Biofuels Consulting

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29 March 2019

Director, Climate Change Programs Branch
Ministry of Environment, Conservation and Parks
Fergus Block, 10th Floor, 77 Wellesley St W,
Toronto, ON M7A 2T5

RE: ERO number 013-4598 – Increasing renewable content in fuels

Biofuels Consulting Canada applauds the Government of Ontario's proposal to increase renewable content in gasoline to 15% as early as 2025.

Biofuels Consulting Canada Inc. has conducted dozens of studies for government agencies pertaining to both first and second-generation biofuels and is a recognized for biofuels expertise and is pleased to provide detailed recommendations and evidence to support the province's move to 15% renewable content in gasoline.

Although it is recognized that the Greener Diesel considerations for this regulation is limited to considerations for aligning the LCA model between this proposed regulation and the Greener Diesel Regulation. Biofuels Consulting Canada recommends using GHGenius v 5.0 in this ethanol regulation and also the Greener Diesel Regulation. Biofuels Consulting Canada also recommends that at the earliest opportunity that MCEP consider increasing the volumetric requirement in the Greener Diesel Regulation over time.

Summary

Across Canada, blending ethanol in gasoline has reduced greenhouse gas (GHG) emissions by a remarkable 3 megatonnes annually – that's the equivalent of taking one million cars off the road. Ethanol is also affordable and averages 20 cents less per litre than gasoline.

Today, approximately 90% of the volume of ethanol blended in Ontario is made in the province. Increasing ethanol blending requirements ensure that a local, Made-in-Ontario product is used to reduce GHG emissions from fossil fuels. It's also a regulatory approach that fairly y balances a healthy environment with a healthy economy.

Ontario's ethanol industry purchases approximately 110 million bushels of Ontario corn (39% of the crop) and produces 1.1 billion liters annually. In 2016, the total economic impact of from Ontario's ethanol producers was $1.16 billion, representing 502 jobs. If you factor in the value displaced crude oil imports, the economic impact is even higher at $1.43 billion.

An economic analysis found that a 550 million litre per year expansion in Ontario ethanol production would create 264 new jobs. Going to E15 could require 2.15 billion litres and create 530 ongoing jobs and approximately 5000 construction jobs.[1]

[1] Economic Impact Assessment of an Enhanced Biofuels Mandate in Ontario. Doyletech Corporation (September 2017)

Biodiesel is also an Ontario success story. Biodiesel production supports farmers through the use of feedstocks like soybean oil, but it also repurposes waste oils and fats. For example, today restaurants get paid for their used deep fryer grease which is used to make biodiesel, thereby supporting local small businesses.

The Greener Diesel regulation provides a modest but important market for Ontario's biodiesel producers. Currently requiring a 4% blend of biodiesel with an average GHG emission reduction of 70% in the diesel pool, this policy allows made in Ontario biodiesel to displace imported petroleum products. In addition to jobs at production facilities, Greener Diesel has brought investments to Ontario for infrastructure to blend the product with diesel fuel. More investments can be expected as the volume of biodiesel blended increases. In this submission, Biofuels Consulting Canada recommends building on this success by increasing the Greener Diesel mandate.

Biofuels Consulting Canada respectfully submits the following recommendations to the MECP:

Policy

1. **Gradual implementation, starting in 2023.** In 2023, renewable fuel content should be moved to 11%, increase one percentage point each subsequent year until the mandate reaches 15%.
2. **45% GHG reduction, increasing over time.** As of the implementation of the policy, the average GHG reduction required should be set at 45%, increasing to 50% in 2028, and 55% in 2030.
3. **Made in Ontario policy and GHG reductions.** Policy uncertainty makes it hard to invest in renewable fuels. A clear regulation from Ontario will help unblock funding for new projects in the province.

Compliance models and credits

4. **Use GHGenius 5.0.** This lifecycle analysis (LCA) model has all the required data to model biofuels in Ontario and is the easiest way to update the current model in use.
5. **Avoid including unproven hypotheses.** The indirect land use change (ILUC) hypothesis has time and time again been proven wrong. MECP should avoid the use of ILUC modelling due to it being unreliable and inaccurate.
6. **Transparent credit trading.** In order to have a fungible credit market, as much information as possible should be published regarding the number of compliance credits traded, value, etc.

Public education

7. **Labelling and public education.** Clear labelling should be provided at retail locations to ensure that consumers know what they are buying.
8. **Public awareness.** More information should be made available to Ontarians to increase awareness that ethanol is a reliable, high-octane performance fuel that is made in the province.

Greener diesel

1. **Increase the Greener Diesel regulation** to 6% biomass-based diesel by 2023, increasing one percentage point each subsequent year until it reaches 10%.
2. **Use GHGenius 5.0.** This update would streamline the lifecycle analysis tool used for the gasoline pool.

Key considerations:

It is evident through the consultations for this proposed regulation that there is some misinformation about the impacts to the proposed regulation and some other questions raised that this response will seek to address.

E15 and Vehicle Compatibility

On January 21, 2011, EPA extended this partial waiver to include MY2001-2006 light-duty motor vehicles after receiving and analyzing additional U.S. Department of Energy ("DOE") test data and finding that E15 will not cause or contribute to a failure to achieve compliance with the emissions standards to which these vehicles were certified over their useful lives. Based on existing data and EPA engineering judgement, EPA have concluded that E15, with its additional oxygen content relative to Tier 3 E10 certification fuel, would have effects on emissions, materials compatibility, and drivability substantially similar to E10 in Tier 3 vehicles. Based on the EPA assessment plus confirmatory data from DOE's extensive test program that aged MY2001 and newer vehicles up to 120,000 miles on E15, EPA concluded that MY2001 and newer vehicles would not have materials compatibility issues with E15.[2]

