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Canada

Biofuels Annual

2019

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Report Highlights:
In December 2018, Canada released a highly anticipated document outlining the beginnings of a nationwide framework for switching from a volumetric to a carbon intensity approach for renewable fuels. In April 2019, the federal carbon pricing backstop was imposed on those provinces not meeting the minimum threshold. Five provinces are currently challenging the federal carbon pricing framework in court. Along with ethanol and biodiesel, wood pellets are included in this report.

Keywords: Canada, CA19017, Biofuels, Ethanol, Biodiesel, Renewable Diesel, HVO, Wood Pellets

I. Executive Summary

From 2007 through 2011, when provincial blending programs were first established, expanding domestic fuel ethanol demand was entirely met through domestic production. Beginning 2011, production did not keep up with increased demand and the first significant shipments from U.S. suppliers arrived. Since then, production and capacity expansion gains leveled off sharply, and through 2014, imports from the United States rose to meet further domestic consumption expansion. After 2014, domestic consumption (and imports) leveled off with only modest year-to-year changes. Today, Canadian ethanol plants are running near full capacity to produce 1.8 billion liters and fuel ethanol consumption is running approximately 3.2 billion liters. This is somewhat above provincial blending requirements (in aggregate terms) and the average national blend rate has edged up and currently is estimated at 6.6 percent. Imports are over 1.4 billion liters, and exports remain negligible. Canada uses mostly corn and also some feed wheat to produce ethanol.

Incentivized by the value of Renewable Identification Numbers (RIN) attached to every gallon of biodiesel that meets mandates under the U.S. Renewable Fuel Standard (RFS) and the U.S. biodiesel blenders credit, Canada continues to ship most of the biodiesel it produces to the United States. Biodiesel and renewable diesel imports fulfill provincial blend mandates, which emerged from 2007 through 2011, and expanded domestic demand thereafter. Consumption growth has been uneven, but has recently surpassed the 1 billion liter mark. Demand is fulfilled mostly with U.S. biodiesel but large shipments (mainly from Singapore but also Europe) of renewable diesel as well. The majority of domestic biodiesel production is exported to the United States. These exports have trended up long term, but have remained 300-460 million liters since 2016. In 2012, provincial and federal renewable content requirements in diesel were met using imports predominately. The average national blend rate has remained above 2 percent since with consumption growth attributed to an expanding diesel pool nationwide. Biodiesel production uses a diverse mix of canola, recycled oils, animal fats, and soybean oil as feedstock.

At the end of 2018, Environment and Climate Change Canada (ECCC) released a long-awaited regulatory design paper for Canada's Clean Fuel Standard (CFS). The paper outlined the beginnings of a switch to a carbon intensity approach when accounting for the quantity of blended renewable fuel. Canada plans to move away from the volumetric approach currently in place under federal Renewable Fuels Regulations, which will remain in force until ECCC clarifies how Canada will transition to an approach that sets goals to reduce the carbon intensity of fuels used. The new benchmark would require a reduction of 10 grams (g) of carbon dioxide equivalent (CO2e) per megajoule (MJ) below the reference year (2016) carbon intensity by 2030. Many unknowns remain with the new approach.

In April 2019, the federal government enacted a national carbon-pricing framework. Announced in 2016, the Pan-Canadian Approach to Pricing Carbon Pollution allowed provinces a year and a half to develop their own carbon-pricing plan before the federal government imposed a backstop on them. The provinces of Alberta, Manitoba, New Brunswick, Ontario and Saskatchewan are challenging the federal carbon-pricing framework (backstop) in provincial court. They either failed to develop a provincial carbon tax by the April deadline or wished to keep their own non carbon-pricing provincial models in place rather than adopting the federal approach or a new provincial approach.

In early 2019, the ECCC published national fuel ethanol and biodiesel production data for the first time for calendar years 2013 to 2017. FAS/Ottawa used this data for the production, supply and distribution calculations for those years.

This report also captures the wood pellets trade and, with Canada's abundance of forest resources, there is great potential to supply growing global demand for wood pellets. Wood pellets are recycled timber and other forest residues that are converted into renewable biomass fuel. Overseas demand growth for Canadian wood pellets is predominantly driven by the United Kingdom followed by Japan, the United States, and Italy. Production and domestic consumption have seen steady growth, and there is an opportunity for even more robust growth as Canada, and other countries, phase out coal power plants.

Looking ahead and drawing on eight years of experience on how California's renewable fuels market has changed under its Low Carbon Fuel Standard and carbon market, one can envision similar changes in Canada's market resulting from successfully meeting carbon reduction goals, taxing carbon in fossil fuels , and investing in projects to accelerate the switch to lower carbon fuels. First, lower carbon ethanols could replace higher carbon ones, but blend rate increases could be limited by the pace of change in delivery infrastructure and the vehicle fleet, in particular the flex-fuel fleet. With such constraints limiting ethanol blending increases, much of the volume gains could be awarded to biodiesel/renewable diesel, which, with the use of renewable diesel, do not face the same blending limitations and may be advantaged compared to ethanol with lower carbon intensity scores depending on the fuels available in the market. As in California, biogas could well find large new sales opportunity.

II. Policy and Programs

Federal Renewable Fuel Policy

Cost-Benefit Analysis Framework
In February 2019, ECCC released the Cost-Benefit Analysis Framework (CBA) for the CFS. This is part of a regulatory impact analysis statement (RIAS) that is published in the Canada Gazette along with regulations (and proposed regulations) to estimate the incremental benefit and cost impacts to society attributable to those regulations (and proposed regulations). This framework accompanies the CFS Regulation Design Paper published in December 2018. Specifically, it outlines the approach for the CBA as part of the RIAS that will accompany the 2019 publication of the proposed regulations.

The CBA identifies compliance cost impacts using one-time costs, and ongoing costs and savings where possible, using available evidence. The CFS would have three main categories of compliance and credit-generating actions:

1. Actions that reduce the carbon intensity of the fossil fuel throughout its lifecycle
2. Supplying low-carbon fuels
3. Specified end-use fuel switching

While ECCC is currently developing a Fuel Lifecycle Assessment (FLA) modelling tool and is updating existing economic models to assess the CFS, there appears to be nothing yet designed to model emission reductions, credit supply, or economic impacts of the CFS policy in detail. At this time, the CBA Framework only states an intention to be flexible on how fossil fuel primary suppliers can comply with the new regulations and that data will come from literature reviews, international studies and consultation with technical working groups.

