)** | | | | | | | | | | |
| Canola Oil | 7 | 65 | 114 | 178 | 305 | n/a | n/a | n/a | n/a | n/a |
| Soybean Oil | 0 | 106 | 54 | 150 | 150 | n/a | n/a | n/a | n/a | n/a |
| Used Cooking Oil | 46 | 65 | 420 | 175 | 42 | n/a | 20 | n/a | n/a | n/a |
| Animal Fats | 26 | 91 | 83 | 75 | 83 | 299 | 56 | 68 | 67 | 65 |
| **Market Penetration, Biodiesel + Renewable Diesel (Million Liters)** | | | | | | | | | | |
| Diesel Pool, total 1/ | 34,017 | 34,530 | 34,279 | 34,998 | 32,760 | 35,392 | 36,363 | 34,870 | 32,927 | 34,401 |
| Blend Rate (%) | 1.6% | 1.7% | 1.8% | 1.8% | 1.6% | 2.1% | 2.1% | 2.3% | 2.7% | 2.8% |

Note 1/ Fossil diesel plus all "bio-components" (biofuels) blended with fossil diesel. Source: IEA f = forecast

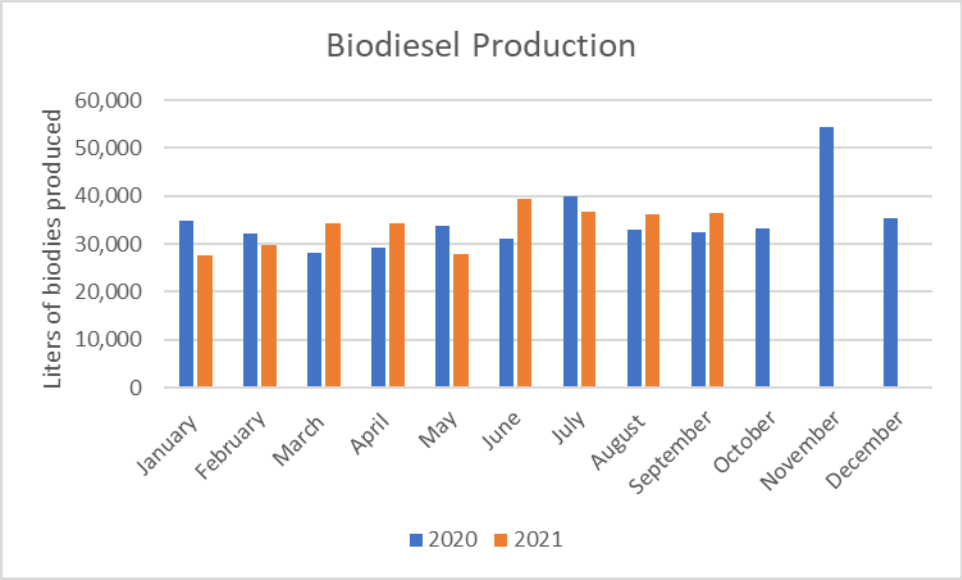
Note 2: HDRD (Hydrogenation-derived Renewable Diesel) dominates commerialized renewable diesel worldwide.

See 'Notes on Statistical Data.'

**Production**

Despite some decline in total diesel demand in 2020 relative to 2019, although more modest than gasoline, biodiesel and renewable diesel use combined actually rose nine percent, driving overall renewable blending in diesel to a record 2.7 percent on average across Canada. Biodiesel production was up 27 percent in 2020 and is estimated to have held close to that level in 2021.

Strong exports to the U.S. supported higher domestic production. Monthly survey data from Statistics Canada only became available in January 2020, making it difficult to do year-over-year monthly comparisons of production data during the first year of the pandemic. A stable demand pull is estimated in 2021.




*Source: Statistics Canada. Table 25-10-0082-01*

Looking ahead to the 2021 annual forecast, annual production is projected to increase further on renewed domestic demand and solid U.S. sales.