EPA stated that they expect that Tier 3 certified vehicles would have similar, if not better, materials compatibility with E15 compared to MY2001 and newer vehicles since Tier 3 certified vehicles should be designed to encounter E15 in-use and manufacturers are required to use E15 as an aging fuel for evaporative durability testing. Auto manufacturers have used E15 for service accumulation for evaporative durability testing since at least MY2014. This means that many Tier 2 certified vehicles since MY2014 and all Tier 3 certified vehicles have been aged on E15 and have been designed with materials capable of handling E15 for extended periods of time. Therefore, EPA stated that they would not expect any materials compatibility issues from E15 in Tier 3 vehicles and expect that E15 would have substantially similar or identical materials compatibility with Tier 3 E10 certification fuel.[3] EPA concluded in the E15 partial waivers that we did not believe that E15 would cause driveability concerns for MY2001 and newer light-duty vehicles. EPA reviewed the data and information from the over 30 different test programs evaluated to grant the E15 partial waivers and they found "no specific reports of driveability, operability or on-board diagnostics (OBD) issues across many different vehicles and duty cycles including lab testing and in-use operation."[4]

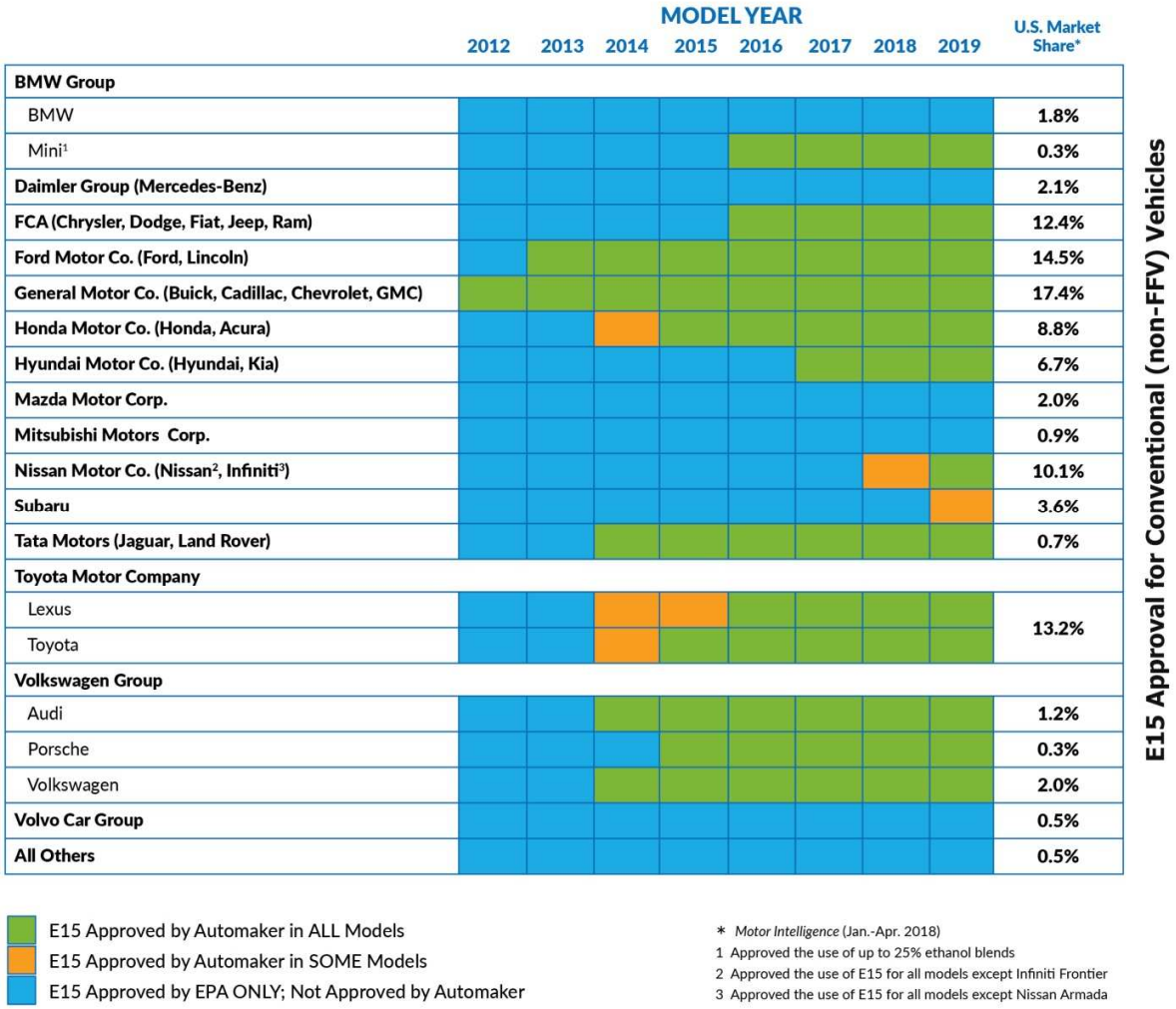
The United States Environmental Protection Agency (EPA) has determined that the use of E15 in vehicles produced in 2001 and later will not have any detrimental impact of the vehicle fuel and emission system. The EPA approved the use of E15 in vehicles built in 2001 and later. At the same time, several vehicle manufacturers are updating their owner's manuals to specifically include E15 as an approved fuel. The latest accounting of the manufacturers' statements is shown in the following figure. More than 90% of 2019 model year vehicles are approved for the use of E15 by the manufacturer as noted in Figure 1 below. It is estimated that 99.5% of the vehicles in 2025 will be able to use E15, using the US EPA criteria.