Clean Fuel Standard
In December 2018, ECCC released the Regulatory Design Paper for the CFS. The Regulatory Design Paper will be published first and focuses on the liquid fuel stream regulations. There will be separate requirements for liquid, gaseous and solid fossil fuels that will come at a later date. Key design elements from the Regulatory Design Paper are carbon intensity, credit generation, the auctioning of credits, and indirect land-use change. For a brief summary, see the Government of Canada's backgrounder. For further information on the CFS see GAIN Report CA17047.

Key Elements of Clean Fuel Standards Regulatory Design Paper

Requirement for the liquid stream: the carbon intensity of liquid fuels will have to be reduced by 10 grams (g) of carbon dioxide equivalent (CO2e) per megajoule (MJ) below their reference (year 2016) carbon intensity by 2030. This corresponds to a carbon intensity reduction of approximately 11 percent and up to 23 megatons (Mt) of incremental emissions reductions by 2030.

Actions that generate credits, including fuel switching by end-users in the liquid stream: credits can be generated when some fuel users switch from a higher carbon intensity fuel to a lower carbon intensity fuel by changing or retrofitting combustion devices when a liquid transportation fuel is displaced by natural gas, propane or a non-carbon energy carrier (e.g., electricity, hydrogen) or when fuels are switched along the production chain of a fossil fuel.

Early action credits will be allowed for actions taken in all three fuel streams after the publication of final regulations for the liquid stream, which is expected to occur in 2020.

Trading of credits between fuel streams: 10 percent of a company's carbon intensity compliance obligation for any stream will be allowed to be met with credits from other streams.

Indirect land-use changes will not be accounted for in calculating the lifecycle carbon intensity of a fuel at this time. However, we (ECCC) are considering using proxies to account for some of these indirect land-use impacts.

Source: Environment and Climate Change Canada

Under the proposed CFS, separate carbon intensity requirements would be established for subsets of fuels in the following sectors: transportation, building requirements, and industry. The proposed CFS will not differentiate between crude oil types that are produced domestically or are imported. The federal government will maintain national blending mandates in the short-term, establishing an 'expiration date' for the volumetric requirements through consultations with stakeholders.

The federal government continues to consult on the liquid fuel stream of the CFS, expecting publication of proposed regulations in Canada Gazette, *Part I* by mid-2019 with publication of final regulations in *Part II* by 2020.[1] Ongoing consultation will continue throughout 2019/20 on the gaseous and solid fuel streams.

[1] Proposed regulations are published in Canada Gazette, *Part I* for public comment. Final regulations are published in Canada Gazette, *Part II* after they have been enacted. New laws are published in Canada Gazette, *Part III* after the laws have received Royal Assent.

Provincial Renewable Fuel Policy

From 2007 through 2011, British Columbia, Alberta, Saskatchewan, Manitoba and Ontario established a blending requirement of five to 8.5 percent for ethanol in gasoline and two to four percent for renewable content in diesel.[2] Federal use mandates followed thereafter, and, since December 2010, federal regulations have required fuel producers and importers to have an average ethanol content of at least five percent based on the volume of gasoline produced or imported. Since July 2011, federal regulations have required fuel producers and importers to have at least two percent, on average, renewable content based on the volume of diesel fuel and heating distillate oil that they produce or import. The current federal Renewable Fuels Regulations include a trading system and administrative, compliance, and enforcement provisions such as recordkeeping and reporting.

Provincial Blend Mandates

Province	Ethanol Blend Mandate for Gasoline	Renewable Blend Mandate for Diesel
British Columbia	5 percent	4 percent
Alberta	5 percent	2 percent
Saskatchewan	7.5 percent	2 percent
Manitoba	8.5 percent	2 percent
Ontario	5 percent	4 percent
Quebec	No Blend Requirement	No Blend Requirement

Source: Natural Resources Canada (NRCAN)

Ontario

Ontario is the most populous Canadian province and leads the country in gasoline, and often diesel, consumption. Ontario's Ethanol in Gasoline regulation came into effect in 2007 and requires, on average, a minimum of five percent renewable content in gasoline. However, Ontario regularly blends upwards of eight percent renewable content in gasoline at this time. A 10-percent bio-based content in regular gasoline has been approved for 2020. The new regulation will also include new requirements for renewable content in gasoline to have at least a 70-percent reduction in lifecycle greenhouse gas (GHG) intensity (similar to the Greener Diesel Regulation enacted in 2014). For further detail see GAIN Report CA17045.

The comment period closed in March 2019 on a Ministry of the Environment, Conservation and Parks proposed amendment that would increase the renewable content in gasoline to 15 percent by 2025. The proposed amendment also includes changes that would require reduced GHG emission from renewable content as well as new lifecycle assessment models (e.g. compliance formulas).

Ontario's 2014 Greener Diesel Regulation was phased-in from 2014 to 2017. The regulation requires a minimum renewable content in diesel and the renewable content has a minimum percent reduction in lifecycle GHG intensity compared to standard petroleum diesel. From 2017 onward, diesel fuel in

[2] Biodiesel is the primary renewable fuel blended with diesel, but hydro-treated vegetable oil (HVO) renewable diesel is also used in British Colombia and Ontario.

Ontario must have four percent minimum renewable content and the renewable content must have at least a 70-percent reduction in lifecycle GHG intensity.