In 2020, there were eight operational biodiesel plants in Canada with 746 mlpy of existing capacity and 232 mlpy were under construction or expansion. Including idled facilities, there were 912 mlpy of capacity in 2020. Canary Biofuels is excluded from the list of operational facilities because it became operational in November 2021. It is included in the Production, Supply and Distribution table, which captures idle facilities.

| Operational Commercial-Level Biodiesel Facilities, 2020 and 2021 | | | |
|---|---|---|---|
| **Biodiesel Plant** | **Location** | **Feedstock** | **Capacity (mmly liters)** |
| **Archer Daniel Midland** | AB | Canola Oil | 284 |
| **Atlantic Biodiesel** | ON | Canola oil, Soy oil | 170 |
| **Consolidated Biofuels Ltd** | BC | UCO | 11.4 |
| **Innoltek Inc.** | QC | Multi | 19 |
| **Milligan** | SK | Canola oil | 20 |
| **Noroxel** | ON | UCO, animal fat | 5 |
| **Canary Biofuels Inc.*** | AB | Multi (animal fat, any plant) | 0 |
| **Verbio Diesel Canada Corp.** | ON | Canola oil, soy oil | 170 |
| **BIOX - Hamilton** | ON | Multi | 67 |
| **Total Nameplate Capacity** | | | **746** |

*Note: Canary Biofuels became operational in November 2021*

*Note II: Production, Supply, and Disposition Table includes all facilities in full operation as well as partially/fully idled whereas the above table lists only facilities that are operational.*

The Rothsay Biodiesel plant in Saint-Catherine, Ontario shuttered in 2020. It has a capacity of 45 mlpy.

Canary Biofuels, which purchased the Invigor BioEnergy facility located in Lethbridge, Alberta, became operational in November 2021 after completing Phase I of its "Generation 2 Biodiesel Upgrade." The company states they will produce 91 mlpy of biodiesel in Phase I and 182 mlpy in Phase II. The expected date of completion of Phase II is unknown. The facility, previously left idle, had a capacity of 71 mlpy until expansion began in 2019.

Fifty million liters per year of capacity remains offline while BIOX upgrades a facility it purchased in 2016 at the Sombra site. The status of the expansion is unknown.

Currently, Canadian biodiesel producers have limited competition for canola oil feedstocks from U.S. fuel producers who opt for other less costly feedstocks covered by the U.S. RFS. An official petition[8] requesting the Environmental Protection Agency (EPA) establish pathways for renewable diesel derived from canola oil as "advanced biofuel" (D4 and D5 RINs) under the RFS program was submitted in March 2020. It is still under review by the EPA. Should canola receive approval, competition for canola oil could increase.

As of 2021, there were still no commercial-level renewable diesel plants in operation, but 81 million liters is expected to come online in Newfoundland 2022, and 3.27 billion liters for development over the next four years. An idled oil refinery in the town of Come By Chance, Newfoundland was reportedly purchased by a Texas-based equity firm that plans to produce renewable diesel and sustainable aviation fuel beginning in mid-2022.