Figure 1: E15 Approval by Make and Model in 2019

[2] https://www.epa.gov/newsreleases/epa-proposes-rule-allow-e15-waiver-and-improve-rin-market-transparency

[3] https://www.epa.gov/newsreleases/epa-proposes-rule-allow-e15-waiver-and-improve-rin-market-transparency

[4] https://www.epa.gov/newsreleases/epa-proposes-rule-allow-e15-waiver-and-improve-rin-market-transparency



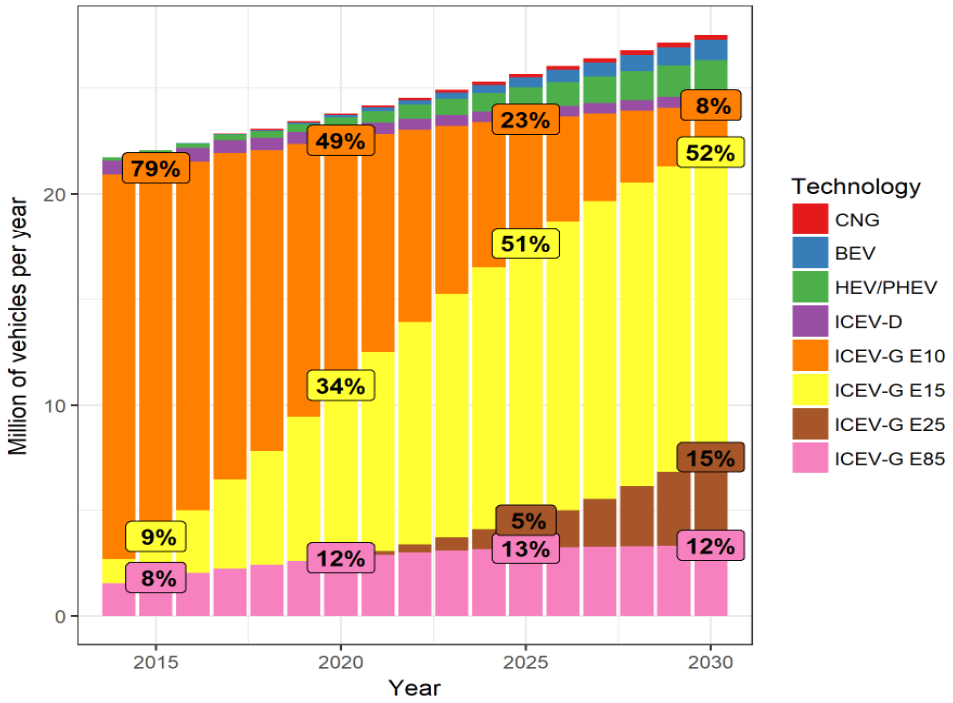
In December 2018, the CFA understated the E15 OEM warranted vehicles in public statements such as "even with increasing sales of E15 compatible vehicles, the slow vehicle fleet turnover rate of nearly 10 years means that by 2025, only about 50 percent of the fleet will be validated for E15 use. The number of E15 compatible vehicles increases to about 70 percent of the fleet by 2030."[5]

This is grossly understated from any direction. The U of T used the same DeRosiers data and vehicle turnover In the *Deployment of Mid-Level Ethanol Blends* study undertaken by NRCan[6] and concluded that it would be 77% by 2025 and 92% by 2030 as noted in the graph below. Note that in the figure below E20-E25 compatible vehicles could also use E15 as could FFVs, and hence it is really only the E10 vehicles that are left.

Figure 2: Canadian Light-Duty Fleet Stock by Technology from 2014 to 2030

[5] https://www.canadianfuels.ca/Commentary/December-2018/

[6] https://www.nrcan.gc.ca/energy/transportation/alternative-fuels/resources/21268



Source: U of T Model based on Statistics Canada (2009a; 2018a; 2018b; 2018d), United Nations Population Division (2018), IHS Polk & DeRosiers, and U.S. Energy Information Administration (2017) data.

Since the discussion at the MCEP consultations surrounded 2001 and newer vehicles, recognizing the work by the EPA to validate their use by 2025 the 2001 and newer fleet is estimated to be 99.5% of the light duty gasoline fleet.

E15 and Energy Content

The CFA has made the argument about energy content in ethanol and infers that it relates directly to mileage driven. This is a gross misconception. This may have some merit in discussions about E85 but is categorically incorrect with reference to E15.

A study titled *Meta-analysis for an E20/25 technical development study - Task 2: Meta-analysis of E20/25 trial reports and associated data*[7] studied data on ethanol content between 15% and 25% (named E20/E25 in this study). In this study, the Institute for Powertrains and Automotive Technology, Vienna University of Technology, collected a variety of literature sources for ethanol blends. The focus was on ethanol blending from 15% to 25%. The focus of the analysis was the influence of the ethanol content in the fuel on fuel consumption based on the generated fuel power. Summary findings are as follows:

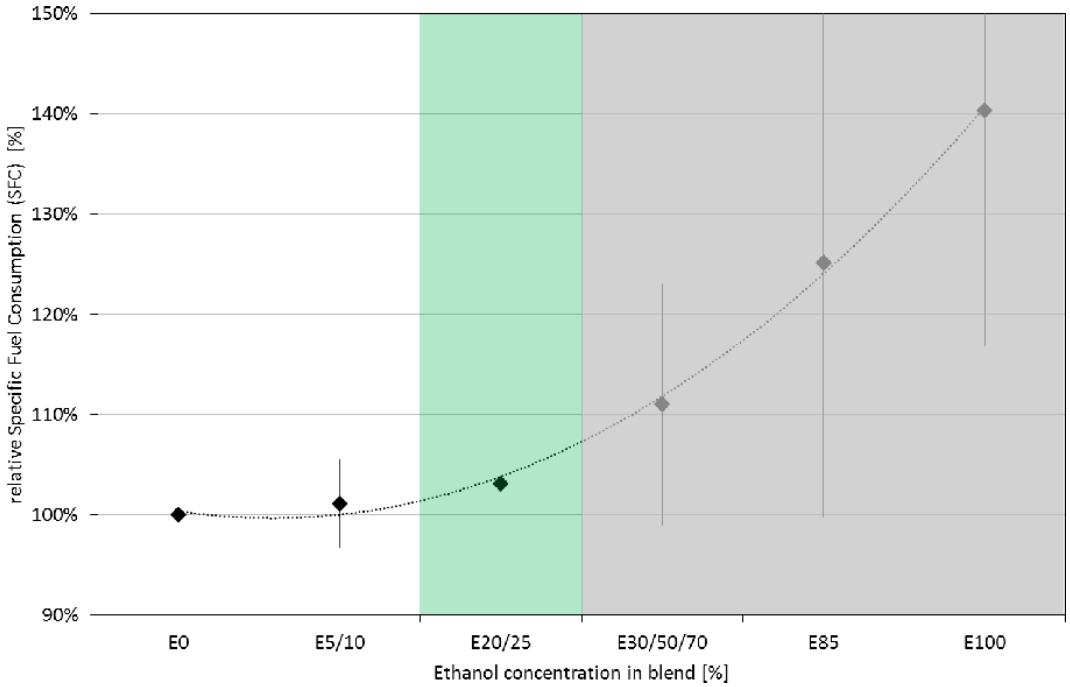
- With E20/25, the overall specific fuel consumption increases about 3% on average.
- For E20/25, the thermodynamic efficiency (energy based) increases by 5% on average.