Quebec

Although Quebec is the second largest market for gasoline and third largest market for diesel, it does not have a provincial renewable fuels requirement for transport fuels. Progress towards a blending mandate began back in 2017 when Phillippe Couillard's Liberal Party released a 2017-2020 Sustainable Development Action Plan, which called for regulations to establish renewable fuels blending requirements starting at five percent for gasoline and two percent for diesel. However, progress on the action plan stalled on the lead-up to the Quebec general election in October 2018. The Liberals lost power after 15 years to François Legault's new Coalition Avenir Québec (CAQ) party. On February 7, 2019, the new Quebec Minister of Energy and Natural Resources, Jonatan Julien, spoke at a meeting of the Quebec Association for the Production of Renewable Energy (AQPER) suggesting the Ministry's intention to continue pursuing this initiative. Many details are unclear, including the commencement date and whether food and feed-based biofuels are excluded. But the new party appears to support provincial blending mandates for both ethanol and biodiesel.

Alberta

Alberta's 2010 Renewable Fuels Standard requires an average of five percent renewable ethanol in gasoline and two percent renewable diesel in diesel fuel sold in Alberta. Alberta's standard requires that renewable fuels must demonstrate at least 25 percent fewer GHG emissions than the equivalent petroleum fuel. Alberta's Climate Change and Emissions Management Act requires a 5-percent reduction in gasoline vehicle GHG emissions below 1990 levels by 2020.

British Columbia

British Columbia's 2008 Greenhouse Gas Reduction (Renewable & Low Carbon Fuel Requirements) Act requires a minimum renewable fuel content of five percent for gasoline and four percent for diesel. These requirements apply to all fuels used for transportation in British Columbia with the exception of fuel used by aircraft or for military operations. Since 2013, British Columbia has maintained six to seven percent renewable content in gasoline and five to six percent in diesel.

In addition to volumetric requirements, British Columbia also has a Low Carbon Fuel Standard (LCFS) enacted in 2008. This requires that fuel suppliers must progressively decrease the average life-cycle carbon intensity of their fuels to achieve a 10-percent reduction in 2020 relative to 2010. In January 2019, British Columbia reported that the fuel supply industry is meeting these requirements. On December 1, 2017, the province began consulting on carbon intensity target feasibility, including the potential to require a 15- to 20-percent total reduction in carbon intensity of transportation fuels by 2030.

Pan-Canadian Framework on Clean Growth and Climate Change

In addition to the CFS, the federal government has released their Pan-Canadian Framework on Clean Growth and Climate Change, which includes a federal carbon-pricing framework (includes a carbon tax). The Pan-Canadian Approach to Pricing Carbon Pollution was announced October 3, 2016.

The pricing strategy provided a year and a half timeline for all provinces and territories to develop some form of carbon pricing plan before April 2019. On April 1, 2019, the federal government introduced its own carbon pricing system (the backstop) in provinces that did not design their own system or elements of the backstop in provinces where the system does not fully meet the federal criteria.

Provincial Carbon Pricing

Prior to the April 2019 deadline, British Columbia, Alberta and Quebec had developed a provincial carbon pricing system to meet the federal benchmark. Ontario also had a carbon pricing system in place until late 2018. However, the change in government led to the new Conservative Party of Ontario scrapping the provincial carbon pricing system. As a result, Ontario is challenging the federal backstop in provincial court. The provinces of Alberta, Saskatchewan, New Brunswick, and Manitoba are all challenging the federal carbon-pricing framework as well. Alberta had a provincial carbon pricing system in place by the April 2019 deadline, but the change of government in mid-April 2019 also led to the elimination of the provincial carbon pricing system. Jason Kenney, the leader of the newly elected (April 2019) United Conservative Party of Alberta, ran on an election platform that promised to throw out the provincial carbon pricing policy put in place by the New Democratic Party (NDP) of Alberta. The new provincial government discarded the carbon pricing policy of the previous government and the federal backstop was imposed on Alberta, causing it to join the growing list of provinces fighting the federal carbon pricing system in court.

Ontario

Ontario passed legislation introducing a cap-and-trade system in May 2016 and held its first carbon allowance auction in March 2017. The Ontario Liberal Party established a standard cap and trade system through the Ontario Climate Change Mitigation and Low-Carbon Economy Act. In 2018, the newly elected Conservative government, led by Doug Ford, scrapped the cap-and-trade system. Ontario had to adopt the federally-imposed backstop on April 1, 2019. The province is currently challenging the federal government in provincial Court of Appeal.

Quebec

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-Quebec carbon allowance auction was held in November 2014. Emission units not allocated free of charge are auctioned off by the government four times a year. A minimum price of $10.75 CAD was set for 2013, and is scheduled to increase at a rate of 5 percent plus inflation every year until 2020. 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.

Alberta

Alberta began applying a levy of $20 CAD per ton on fossil fuel consumption on January 1, 2017, and raised the levy to $30 CAD per ton in 2018. This levy, implemented under the Climate Leadership Act, acts as a carbon tax on fossil fuels and exempts biofuels. All biofuels sold in Alberta must demonstrate at least 25 percent fewer GHG emissions than the equivalent petroleum fuel. The newly elected United Conservative Party of Alberta scrapped the carbon pricing policy put in place by the previous provincial government and is now challenging it in court.

British Columbia

In 2008, British Colombia introduced a carbon tax on the purchase and use of fuels. British Columbia was the first Canadian province to create a carbon tax. The tax covers approximately 70 percent of total GHG emissions in BC. Carbon tax rates started at $10 CAD per ton of carbon dioxide equivalent (CO2e) emissions in 2008, increasing by $5 CAD per ton each year until reaching the current rate of $30 CAD per ton of CO2e emissions in 2012.

Saskatchewan

Saskatchewan, led by Premier Scott Moe of the Saskatchewan Party (center-right), was the first province to push back on the constitutionality of the federal carbon pricing framework through the provincial Court of Appeal. On the lead up to April 2019, Saskatchewan was asking for a delay on the federal backstop while it waited for a provincial court ruling. Currently, the province has had the federal backstop imposed on it and it is continuing to fight it in court.

Manitoba

On July 30, 2018, Manitoba announced the Made-in-Manitoba Climate and Green Plan, which included a cap-and-trade style carbon tax. However, on October 3, 2018, while the Manitoba government announced it would still be going ahead with the Made-in-Manitoba Green Plan, it would no longer contain carbon taxes. Originally, the Manitoba plan would have imposed a $25 CAD per metric ton (MT) flat rate, whereas the federal backstop would raise the tax to $30 CAD per MT by 2020 and $50 CAD per MT by 2022. On April 24, 2019, Manitoba followed Saskatchewan and Ontario in filing a provincial court challenge of the federal backstop.