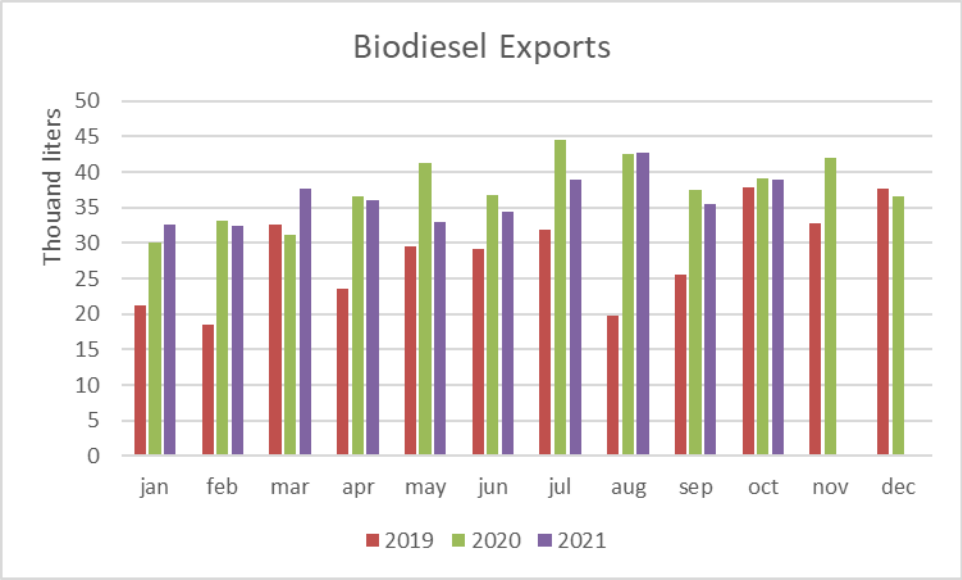
[8] While canola oil has been an approved feedstock for biodiesel production in the United States since September 2010 (i.e. it can generate D6 RINS), it is not an approved feedstock in renewable diesel production for fuel providers looking to meet their legal obligations.

## Consumption

The average national blend rate in 2020 rose to a record 2.7 percent. Consumption growth was attributed higher blending despite some reduction in the diesel pool nationwide. The blending rate is forecast to nudge upwards in 2021 on increased domestic consumption; 2021 data is not available.

## Biodiesel Exports

In 2020, Canadian biodiesel exports increased by 32 percent year-over-year on strong demand from the United States. Exports reached their peak in July and August.




*Source:* *Trade Data Monitor, LLC*
*Note:* *This table includes only HS 32600; exports under HS 271020 remain minimal*

Canada's biodiesel plants are export oriented. In any given year, 88 to 99 percent of Canadian biodiesel is exported and virtually all is shipped to the United States while only small residual exports head to Europe.

The U.S. market nets higher returns to producers than domestic outlets due to the U.S. Biomass-Based Diesel (BBD) blenders tax credit of USD $1/gallon, and Renewable Identification Numbers (RINs) which are attached to every gallon of BBD and have value when the product is sold to blenders. RIN values vary over time and are impacted by many factors, including non-market factors tied to ongoing political risk. The blenders credit adds considerable value to each gallon sold into the United States by Canadian companies.

**Biodiesel and Renewable Diesel Imports**

Biodiesel imports fell six percent in 2020 year-over-year on reduced domestic demand and a higher level of domestic supply. Renewable diesel imports increased 32 percent in 2020 over 2019 levels. Product misclassification under available trade codes injects some uncertainty into these statistics (see Appendix).

The share of renewable diesel and biodiesel imported from the United States increased from 2019. Eighty-three percent of Canada's imports of biodiesel and renewable diesel came from the United States in 2020, with most of the remainder coming from the Netherlands and Singapore. In 2019, 68 percent of imported biodiesel and renewable diesel came from the United States.

## V. Advanced Biofuels

Though Canada's production of biofuels using advanced technology platforms is limited, federal and provincial policy incentives favoring lower carbon intensity biofuels would provide additional support to advanced biofuels production in Canada. FAS Ottawa is aware of 3.3 billion liters of RD production capacity that has been announced will come online between 2022 and 2025. Construction has begun on a fraction of this and as with similar announcement in the United States not all will be built within the timeframe identified. Encouraging the massive expansion of RD production capacity across North America, and first ever plants in Canada, is the increasing likelihood more U.S. states will adopt LCFS-like programs, increasing state and federal program support across the market chain, favorable tax policy, and changes the CFS is expected to bring to Canada transport fuel market. In Canada, at least seven companies are seriously considering producing SAF as well at their new plants, two companies have committed to producing SAF, and one company is currently co-processing SAF at an existing oil refinery.

Two Canadian firms have achieved commercial-scale production of advanced biofuels. Enerkem's Edmonton, Alberta facility makes cellulosic methanol and ethanol (which can be used as fuel or other industrial chemicals) from syngas by recycling carbon in municipal solid waste (MSW). With the addition of a methanol-to-ethanol converter unit, the plant began producing ethanol in 2017, and has a maximum annual methanol-ethanol production capacity of 49 million liters.