In other words, the difference between E0 and E20/E25 is approximately 3% and the difference between E10 and E15 is roughly 0.6 – 0.7%. That difference is arguably less than difference due to differences in driving habits.

Figure 2 shows the results from the meta-analysis for the specific fuel consumption.

[7] https://ec.europa.eu/energy/sites/ener/files/documents/Meta-Analysis_ReportFinal.pdf

Figure 3: Specific Fuel Consumption



As seen in Figure 3, the specific fuel consumption is rising in concert with an increasing amount of ethanol in the fuel-blend. For E20/25, the meta-analysis shows an increase by 3% on average. Again, this is for non-optimized engines that cannot take advantage of the higher octane in the manner that higher compression engines can.

Results shown in Figure consider the lower heating value of ethanol. Theoretically, the fuel consumption when using E20/25 would rise by approximately 8% in an unoptimized engine. The results from the meta-analysis, however, show only an increased consumption of about 3%, which reflects the increased thermodynamic efficiency due to the use of ethanol. These results are consistent with the data extracted from the meta-analysis for the engine efficiency.

Compliance Options

The proposed regulation, as with the current Greener Ethanol regulation includes several compliance options to attain the GHG reductions. In addition to these options that are in the current Greener Ethanol regulation such as coprocessing and utilizing low CI components such as green naphtha which is a coproduct from renewable diesel production would suggest the following provide additional compliance options to obligated parties.

As the CI of ethanol is continually improved over time, with an ethanol regulation that links the volumetric requirement to the CI in the same manner as the Greener Diesel regulation, as the CI is improved over time, the corresponding volumetric requirement decreases.

An additional compliance option is the inclusion of E10 in Premium gasoline for those refiners and those retailers who choose to take advantage of this option. The first Canadian Refiner to take advantage of this was Suncor back around 2000 with Ultra 94 branding. Some Canadian premium does include ethanol now and un the U.S some major retail chains in Minnesota have E10 ate 40% of their retail sites. The advantage from a compliance option for those that choose to utilize this option is that it counts in the numerator but not the denominator for the compliance calculation.

The other compliance option is to offer E20 for FFVs. There is a new grade in the CGSB FFV standard CAN/CGFSB-3.512 that includes E20-E25. Although FFVs can take up to E85 the rationale for this additional type in the CGSB FFV standard is that as noted in Figure 3 above there is minimal mileage penalty for E20 and hence for the Ontario market this is an attractive offering for both retailers and consumers. The CGSB E20 standard specifies the same BOB as used to blend E10 and hence the higher octane (AKI) of the E20 provides premium plus octane. In addition, in the U.S. the E20 is prices 4% lower than E10.[8] The FFVs in Ontario represent 8% of the light duty gasoline vehicle population and that is significant.

The other key consideration is that future engines that require better fuel economy also require higher compression. The CAFÉ standard was to have introduced these vehicles as early as 2022. The CAFÉ standard under the Trump administration has replaced tis with the SAFE standard which has a lower ramp up to improved mileage improvement by OEMs. Nevertheless, although this has delayed the implementation of high compression engines by 2025 there will be some of these engines in the marketplace. There is already an early adoption of E25 approved vehicles such as the Mini Cooper hardtop.[9] The reason being that this engine requires 93 octane and the octane and thermal combustion efficiency that E25 provides. Oakridge National Labs under the U.S. Doe (Department of Energy) conducted studies with this vehicle and the reference findings show improved power, improved performance (torque and power) and improved fuel efficiency as compared to E10.[10]

It was for this reason that the ASTM (American Society for Testing and Materials) D8076 Standard Specification for 100 Research Octane Number Test Fuels for Automotive Spark Ignition Engines[11] was created. That is in part, why OEMS were supportive of the E20-E25 type being added to the CAN/CGSB-3.512 as they saw the that grade as a specification that could be easily transferable to high compression engines requiring higher octane. Relative to this proposed regulation and related retail infrastructure that means that E20 pumps put in place between now and 2025 would serve not only remaining FFVs in the market but also high compression engines requiring higher octane.

Blending Terminal Infrastructure Implications

Currently in Ontario, gasoline is sent to blending terminals by pipeline. Typical blending terminals have an above ground storage tank for BOB (Blendstock for Oxygenated Blending) and one for ethanol and another for premium. The premium is simply loaded into trucks for delivery to retail stations. For E10 blends the BOB and ethanol are blended as they are loaded into delivery trucks for distribution to retail stations.

On December 2018, the CFA stated that “Canada’s 70 distribution terminals will require substantial capital infrastructure upgrades costing millions of dollars per terminal”.[12] There is no basis for this assertion. EPA stated that they expect that these proposed provisions would not substantially alter the cost of compliance for parties that produce and distribute E15.[13]

[8] https://e85prices.com/

[9] https://mnbiofuels.org/media-mba/blog/item/1404-bmw-approved-e25-for-the-mini-hardtop-back-in-2014

[10] https://www.eesi.org/files/Brian_West_111317.pdf

[11] https://www.astm.org/Standards/D8076.htm

[12] https://www.canadianfuels.ca/Commentary/December-2018/

[13] https://www.epa.gov/newsreleases/epa-proposes-rule-allow-e15-waiver-and-improve-rin-market-transparency

Retail Blending Infrastructure Implications

The CFA publication asserted that "Canada's 70 distribution terminals will require substantial capital infrastructure upgrades costing millions of dollars per terminal, and the 12,000 retail sites will require tank and dispenser additions and upgrades costing hundreds of thousands of dollars per site."[14]

This statement is broad and encompasses all of the retail sites and blending terminals in Canada, but again is grossly overstated. There is no basis for the assertion that blending terminals will require millions spent at each blending terminal. Moreover, there will be some costs for retail sites and they will be evaluated on a site by site basis and the decision at that site will be a combination of the number of storage tanks on site, the age of the existing pumps on site and the fuelling options that site decides to offer.