Prior to the federal backstop coming into effect, Nova Scotia's newly designed cap-and-trade program came into effect January 1, 2019. Prince Edward Island (PEI) had its carbon plan accepted by the federal government prior to April 1, 2019. New Brunswick (NB) is the only Atlantic province to have federal backstop imposed on them.

Other Federal and Provincial Initiatives

The provinces and federal government have several initiatives in place intended to spur technology innovation aimed at lowering carbon emissions across different sectors including transport, point of sale/lease incentives for so-called Zero Emission Vehicles (ZEVs), and Alberta has a grants program to support producers of liquid biofuels and electricity made from woody wastes and on-farm biogas.

In June 2017, the federal government announced a Low Carbon Economy Fund of $2 billion CAD to support projects that will generate clean growth and reduce GHG emissions towards meeting or exceeding commitments under the Paris Agreement. The fund includes:

1. A Low Carbon Economy Leadership Fund that will provide $1.4 billion CAD to provinces and territories that have adopted the Pan-Canadian Framework on Clean Growth and Climate Change to help them deliver on "leadership commitments" to reduce GHG emissions;
2. $600 million CAD for a "Low Carbon Economy Challenge" and for implementing the Pan-Canadian Framework on Clean Growth and Climate Change.

The new Conservative Party of Ontario is in the process of "an orderly wind-down of programs funded through the cap-and-trade carbon tax." The provincial government is committed to honoring contracts under the Low Carbon Innovation Fund (LCIF), but no further contracts will be rewarded. The LCIF, introduced in 2017, was part of Ontario's Climate Change Action Plan and is funded by proceeds from the province's carbon market. Companies, entrepreneurs and eligible universities and colleges applied for funding to create and commercialize new, globally competitive, low-carbon technologies that would help Ontario meet its GHG emissions reductions targets.

From 2007 to 2017, Alberta facilities that emitted more than 100,000 tons of carbon dioxide equivalent (CO_2e) per year, including electricity producers, were subject to the Specified Gas Emitters Regulation (SGER), and were required to reduce their baseline emissions intensity from July 1, 2007 by up to 20 percent in each compliance period. From January 1, 2018, facility-specific SGER targets were replaced by an output-based allocation approach using product-level standards under the Carbon Competitiveness Incentive (CCI) Regulation. This approach aimed to incentivize deployment of best-in-class technology in each sector, support investment, drive emissions reductions and maintain industry competitiveness. However, the newly elected United Conservative Party (UCP) of Alberta has stated that it wishes to remove the CCI regulation and revert to a system similar to SGER called Technology Innovations and Emissions Reductions (TIER), which could take effect as early as January 2020. Comments are being received until August 2, 2019 and can be made via the previous link.

Another proposed change by the newly elected government in Alberta is to scrap the previous government's Climate Leadership Plan. The Climate Leadership Plan intended to phase-out coal-generated electricity, triple renewable energy supply, and reduce emissions from the oil and gas sector, among other objectives. The new provincial government extended the Bioenergy Producer Program, with a revised, limited scope through March 31, 2020. The program will provide grants to dedicated biofuel-producing facilities, including for:

- liquid biofuels, such as biodiesel, ethanol and pyrolysis oil;
- biogas electricity production from farm-based anaerobic digesters;
- electricity produced from woody biomass.

Some research and development funding is also available for biofuels under the $225 million CAD innovation stream in two program areas: Emissions Reductions Alberta ($80 million CAD) and Climate Change Innovation and Technology Framework ($145 million CAD).

On January 11, 2018, the Zero-Emission Vehicle (ZEV) standard came into force in Canada. The standard encourages automakers to improve their ZEV offers. The ZEV mandate is an approach developed in the United States that imposes penalties on automakers that do not sell enough electric vehicles. As of May 1, 2019, the government of Canada will provide point of sale incentives for

customers who buy or lease an eligible ZEV. There are two levels of incentives for vehicles under $55,000 CAD including:

- Battery-electric, hydrogen fuel cell, and longer range plug-in hybrid vehicles are eligible for an incentive of $5,000
- Shorter range plug-in hybrid electric vehicles are eligible for an incentive of $2,500

Through the ZEV Infrastructure Program, the Government of Canada has set ambitious federal targets for ZEV reaching 10 percent of light-duty vehicles (LDV) sales per year by 2025, 30 percent by 2030 and 100 percent by 2040. Through Budget 2019, $130 million CAD over five years (2019-2024) has been devoted to deploy a network of zero-emission vehicle charging (level 2 and higher) and refueling stations in more localized areas where Canadians live, work and play. Support is also available for strategic projects for electric vehicle and/or hydrogen infrastructure for corporate fleets, last-mile delivery fleets, and mass transit.

III. Gasoline and Diesel Markets

Fuel Use (Million Liters)										
Calendar Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019f**
Gasoline Use	44,186	44,555	43,065	44,009	45,355	44,933	46,920	47,018	46,299	46,000
Diesel Total	28,516	30,030	28,179	29,464	29,987	29,306	28,893	31,200	33,092	34,000
On-road	16,823	17,339	17,070	17,495	17,909	17,292	17,048	18,400	19,524	20,060
Agriculture										
Construction & Mining										
Shipping & Rail										
Industry										
Heating										
Jet Fuel Total	6,089	7,480	6,424	6,657	6,366	7,372	7,530	8,241	9,066	9,250
Total Fuel Markets	78,791	82,065	77,668	80,130	81,708	81,611	83,343	86,459	88,457	89,250

Source: Statistics Canada, CANSIM, Table: 25-10-0044-01 (formerly CANSIM 134-0004); FAS/Ottawa

Gasoline use declined in 2018 and FAS/Canada forecasts a further decline in 2019. However, lower oil prices and higher-than-expected sales of large vehicles due to lower fuel prices contributed to increased consumption from 2015 to 2017. Long-term gasoline use will decrease due to improved fuel economy and lifestyle changes. However, diesel fuel consumption increased in 2018 and is forecast to increase again in 2019. The economic growth rate in Canada slowed from 3.05 percent in 2017 to 1.80 percent in 2018, and is expected to average 1.50 percent for 2019, contributing to changes in gasoline demand.