Ensyn Technologies Inc. uses woody biomass to make biocrude, used in one of two ways. First, it is used as feedstock that is co-processed at refineries to produce lower carbon fuels and any number of chemicals. Secondly, it is used to produce renewable fuel oil for heating and cooling, and other specialty chemicals, via a process called rapid thermochemical liquification.

Enerkem's demonstration plant in Sherbrooke, Quebec has been making ethanol since 2012. The Westbury facility tests new feedstocks, produces syngas, methanol, and ethanol, and has an annual methanol production capacity of five million liters. In 2021, Enerkem announced that it had produced SAF under Canada's Sky's the Limit Challenge, leading the company to assess SAF production at the commercial level, as described in the SAF section of this report.

**Sustainable Aviation Fuel (SAF)**

As approved under ASTM, SAF blends are drop-in fuels fully compatible with the legacy fleets and airport fueling infrastructure with no modification required to aircraft or airport fueling systems. By design, they meet and exceed all operational requirements for fossil jet A and A-1.

There is currently no commercial production of SAF in Canada. The cost of production is remains high and while costs will come down over time this element is expected to remain a key challenge for the next several years in high-income countries and even longer for the rest of the world. Significant incentives are required on both the supply and demand sides before SAF use in Canada takes off in a sustained manner. Industry analysts and key industry organizations foresee the global SAF industry will depend hydro-treated on virgin and waste oils and fats initially and possibly some alcohols derived through fermentation, but eventually that reliance will shift toward to different advanced technologies using cellulosic forestry wastes, MSW and other alternative feedstock. Canadian studies show that "overall, adopting biojet fuel based on Canadian canola has the potential to reduce GHG emissions of jet fuels by 42 to 49 percent."

SAF presents the single largest opportunity for the airline industry to reduce its carbon footprint, especially for long haul flights, larger than new airframe and engine technologies and much larger than flight management and operations. In addition to more SAF certifications under ASTM, efforts are now well underway to approve certain SAF or SAF combinations for 100 percent neat use in jet engines which will greatly increase SAF's contribution to GHG emission reductions, especially for those SAF with the lowest CI. It now seems probable that emerging technologies will permit electrification and hydrogen to replace fossil jet fuels for smaller aircrafts flying short distance routes, but efforts will take time.

Aviation and marine transportation are receiving attention because they collectively account for 28 percent of worldwide transportation emissions and those emissions will increase as goods and passenger transportation grow. Most models, including those of the International Energy Agency, project that energy use in air transport will continue to grow at rate that exceeds that of any land transport mode following a trend now well established for well over the past couple of decades. According to the European Environmental Agency, emissions from international aviation and shipping have increased by nearly 130 percent and 32 percent respectively over the past two decades.[9] Marine transportation alone is projected to experience an increase in emissions by another 50 to 250 percent by 2050 in the absence of a switch to lower-carbon sources of energy. By 2050, emissions from planes are projected to be seven to ten times higher than 1990 levels.

Several initiatives in Canada seek to connect industry and bring industry and government together to create solutions to advance SAF use in Canada, including Canada's Sky's the Limit Challenge, and C-SAF. As previously noted, the government of B.C. proposed bringing marine and aviation fuels into the LCFS program starting in 2023.

## Production

At least two commercial-level SAF production facilities are expected to be operational in the next two years: Covenant in Saskatchewan (2023) and Expander in Alberta (2024). At least eight other companies are assessing commercial-level production of SAF in Canada.

In addition, Parkland's refinery in Burnaby, B.C. co-processes SAF and supplies it to the Vancouver International Airport (YVR). Parkland's facility uses both tallow and diesel in their FCC unit. The FCC produces mostly gasoline and some diesel, producing a gasoline blend with some biogenic components and a diesel blend with some biogenic components.