The consensus among industry groups and equipment manufacturers is that it will be easier and less costly to deploy fuel containing ethanol up to E25 than an E25+ fuel (i.e., E85). While E85 equipment is available, it is challenging for the marketplace as the price differential between E10 and E25 equipment is negligible compared with the price premium for E85-listed products.[15] Table 1 summarizes estimated minimum costs for offering E10+ fuels at a retail station.[16] Prices are from the *Increasing Biofuel Deployment and Utilization through Development of Renewable Super Premium: Infrastructure Assessment*[17] study and so, are in U.S. dollars.

Table 1 Minimum Costs for E15-E25 at One E10+ Refueling Position at a Station

Equipment	E15-E25
Use an Existing Tank Dispenser [a]	$2,100
Hanging Hardware and Shear Valve	$835
Tank Cleaning Cost	$1,500
Total (using an existing tank)	$4,435
New tank [b]	$95,000
Total (with a new tank)	$97,935

Source: Refueling equipment distributors, manufacturers, and Petroleum Equipment Institute.
a - assumes E15 uses a UL-listed retrofit kit on an existing dispenser.
b - installed tank and all associated tank equipment cost at an existing station; tank costs are the same regardless of fuel costs; tank at a new station is $75,000.

Storage Tank Infrastructure Modifications for E15 and E20-E25

Wayne Fuelling Systems is now part of Dover Fuelling Solutions as of early 2017.[18] The Wayne (now Dover) North America Office is based in Austin, Texas and there are regional service providers across

[14] https://www.canadianfuels.ca/Commentary/December-2018/

[15] https://www.afdc.energy.gov/uploads/publication/increasing_biofuel_deployment.pdf

[16] https://www.afdc.energy.gov/uploads/publication/increasing_biofuel_deployment.pdf

[17] https://www.afdc.energy.gov/uploads/publication/increasing_biofuel_deployment.pdf

[18] https://www.doverfuelingsolutions.com/en/about/.

Canada.[19] Wayne pumps are the only mid-level ethanol pumps for E15 and E20-E25 that are presently certified in Canada.[20] Although Gilbarco and others have a strong presence in the U.S., at this juncture they are not certified in Canada.[21]

There are several contracting companies that do fuel tank storage installations. One such company in Ontario is Claybar Contracting.[22] Services for this example company include site and system design-build services, above ground and underground tank and piping installation, fuelling system installations including state-of-the-art containment and electronic monitoring systems, card lock, full service and self-service fuelling facility construction and fuel tank removal and replacement program management. One concern that has been expressed by the CFA has been the time for installation of new tanks if needed. The installation time for a new tank has been estimated at three months for an existing retail site, including permitting time.[23]

Wayne (now Dover) pumps out of the box with no modifications as of January 1, 2016 are E25 complaint (and therefore also E15 complaint). For Wayne pumps between 2005 – 2015 there are O-rings that over time if used in E15 service will break down. Dover stated that although it is difficult to say based on the year of the pump how soon the risk of leaks may occur also stated that it should be systematically scheduled for upgrade, but it is not necessary before any E15 is dispensed. Dover also stated that the cost for the O-rings is a couple of hundred dollars and so with labour is less than 1k per pump.

Dover added that for pre-2005 pumps they would need to be upgraded for E10, but those pumps would also not be card read capable and so would likely be in more remote locations. The cost for new pumps with card readers is 25k and new pumps without card readers is 18k per pump.

Dover has the market for the E25 and E85 pumps in Canada. However, the other primary retail pump supplier Gilbarco also has retail pumps in Canada. However, the Gilbarco share of the retail market in Canada is shrinking for two reasons. Because unlike Wayne (now Dover) pumps which are E25 compliant out of the box as of January 1, 2016 and secondly, the Gilbarco pumps are nor card reader complaint for Canada apparently.

There are roughly 12,000 retail stations in Canada based on the latest census. It is estimated that the market share of pumps for Wayne is roughly 60% and Gilbarco roughly 40%. Of the Wayne pumps, Dover estimated that roughly one third to one half are in the 2005 – 2016 vintage in which case over time seals and O-rings should be upgraded.

Dover also stated that the underground storage tanks are all fiberglass and double lined and would be suitable without the need for change underground storage tanks to change from storing E10 to storing E15 or E20.

Retailer Infrastructure Options

For stations that have only two gasoline tanks, an option is to reconfigure the fuel products as shown in Figure 3 and stop offering midgrade. Replacing midgrade gasoline with higher ethanol blends that have higher octane significantly decreases the equipment costs to the station because it avoids installing a third underground storage tank. It is accomplished through the tank use scenario shown in Figure 3, where premium is replaced with high octane fuel in the underground storage tank and is instead blended from E10 and high-octane fuel.

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[19] https://www.wayne.com/en/contact/sales-service-locator/.

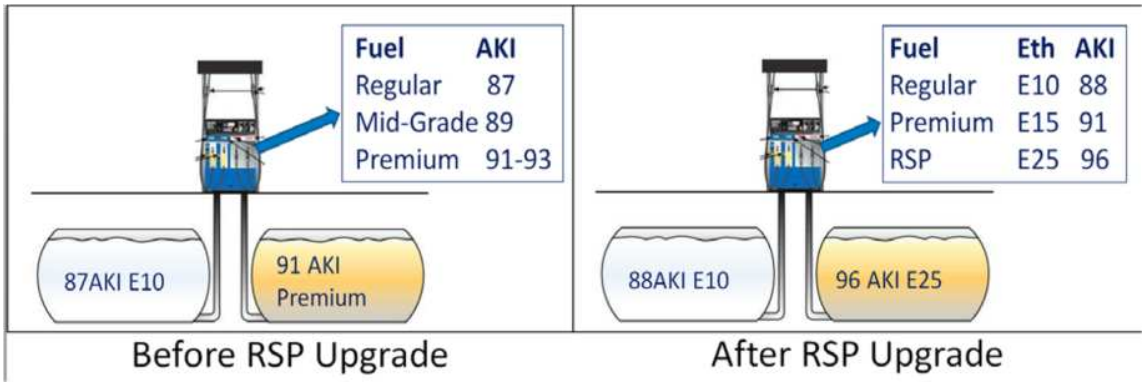
[20] Interview with Dover Fuelling Solutions Canada office.