IV. Ethanol

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018e**	**2019f**

Beginning Stocks	108	128	127	130	131	131	131	131	131	131
Fuel Begin Stocks	108	128	127	130	131	131	131	131	131	131
Production	1,530	1,790	1,780	1,800	1,845	1,815	1,860	1,890	1,900	2,000
Fuel Production	1,420	1,700	1,695	1,715	1,755	1,720	1,740	1,730	1,750	1,830
Imports	449	983	1,062	1,185	1,340	1,409	1,401	1,450	1,440	1,420
Fuel Imports	11	450	805	1,152	1,302	1,369	1,356	1,402	1,390	1,370
Exports	94	77	54	58	63	68	76	88	90	90
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	1,865	2,697	2,785	2,926	3,122	3,156	3,185	3,252	3,250	3,330
Fuel Consumption	1,411	2,151	2,497	2,866	3,057	3,089	3,096	3,132	3,140	3,200
Ending Stocks	128	127	130	131	131	131	131	131	131	131
Fuel Ending Stocks	128	127	130	131	131	131	131	131	131	131
Total Balance Check	0	0	0	0	0	0	0	0	0	0
Fuel Balance Check	0	0	0	0	0	0	0	0	0	0
Refineries Producing Fuel Ethanol (Million Liters)										
Number of Refineries	15	15	14	15	15	13	13	13	13	13
Nameplate Capacity	1,429	1,818	1,815	1,760	1,800	1,800	1,750	1,872	1,970	2,150
Capacity Use (%)	99%	94%	93%	97%	98%	96%	99%	92%	89%	85%
Co-product Production (1,000 MT)										
DDGs	980	1,220	1,075	1,100	1,100	1,000	1,120	1,140	1,150	1,250
WDG	575	550	635	650	650	650	425	425	425	425
Corn Oil	2	2	3	6	6	6	10	10	11	11
Feedstock Use for Fuel Ethanol (1,000 MT)										
Corn	2,773	3,300	3,385	3,410	3,505	3,350	3,400	3,400	3,360	3,668
Wheat	775	950	850	875	880	822	820	795	890	890
Market Penetration (Million Liters)										
Fuel Ethanol Use	1,431	2,150	2,500	2,867	3,057	3,089	3,096	3,132	3,140	3,250
Gasoline Use	44,186	44,555	43,065	44,009	45,355	44,933	46,920	47,018	46,299	46,000
Blend Rate (%)	3.1%	4.6%	5.5%	6.1%	6.3%	6.4%	6.2%	6.2%	6.4%	6.6%

See 'Notes on Statistical Data,' on page 20. Conversion rate calculations are in the footnote.[3]

[3] The Feedstock-to-Biofuel conversion rates used to convert metric tons (MT) of corn and wheat kernels to liters of ethanol are:

Corn kernels: 1 MT = 402 (before 2014) and 417 liters (after 2014)

Wheat kernels: 1 MT = 393 liters

Consumption
A federal use mandate of five percent ethanol blended into the gasoline supply required an estimated 2,350 million liters of ethanol in 2017. At 3,132 million liters that same year, Canadian fuel ethanol utilization exceeded that. However, for the purposes of the mandate, compliance units can be carried forward into a future compliance period, carried back for use in a previous compliance period, or cancelled if required to do so.
Canadian data shows relatively stable fuel ethanol consumption growth from 2013 through 2017, climbing marginally from 2015 to 2017. Recent upward consumption trends support FAS/Ottawa's 2018 ethanol fuel consumption figure of 3,140 million liters in 2018, increasing the actual blending rate to 6.4 percent overall. Ontario, the largest importer and producer of ethanol, regularly blends at upwards of eight percent.

Production
Fuel ethanol production had been nearly static since 2011, edging up from 1,700 million liters in 2011 to 1,750 million liters in 2018 (estimated). However, with increased refinery capacity coming online this year, ethanol production is forecast to increase to 1,880 million liters in 2019.

Nameplate production capacity fell from 1,800 million liters per year in 2015 to 1,750 million liters in 2016, as one plant closed in 2016. In 2017, capacity increased again to 1,872 million liters. Further capacity growth of five percent became operational for 2018, adding an additional 98 million liters for a total of 1,970 million liters. In 2019, capacity will rise to 2,140 million liters because IGPC Ethanol Inc. finished construction and more than doubled capacity of its southern Ontario plant to 378 million liters per year (second largest). Media reported that the expanded plant could consume 2,500 MT of locally-produced corn per day. Over the past ten years, plant expansions have boosted the industry's capacity as the number of plants in operation has fallen.

In August 2017, Greenfield Global announced that it commenced a feasibility study to expand operations for sustainable biofuel production at its bio-refinery in Varennes, Quebec. The expansion could increase the facility's annual ethanol production capacity from 175 million liters per year to 300 million. The feasibility study, which is still on-going, will also evaluate the adaptation of emerging advanced biofuels technologies using non-traditional feedstocks and processes, including cellulosic ethanol, renewable diesel, and renewable natural gas.

Feedstock choice for ethanol plants is driven by differences in geography. Wheat is used in Alberta and Saskatchewan, wheat and corn in Manitoba, and corn in Ontario and Quebec. The use of corn in Manitoba has largely overtaken the use of wheat. There has been an increasing interest in developing corn varieties that can be grown in Western Canada. As more corn varieties are developed with lower heat unit requirements, it is expected that corn use for ethanol production in Saskatchewan and perhaps Alberta could increase. There has also been increasing research into wheat varieties for industrial uses. Wheats tailored to the needs of the bioethanol industry are varieties with high-starch, low-protein content.

FAS/Ottawa estimated that 78 percent of Canadian ethanol production was derived from corn and 22 percent from wheat in 2014. Between 2014 and 2016, two facilities switched feedstocks from wheat to corn in order to increase throughputs (the higher starch content in corn provides a greater ethanol yield).