YVR is the only airport in Canada that uses co-processed SAF. Parkland supplies 30 percent of Vancouver International Airport's jet fuel. A feasibility study by Bioport YVR states that coprocessing of SAF has been encouraged via participation in the BC-LCFS's Part 3 Agreement program and the BC SMART Fuels Consortium led by the University of British Columbia.

At this time, seven different fuel-technology platforms are certified by ASTM to produce SAF for use in commercial aviation, in addition to co-production, offering numerous feedstock possibilities. Six other pathways are in the approval process.[10] HEFA-based SAF is the only product that is commercially available today and it has powered more than 95 percent of all SAF flights around the world to date. Alcohol-to jet (ATJ) is ASTM certified and appears poised to enter the North American market soon. Research is ongoing into more affordable "advanced" biojet fuels.

Other pathways are under development in Canada. For example, a proprietary thermochemical process was developed at Enerkem's Innovative Centre in Westbury, Quebec under Canada's Sky's the Limit Challenge.

Rising U.S. interest in SAF, the potential for long-term U.S. policy support, and a concerted effort by U.S. government departments to increase SAF usage will likely boost U.S. supply and incentivize Canadian markets, due to the close ties between the two countries.

## Trade

Canada currently does not produce any SAF and there is no consistent established supply chain for SAF imports.

The United States' Sustainable Skies Act is a new bill introduced in May 2021 that may lead to Canadian SAF exports to the United States. The Act would introduce a blenders' credit for SAF, like the U.S. blenders credit for biodiesel and renewable diesel. If passed as currently framed, it would offer a maximum USD $2-per-gallon credit. Such a significant supply incentive could lead to Canadian SAF exports, as is the case for biodiesel, unless domestic incentive programs are lucrative

[10] The following pathways are in the approval process: ATJ-SKA, HEFA-SKA, HDO-SAK, CPK-0, HTL, SAK + SPK.

enough to keep product at home. Otherwise, we are likely to see the same circular trade emerge for SAF as occurs for biodiesel.

The U.S. Sustainable Skies Act disqualifies refinery co-processing of any feedstock other than Fischer-Tropsch liquids from receiving the blenders Tax Credit; it excludes the co-production of HEFA-containing jet fuels via co-processing, such as currently produced at Parkland's Burnaby refinery in British Columbia.

## APPENDICES

### Notes on Statistical Information

**Ethanol Production:** FAS Ottawa's reported production estimates for the year 2020 and for YTD 2021 are calculated by adding denatured production reported by Statistics Canada's Table 25-10-0082-01 to undenatured fuel ethanol exported from Canada to France and the Netherlands, using unit values and volumes as guidance. Year 2020 was the first year that exports to the Netherlands occurred. Volumes sent to France increased significantly in 2021.

Statistics Canada, in their facility-level monthly survey, is unable to separate the production of denatured ethanol used for fuel ethanol from the production of denatured ethanol used for sanitizer, in Table 25-10-0082-01, due to the complexity. Producers who sell their products to distributors cannot reliably report whether the fuels were exported, kept in Canada, used as a fuel, etc. Additionally, fuel ethanol producers pivoted to produce ethanol for hand sanitizer during the pandemic, which may have been mis-categorized as well. FAS Ottawa resolves this problem by assessing unit values and volumes within the Canadian International Merchandise Trade Web Application and adding undenatured fuel exports to production levels submitted to ECCC.

Production data is submitted to ECCC by regulated facilities pursuant to the requirements of the RFR under the Canadian Environmental Protection Act. The data published is audited and is subject to ongoing verifications.

Separation of beverage ethanol from total ethanol volumes continues to be a challenge and, for that reason, total ethanol production is left blank in the PSD table for recent years.

Production levels in the years 2013 to 2019 are derived from data submitted to ECCC.

Capacity levels are determined by speaking with the ethanol industry and tracking publicly available news releases from companies.

**Ethanol Trade:** Total trade in ethanol used as both fuel and other industrial chemicals is derived from the Canadian International Merchandise Trade Web Application. Ethanol exports include undenatured ethanol under HS 2207.10 (excluding beverage ethanol under HS 2207.10.3000) plus all denatured codes under 2207.20.