[21] Interview with Gilbarco Canada.

[22] https://claybar.ca/petroleum-contracting/.

[23] Interview with Claybar Contracting President.

Figure 3: Strategy to offer HOF from a Station with only Two Gasoline USTs



Removing midgrade from the suite of fuels sold is deemed acceptable because no vehicles require midgrade. Therefore, the people purchasing it are either using it in regular vehicles (and therefore wasting the octane) or in premium vehicles (and are therefore slightly reducing their fuel economy or performance).[24]

Retail Pump Scenarios for E15

Most retail stations in Ontario have two underground storage tanks; one for E10 and one for premium. The mid-grade is simply a blend of the two. A variation on Figure 2 above is what would be the most benefit for the Ontario case as a scenario. Although the government can't dictate what refiners or retail stations do, it is difficult to argue with the following.

Option 1:

For those stations that decided to add the additional storage tank, they could store E20 and dispense from that storage tank both E20 for FFVs and also E15. If their existing retail pumps are 2016 or newer, they could dispense E20 and E15 at no additional cost. If minor upgrades are needed there are options as discussed above. The E15 could be blended from the same BOB and ethanol tanks at the blending terminal for delivery to the retail site.

Option 2:

For those retail stations that choose to offer E15, the following option is there that would mitigate the need for an additional underground storage tank. The E15 could be blended from the same BOB and ethanol tanks at the blending terminal for delivery to the retail site. E10 could be blended from the E15 and premium tanks. In addition, the premium would be delivered to the retail site as usual.

Option 3:

For refiners that choose to offer premium E10 as part of their compliance option, this will provide retail stations different options and also be less costly for refiners to make. Moreover, this premium BOB could also be used to sell E0 to northern locations in the transition period. In this case, the retail site could have the E10 as they do now and have the premium E10 blend in their premium tank. The mid-grade would be an E10 blend of the E10 regular and E10 premium.

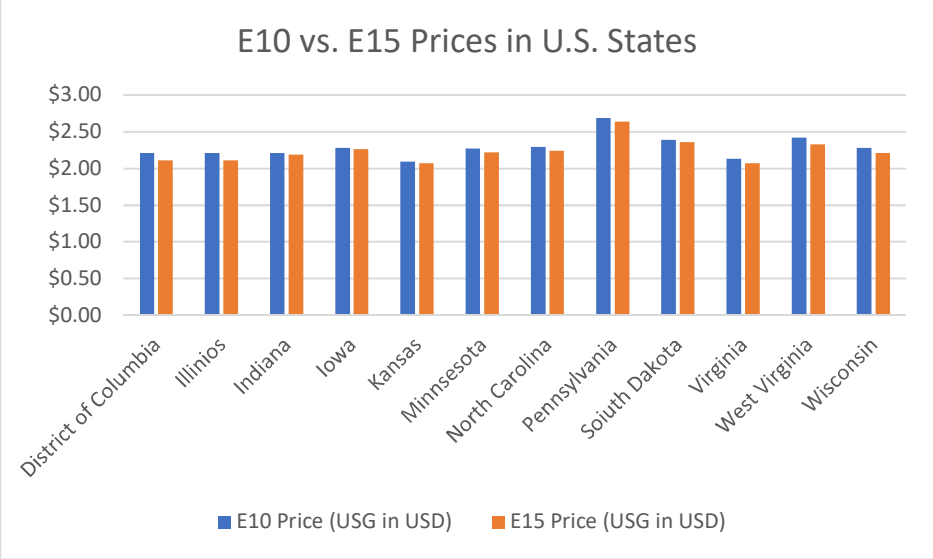
[24] https://www.afdc.energy.gov/uploads/publication/high-octane_mid-level_ethanol_mkt_assessment.pdf.

E15 and Retail Pricing

E15 prices in Canada are difficult to predict. The market dynamics and drivers are different in the U.S. than in Canada. That said, that is all we have as a benchmark and based on data in the U.S., E15 is priced slightly lower than E10 regular.[25]

As seen in Figure 4 below, the pricing for E15 as compared to E10 in the USA is consistently 2% lower.

Figure 4: Comparison of E10 versus E15 Pricing in the U.S.



Source: E85prices.com/Iowa

Refinery Blending

EPA is also proposing an interpretive rulemaking which defines gasoline blended with up to 15 percent ethanol as "substantially similar" to the fuel used to certify Tier 3 motor vehicles. As a result of this action, parties would be able to make and distribute E15 made with the same conventional blendstock for oxygenate blending (BOB)[7] that is used to make E10 by oxygenate blenders during the summer.[8] E15 would then be held to the same gasoline volatility standards that currently apply to E10, maintaining substantially the same level of emissions performance as E10 since E15 made from the same BOB during the summer would have slightly lower RVP than E10 and would be expected to have similar emissions performance.

Ethanol is one of the highest-octane components available to increase the octane rating of gasoline. 10% ethanol in gasoline will increase the octane rating of regular gasoline by about 3 octane numbers. There are no published prices for octane, but it is possible to calculate the value of octane by looking at the price differences between the different grades (octane values) of gasoline. In the United States, where there is a more viable market, the price difference between 87 regular and 93 octane premium is a better representation of the true value of octane, although fluctuations may be observed, depending on supply and demand. Figure 4 illustrates the octane value over the past 20+ years.