In 2016, the ethanol industry purchased 4.220 million MT of feedstocks. By 2016, FAS/Ottawa estimates that corn contributed to 81 percent of ethanol production, with wheat falling to 19 percent. For 2018, corn contributed to over 80 percent of ethanol production given the favorable price.

Production of wet distillers grains (WDG), a co-product of ethanol, fell from 0.65 million metric tons in 2015 to 0.425 million metric tons in 2016, as one facility installed a drier. Only one third of the change in WDG is expected to show up in distiller's dried grains with solubles (DDGS), because DDGS have less moisture content and therefore less weight. Further, corn produces less DDGS than wheat, so the increase in corn and decrease in wheat utilization in 2016 reduced DDGS production. Rounding the data results in no change in the production of DDGS in 2017. Assuming all things being equal, levels of DDGS production are expected to increase marginally for 2018 and 2019.

Corn oil extraction rates at Canadian ethanol plants remain low compared to U.S. plants due to Canada's Feeds Regulations and feeding practices require that DDGS have a minimum energy content for cattle due to colder environmental conditions. This means that buyers require more oil remain in Canadian DDGS. Guidance on these regulations is here.

Trade

Canada has not had sufficient ethanol production capacity to meet federal and provincial mandates since 2011, and has imported 40-45 percent of its consumption since 2013. On average, the United States supplies 98 percent of Canada's ethanol imports (and essentially 100% of its fuel ethanol imports). Canada's exportable supply is essential zero.

Canada collects a $0.0492 CAD 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.

V. Biodiesel / Renewable Diesel

Biodiesel (Million Liters)										
Calendar Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019f
Beginning Stocks	10	19	19	4	20	20	20	20	20	20
Production	115	120	100	159	351	307	463	397	300	375
Imports	100	170	417	545	505	382	385	473	377	580
Exports	110	80	85	124	290	239	424	327	299	275
Consumption	96	210	447	564	566	450	424	543	378	680
Ending Stocks	19	19	4	20	20	20	20	20	20	20
Balance Check	0	0	0	0	0	0	0	0	0	0
Production Capacity (Million Liters)										
Number Bio-refineries	13	9	8	8	8	9	9	9	8	8
Name plate Capacity	258	225	223	400	400	400	530	591	577	577
Capacity Use (%)	44.6%	53.3%	44.8%	39.8%	87.8%	76.8%	87.4%	67.2%	68.5%	69.3%
Feedstock Use for Fuel (1,000 MT)										
Canola Oil	3	7	7	65	114	178	305	364	400	400
Animal Fats	78	63	26	91	83	149	83	85	85	85
Used Cooking Oil	27	46	65	420	175	42	133	150	150	150
Soybean oil	1	1	0	106	54	150	150	150	150	150
Renewable Diesel (HVO) (Million Liters)										
Imports	130	235	178	288	346	224	261	380	390	390
Consumption	130	235	178	288	346	224	261	380	390	390
Market Penetration (Million Liters)										
Biodiesel/RD, on-road use	126	275	350	370	375	300	320	380	380	400
Diesel, on-road use	16,823	17,339	17,070	17,495	17,909	17,292	17,048	18,400	19,524	20,060
Blend Rate (%)	0.7%	1.6%	2.1%	2.1%	2.1%	1.7%	1.9%	2.1%	1.9%	2.0%
Diesel, total use	28,516	30,030	28,179	29,464	29,987	29,306	28,893	31,200	33,092	34,000

See 'Notes on Statistical Data,' on page 20

Production

Canada's biodiesel plants and biodiesel production (Canada does not produce renewable diesel) are export-oriented with only part of the business focused on the domestic market. In any given year, Canada exports the majority of its biodiesel to the United States. The U.S. market nets higher returns than domestic outlets due to the U.S. biomass-based diesel (BBD) blenders tax credit, and value of Renewable Identification Numbers (RINs).

Canadian exports and thus production rose to about 100 million liters by 2008, stabilized for a few years and then showed sustained increase from 2013 through 2016 both reaching record highs that year of over 460 million liters. Obligated volumes for biodiesel demand BBD set by EPA under the U.S. RFS continued to grow U.S. BBD demand (and demand for Canadian biodiesel along with it). Canadian exports (and thus production) faltered after 2016 due to the increase in Smaller Refinery Exemptions (SREs) and resulting BBD demand destruction in the U.S. market. Canadian production fell from 463 million liters (2016) to 397 million liters (2017). Post expects a decline to 300 million liters in 2018 followed by an increase in production in 2019 as additional production capacity comes online. If realized, the percent of Canadian production exported will fall from a high of 91 percent in 2016 to 73 percent in 2019.

Canadian biodiesel production capacity has trended upward but not dramatically. Capacity decreased in 2018 following the closure of the Miligan Biofuels plant in Foam Lake, Saskatchewan. Late in 2019 or

early 2020, national capacity is expected to increase 45 million liters per year as BIOX Corp. increases the production capacity of its Canadian operations to 112 million liters per year (16 percent of national biodiesel capacity). The additional 45 million liters a year would come from the company's purchase of a shuttered biodiesel facility in Sombra, Ontario.

Trade

Biodiesel Exports

In any given year, 75 to 90 percent of Canadian biodiesel is exported and virtually all is shipped to the United States. Small residual exports head to Europe. The U.S. market nets higher returns than domestic outlets due to the U.S. BBD blenders tax credit of $1/gallon tax support, 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 uncertainty and policy risk. Canadian companies reportedly capture up to 70 percent of the blenders credit which adds considerable value to each gallon sold.

Obligated volumes set by EPA under the U.S. RFS continued to grow U.S. BBD biodiesel demand now at 2.43 billion gallons in 2020. This increase was tempered by a large recent increase in Smaller Refinery Exemptions (SREs) and resulting BBD demand reduction in the United States. Canadian exports have faltered accordingly after reaching a record 422 million liters 2016, falling to 325 million liters in 2017, 297 million liters in 2018, and finally an estimated 270 million liters in 2019. Persistent uncertainty over the passage of a tax extender for the BBD blenders tax credit weighs heavily on the market as well. The credit was not extended past January 1, 2018, and biodiesel plants in the United States and Canada will weigh concern over its continued absence and possibility that it will not be extended retroactively.