Codes for ethanol used as fuel, both undenatured and denatured, were introduced in 2012 with most trade falling under denatured. However, FAS Ottawa does not assume all ethanol traded under fuel ethanol codes is used as fuel, nor does it assume all ethanol traded under non-fuel codes is used as non-fuel. As discussed, Canadian statistics (like those of other countries including the United States) that identify fuel use and non-fuel use are not fully accurate as shippers often may enter their end-use incorrectly. One way to differentiate non-fuel product is to look for smaller volume and higher unit value shipments. This is relative of course depending on the fuel ethanol price. Typically, the lowest unit value ethanol shipped in large volumes is fuel ethanol.

**Ethanol Co-products:** Co-product data is unavailable for years 2019 through 2021. Statistics Canada's renewable fuel table (Table 25-10-0082-01) aggregates co-products with undenatured ethanol production, making the category difficult to dis-aggregate and use.

**Ethanol Feedstocks**: Years 2013 to 2020 feedstock data is derived from data submitted to ECCC by regulated facilities. Feedstock numbers appear to be very accurate, with the exception of the aggregate 2020 value which may be low. The 2021 feedstock forecast is based on known feedstock/biofuel conversion rates, which are:

- Corn kernels: 1 MT = 402 (before 2014) to 417 liters (after 2014)
- Wheat kernels: MT = 393 liters

**Biodiesel Production:** Years 2013 to 2020 are derived from data submitted to ECCC by regulated facilities. Capacity levels are determined by speaking with the biodiesel industry and tracking publicly available news releases from companies.

**Biodiesel/Renewable Diesel Trade:** Biodiesel trade data is tracked under HS code 3826.00, which covers biodiesel blended above 30 percent by volume with fossil diesel, and HS code 2710.20 for petroleum oil containing biodiesel up to and including 30 percent biodiesel by volume. All biodiesel traded under HS 3826.00 is assumed to be B99. Some RD is also erroneously reported by customs officials under the biodiesel code HS 2710.20 and HS 3826.00. Trade data is derived from the Canadian International Merchandise Trade Web Application.

Canada imports large volumes of renewable diesel, but there is currently no trade code specific to this product. The few supplying companies do not share sales data. Renewable diesel imports are estimated by evaluating the unit value of imports from Finland, the Netherlands, and Singapore – all countries with renewable diesel plants – under biodiesel code 3826.00. Those result is added to the quantity of imports from the United States to determine total renewable diesel imports. FAS Ottawa adjusted the table for 97 million liters of biodiesel imports that were incorrectly coded as biodiesel in 2020.

New statistical subdivisions for specific biodiesel and RD import codes will be implemented effective January 01, 2022.

Statistics Canada's HS Breakout Committee reasoned:

*The original request was to create breaks under HS 3826.00. After discussions with the CBSA, the CBSA identified HDRD (hydrogenation-derived renewable diesel) as not classified under heading 38.26 as it does not meet the definition of "biodiesel" in Note 7 of Chapter 38 or Subheading Note 5 of Chapter 27. Rather, it meets the description in exclusion note (b) of the Explanatory Notes to heading 38:26: "(b) Products derived from vegetable oils which have been fully deoxygenated and consist only of aliphatic hydrocarbon chains (heading 27.10).*

Therefore, the breaks were created as follows under 2710.19:

- 2710.19.99.23: Diesel fuel blended with hydrogenation-derived renewable diesel (HDRD)
- 2710.19.99.93: Hydrogenation-derived renewable diesel (HDRD)

**Biodiesel Feedstocks:** Feedstock quantity for years prior to 2017 are based on information supplied by industry and consistent with known feedstock/biofuel conversion rates. Animal fat feedstocks are taken from ECCC data. Available data on canola oil, soybean oil, and UCO feedstock data for 2017 to 2020 is either aggregated or unreliable.

**Attachments:**

No Attachments