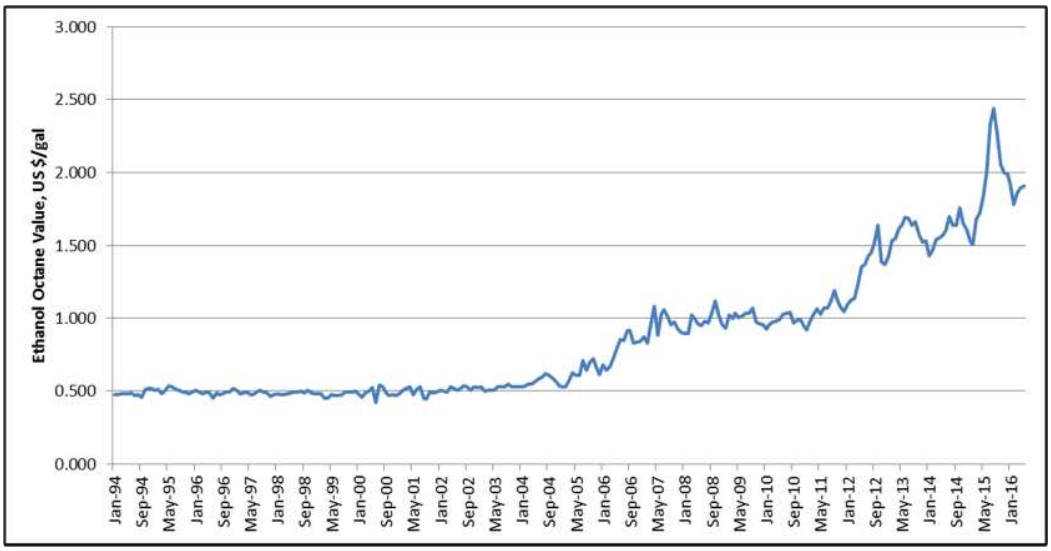
The Canadian price spreads between regular and premium grades are artificial by comparison to the U.S. spreads. The rack prices are the same for Canada and the U.S. However, in the U.S. it is a truly fungible fuel system, and thus the value of octane can be determined. The monthly price difference between

[25] https://e85prices.com/iowa.html.

regular and premium gasoline for rack sales by refiner is reported by the DOE EIA and is dynamic. It is assumed that regular gasoline is 87 octane and premium is 93 octane and ethanol has a blending octane value of 113 (R+M)/2 (or AKI).

The Canadian gasoline price spreads between regular and premium grades are not based on cost of components or octane value. To put it another way, they diverge from the differential between regular and premium prices in the U.S. even when taking into consideration conversions to litres and Canadian currency. The effective value of the octane of ethanol is shown in Figure 5 below.

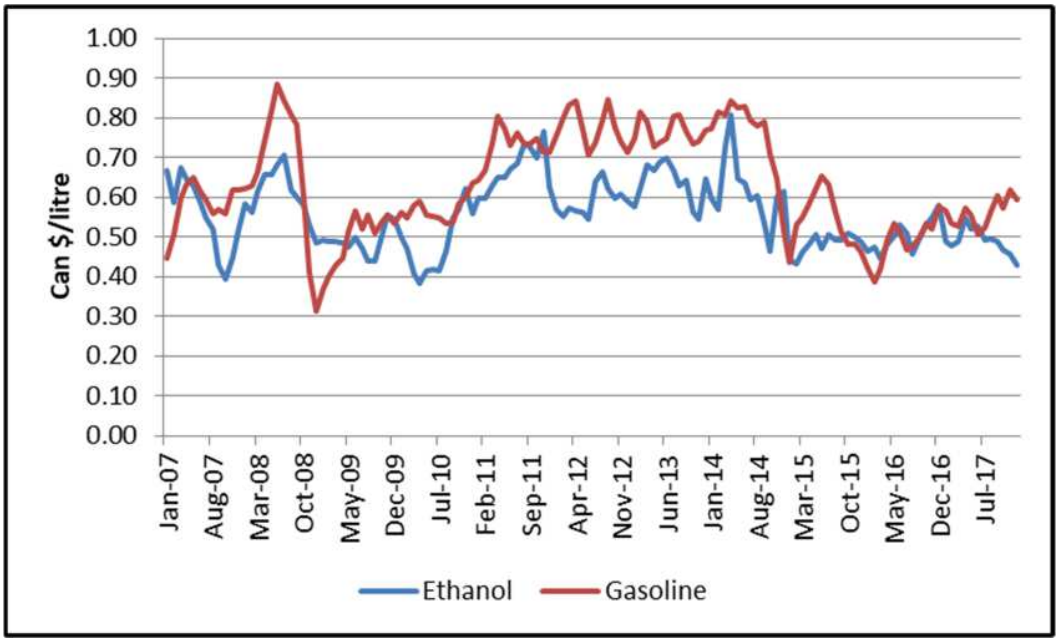
Figure 5: Historical Value of Ethanol's Octane Content



Source: U.S. DOE EIA.

Between 2012 and 2015, the U.S. average value of octane was 1.5 cpl octane number (Canadian currency). This value equates to an extra 47.8 cents per litre of ethanol to a refiner. Refiners can achieve this value in different ways. They can continue to make the octane in the refinery and then sell the high-octane products to other refiners, or they can reduce the amount of octane they make for fuel, and thereby reduce their operating costs and the GHG emissions. Refiners in Canada do both, but the most common approach is to reduce the octane in the blendstock that they supply. Refiners produce 84-octane gasoline for blending with ethanol, rather than the 87-octane gasoline without ethanol that they used to provide. If we account for the value that accrues to the refiner from the octane value, the picture is quite different, as shown in Figure 6. The ethanol price shown is adjusted for both the octane value and the lower energy content. As the octane value has increased over the past two years, the cost of ethanol, after including octane value, has become negative. In other words, the value of ethanol as an octane enhancer is worth more to the refiners than the actual price they pay for ethanol. The ethanol value to a refiner has increased over time.

Figure 6: Comparison of Gasoline and Ethanol Prices, including Octane Value and Energy Content



Source: Calculations based on U.S. EIA data.