Biodiesel and Renewable Diesel Imports

Prior to the expansion phase of renewables in Canada's diesel pool, which began in earnest by 2010, Canada relied solely on imported U.S. biodiesel to meet its early domestic consumption requirements driven my provincial mandates while essentially all of Canada's production was shipped to the U.S. market. Since 2010, imports of both biodiesel and renewable diesel have risen and consistently meet 90 percent or more of domestic requirements has they increased at first rapidly from 2010 through 2014 followed by some retreat and stagnation since. Unfortunately, there is some uncertainty regarding the accuracy of Canada's imports of both fuels because 1) there is no trade code that separately identifies renewable diesel which is mixed with other non-fuel products, and 2) renewable diesel has been incorrectly classified under the biodiesel trade code.

Though there is uncertainty regarding the trade numbers, a few observations are possible. Canada has imported more biodiesel than renewable diesel over the years, although renewable diesel's position in the market is significant. The United States is by far the largest supplier of biodiesel, but Canada imports some from Europe, especially Germany. Interestingly, Argentina showed up as a supplier for the first time in 2018. Shut out of the U.S. market by antidumping duties (AD) and countervailing duties (CVD), Argentine suppliers have turned to Canada to cover a small portion of lost sales.

Canada, Europe and the United States are the only markets that use renewable diesel to any extent, and this drop-in replacement to fossil diesel has been very successful in all three markets. The only renewable diesel that has successfully reached large-scale commercialization is hydrogenated vegetable

oil (HVO), which also goes by other names including hydrogenated-derived renewable diesel (HDRD). Government sources confirm that Canada has imported renewable diesel from Singapore, the Netherlands and Finland. Industry sources indicate that Canada has imported this product from the United States as well.

VI. Biomass for Heat and Power

Wood Pellets

Wood pellets are recycled timber and other forest residues that are converted into renewable biomass fuel. The Canadian wood pellet industry is export-oriented with high production capacity and exports far exceeding domestic demand. Overseas demand growth for Canadian wood pellets in recent years was largely fueled by the United Kingdom and Japan as these countries seek to increase their use of renewable energy in heat and power plants. Government spending on renewable energy for power generation is expected to stimulate market development in this sector.

Wood Pellets (1,000 MT)									
Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018e**	**2019f**
Beginning Stocks	37	47	64	87	129	161	129	393	547
Production	1,450	1,521	1,822	1,900	1,900	2,600	2,700	3,100	3,300
Imports	0	45	21	30	30	20	20	20	20
Exports	1,300	1,369	1,640	1,638	1,628	2,373	2,172	2,651	2,900
Consumption	140	180	180	250	270	279	284	315	380
Ending Stocks	47	64	87	129	161	129	393	547	587
BalanceCheck	0	0	0	0	0	0	0	0	0
Production Capacity									
Number of Plants	39	42	41	41	39	42	42	45	45
Nameplate Capacity	2,082	2,900	3,175	3,282	3,681	4,282	4,282	4,657	4,657
Capacity Use (%)	69.6%	52.4%	57.4%	57.9%	51.6%	60.7%	63.1%	66.6%	70.9%

For a detailed map of wood pellet production, follow the link.

Consumption

Wood pellet consumption in Canada shows linear growth averaging 13 percent average annual increases since 2013. Consumption for 2018 is estimated at 315,000 MT in 2018 rising to 380,000 MT in 2019. The is potential for a large future expansion in domestic demand depends on the success of Canada's goal to phase out coal-fired power plants by 2030 and the cost of alternative renewable energies.

Production

Pellet production in Canada has also achieved linear growth averaging 12-percent average annual increases from 2013 thru 2018 and post forecasts an increase in 2019. Increases in nameplate capacity were also steady over the same period, but have not kept up with demand growth as capacity use rate has risen from 57 percent to an estimated 67 percent in 2018 and further increase to 71 percent in 2019. FAS/Ottawa estimates current capacity at 4.66 MMT, however some projects are underway and this will likely increase by 2020.

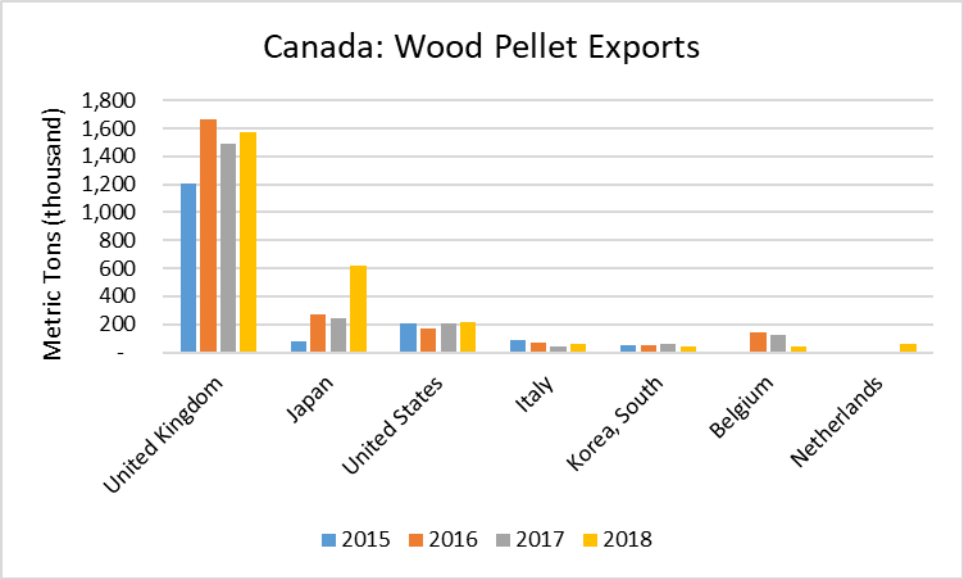
Since 2015, Aurora Wood Pellets proposes to build a 200,000-ton capacity wood pellet production facility in Hay River on the south end of Great Slave Lake in the Northwest Territories. Construction on the project is currently being held up while necessary approvals are received from the Hamlet of Enterprise, the local administrative authority.

Another pellet plant is being proposed by Northern Energy Solutions Ltd in Mirimichi, New Brunswick. The proposal would expand the already existing Miramichi Wood Pellet Plant and increase total production to 275,000 MT. The operation is proposing to export to Europe in 2021.

Trade

Global industrial wood pellet demand is projected to continue growing at 2.7 MMT per year through to 2025. Canada has significant forest resources and potential to capture some of this growing demand.

In 2016, the United Kingdom and Japan accounted for roughly 85 percent of Canada's total wood pellet exports. The United Kingdom has planned a phase-out of coal fired power generation by 2025, which helps to explain the demand. Many coal boilers can be converted to use wood pellets.



Source: Canadian International Merchandise Trade Database (CIMTD)

VII. 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. Two Canadian firms have achieved, or will soon achieve, commercial-scale production. Enerkem 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). Ensyn Technologies Inc. uses woody biomass to make biocrude, used as feedstock and co-processed at refineries to produce lower carbon fuels and any number of chemicals or used to produce renewable fuel oil for heating and cooling) and other specialty chemicals via a process called rapid thermochemical liquification.

In 2003, Enerkem started operating a pilot facility in Sherbrooke, Québec. Later, a demonstration plant making syngas started operations in Westbury, Quebec in 2009, which then began methanol production in 2011 and ethanol production in 2012. The Westbury facility tests new feedstocks, produces syngas, methanol and ethanol, and has an annual methanol production capacity of five million liters. In 2014,

Enerkem launched the world's first full-scale MSW-to-biofuels and chemicals facility in Edmonton, Alberta. Enerkem's Edmonton plant started with methanol, but with the addition of a methanol-to-ethanol converter unit, the plant began producing ethanol in 2017. The plant has a current maximum annual methanol-ethanol production capacity of 38 million liters.

The Edmonton plant became the first ever MSW-to-cellulosic ethanol plant certified to meet renewable fuel obligations under the U.S. RFS and to generate RINs, having received U.S. EPA pathway approval in 2017. Also in 2017, its ethanol scored the lowest carbon intensity value ever issued by the British Columbia Ministry of Energy and Mines under British Columbia's Renewable and Low Carbon Fuel Requirements Regulation. Enerkem develops partnerships and licensing agreements to build facilities that convert MSW to renewable fuels and chemicals. The company provides fabricated modular equipment and handles assembly on site, and several supported projects are now in development in the United States, Europe and China.

Ensyn Technologies Inc., established in 1991, began its focus on renewable fuels in 2005 with the commissioning of its 70 dry tons/day plant in Renfrew, Ontario. This facility was designed to produce renewable fuel and chemicals and then retooled in 2014 to focus on fuel. In 2016, construction began on the Côte Nord Project at Port Cartier, Quebec. A 50/50 joint venture between Ensyn and Arbec Forest Products, the plant uses rapid thermochemical liquification with a capacity to transform forest residues into 40 million liters/year of biocrude. The Côte-Nord Project is currently in start-up and is the first of several production plants being developed by Ensyn to expand the production of biocrude for energy applications, focusing initially on U.S. northeast and eastern Canada heating markets and as a renewable feedstock for petroleum refineries for the production of low carbon transport fuels. Rapid thermochemical liquification of biomass wastes is a closed system whereby lignocellulosic materials are heated rapidly in the absence of air causing a breakdown of their polymeric structure to produce low molecular weight liquids.

VIII. Notes on Statistical Data

Ethanol Production: Reported production estimates for the years 2013 to 2017 are from the data collected by ECCC submitted by regulated facilities pursuant to the requirements of the Renewable Fuels Regulations under the Canadian Environmental Protection Act. The audited published data is subject to ongoing verifications. FAS/Ottawa's numbers for 2012 and earlier years are derived from data on program subsidy payments.

Ethanol Trade: Total trade in ethanol used as both fuel and other industrial chemicals is based on ECCC data and on all undenatured codes under 2207.10 (excluding beverage ethanol) plus all denatured codes under 2207.20. Statistics Canada data was cross-checked for accuracy with U.S. customs data. Codes for ethanol used as fuel, both undenatured and denatured, were introduced in 2012 with most trade falling under denatured. Prior to 2012, trade in fuel ethanol is estimated based on plant production data, progress toward meeting provincial mandates, domestic consumption, and the fact that Canada has been a net importer of nonfuel industrial chemical ethanol.

Biodiesel/Renewable Diesel Trade: Biodiesel trade data is based on ECCC data and is tracked under code 3826.00, which covers biodiesel blended above 30 percent by volume with fossil diesel and

includes pure biodiesel (B100), and the code for petroleum oil containing biodiesel up to and including 30 percent biodiesel, by volume (2710.20). All biodiesel in the market balance table is reported as pure biodiesel (B100) or B100 equivalent. We assume all biodiesel traded under 3826.00 is pure B100, and all trade under 2710.20 is B5. Therefore, volumes traded under 2710.20, which have thus far remained relatively small, are multiplied by .05 before they are added directly to 3826.00. Statistics Canada data was cross-checked for accuracy with U.S. customs data.

Canada imports large volumes of hydrogenation-derived renewable diesel, but there is no trade code specific to this product and the few supplying companies do not share sales data. Sources report that renewable diesel has been listed under different codes over time, including even biodiesel although their chemical characteristics are different. Renewable diesel imports are estimated by assuming all imports from Finland, the Netherlands and Singapore under biodiesel code 3826.00 are pure renewable diesel and added to estimates for shipments from the United States. This estimation method is prone to over- and under-counting errors.

Feedstocks: Feedstock use figures are derived using the below conversion rates.

Ethanol Corn kernels:	*1 MT = 402 (before 2014) to 417 liters (after 2014)*
Wheat kernels:	*1 MT = 393 liters*
Biodiesel Soyoil, crude:	*1 MT = 1,113 liters*
Soyoil, 1x refined:	*1 MT = 1,128 liters*
Animal fats/grease:	*1 MT = 1,043 liters*
Used cooking oil (UCO):	*1 MT = 1,043 liters*