The refiners also benefit from lower GHG emissions because of not having to produce the extra octane. The emission benefit will vary from refinery to refinery and it is difficult to determine precisely. Statistics Canada reports the total energy consumed in refineries and the total production of refined products. Since ethanol began to be added to gasoline, the average energy intensity of refinery operations has been reduced by about 10%. If all this energy reduction were due to the lower octane as a result of blending the ethanol, the GHG emission reduction is very significant. Large reductions in refinery GHG emissions are also found in some peer reviewed literature.[26] Croezen found that the GHG emission reductions in the refinery can be larger than the reduction from the production and use of ethanol.

E15 and Emissions

"For two years, the Department of Energy's Oak Ridge National Laboratory performed extensive study and analysis of midlevel ethanol blends including E15 on engine emission systems," the comments said. "In fact, Oak Ridge ran 82 vehicles for 6 million miles before concluding that 'ethanol blends did not affect emissions changes over time differently than aging with ethanol-free gasoline' and that the use of ethanol blends resulted in reductions in carbon monoxide and non-methane hydrocarbons."[27]

LCA Tool for GHG Reductions

Recommendation four recognizes that in order to ensure that renewable fuel in use meets the compliance threshold, it is important that a third-party lifecycle model is used. Given the extent that GHGenius has been used across Canada (federally, in Ontario, Alberta, and British Columbia). Biofuels Consulting Canada recommends the use of GHGenius 5.0 for the Greener Gasoline and Greener Diesel regulations.

[26] H. Croezen, B. Kampman, The Impact of Ethanol and ETBE Blending on Refinery Operations and GHG-Emissions, Energy Policy, Volume 37, Issue 12, December 2009, Pages 5226-5238, ISSN 0301-4215, http://dx.doi.org/10.1016/j.enpol.2009.07.072.

[27] https://www.dtnpf.com/agriculture/web/ag/perspectives/blogs/ethanol-blog/blog-post/2019/02/04/ontario-considers-e15-environmental

Biofuels are low-carbon fuels proven to reduce GHG emissions. The challenge when designing good fuel standards is ensuring the lower carbon intensity of ethanol and biodiesel is valued correctly, which depends almost entirely on choosing the best LCA tool. There can be variations in the carbon intensity results between LCA models due to different system boundaries, different allocation methods, and different geographical and temporal data sets – all of which can compromise meeting GHG reduction targets.

The latest version of the GHGenius version 5 model has over 100 updates over the currently specified GHGenius 4.03. Furthermore, the gasoline combustion GHG emissions are now calculated in a manner that is consistent with the emission factors for gasoline used by Ontario in the development of their GHG emission inventories. The more recent GHGenius version 5.0 have even better agronomics data by province for Canada and better data on Canadian refineries also. Among the other updates are Ontario specific fertilizer application rates for annual crops, updated emissions for Canadian fertilizer production, better algorithms for determining farm fuel use, many more pathways for producing greener gasoline and diesel fuels. The latest version also has increased flexibility for analyzing the carbon intensity of co-processed fuels and emerging pathways.

The carbon intensity of gasoline and diesel fuel in Ontario is very sensitive to the types of crude oil refined in Ontario refineries. The growth in Canadian oil production over the past decade has been primarily in bitumen and synthetic crude oil production. While it is unlikely that the proportion of bitumen refined in Ontario will increase significantly in the next decade, it is possible that the synthetic crude oil could increase resulting in higher GHG emissions for gasoline. The ministry should be able to respond to any such changes, should they occur.

Biofuels Consulting Canada strongly recommends that GHGenius be used. This was the outcome of the *Review and Recommendations for Life Cycle Analysis in Support of Ontario's Low Carbon Fuel Standard* study conducted for Ontario in 2009 by BBI Biofuels Canada. GHGenius has the advantage in that it contains the best available set of Canadian data (including at the Provincial level), includes United States data and can therefore model fuels that are imported from the United States – such as natural gas, ethanol, biodiesel, and renewable diesel. The key aspect to that study was assessing what LCA model was most appropriate for Canada and in that case specifically Ontario. In the *Review and Recommendations for Life Cycle Analysis in Support of Ontario's Low Carbon Fuel Standard,* the comparison was made between GHGenius and GREET on several fronts. This included which was most transparent, meaning which had the ability to see the input values on which the model was based, and which had the ability to update for agronomics and the like. GHGenius was the clear choice in that regard. GHGenius is already used in the BC and Ontario clean fuel programs and in the Alberta RFS. It has been proven to be transparent, flexible, and expandable.

It is ironic that in the March 21, 2019 MCEP consultation that the CFA went on record citing that they did not like GHGenius due to the "governance" of the model. It was the Canadian Fuels Association (CFA) that back in 2013 asked NRCan to have GHGenius taken out from under NRCan citing that "it was inappropriate for the Canadian government to house a model cited in provincial regulations". A GHGenius Transition Team was set up to assess options with representatives from natural gas, biofuels industry, petroleum industry, academia and governments (in particular Ontario and BC). A representative from Biofuels Consulting Canada was part of that "GHGenius Transition Team" and a governance model was agreed upon by all parties including the provinces of Ontario and BC with one exception - the CFA. As a result, GHGenius has now become separated from NRCan and has a separate web site and is in the public domain.

Conclusion

Moving to a 15% ethanol mandate will make Ontario Canada's leading province in the use of renewable transportation fuel and show leadership for Canada as a whole. Biofuels Consulting Canada applauds the

Ontario Government for recognizing the benefits to the Ontario economy and agriculture sector and the opportunity to provide more affordable clean burning fuel to Ontarians.

Biofuels Consulting Canada looks forward to work together with MCEP to assist with the education and labelling for E15 and E20 blends for Ontario.

Biofuels Consulting Canada looks forward to the opportunity to work with MCEP in future expansions of the Greener Diesel Regulation to expand that in future also.

Biofuels Consulting Canada is grateful for the opportunity to submit its recommendations to the MECP. I am happy to provide any additional information that may be useful and happy to assist in any that may be helpful to the MECP as this important policy is finalized.

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