

**VIA EMAIL:** xxxxxxxxxxxxxxxx

May 29, 2015

Honourable Pierre Arcand  
Minister of Energy and Natural Resources  
Minister Responsible for the Northern Plan  
5700, 4e Avenue Ouest  
Québec (Quebec) G1H 6R1

Dear Minister,

**Re: *New Energy Policy (2016-2025): Decarbonization of Road Transport***

Firstly, I would like to congratulate you and your team at the Ministère de l'Énergie et des Ressources naturelles for conducting an exceptional consultation review for the *New Energy Policy (2016-2025)* for Québec. The quality of the documentation published by your department, and consultation process itself, will serve your decision requirements well. In particular, the *Decarbonization of Road Transport*<sup>1</sup> report is an excellent compilation of current data, trends, opportunities and challenges facing the transformation of the transportation sector to zero and low carbon technologies and fuels.

Secondly, I wish to thank you for inviting me to participate as an expert panelist in the Decarbonization of Road Transport session, and as a partner at the Renewable Energy (Bioenergy and Heat) session. Both sessions were very informative, and the mix of expert presentations with follow-on partner and open public questions and comments enriched the overall review of the subjects.

**Introduction** We are writing to set out our summary recommendations for the *New Energy Policy (2016-2025)* consultations. Québec has a unique role and opportunity, as the first Canadian jurisdiction to implement a comprehensive cap & trade carbon program (which includes transportation fuel emissions) and as a national leader in the emerging Canadian Energy Strategy, to complement measures taken to date with new policies and market-based tools to ensure that the transportation energy sector meets the needs of Québec society over the coming decade.

**Western Canada Biodiesel Association** The Western Canada Biodiesel Association (WCBA) promotes the production and use of low carbon renewable diesel in Canada and the US Pacific Coast states. We represent 100% of the industrial scale (>10mly) renewable diesel production capacity, as well as the full production value chain, in western Canada. Our members supply biodiesel across North America and have substantial processing and supply chain operations in Ontario and Québec. We have worked closely with the federal government, and all provincial governments, in developing and implementing renewable and low carbon fuel policies and regulations for over a decade, and served on numerous ministerial roundtables and national energy policy review committees (e.g. Energy Policy Institute of Canada, Canadian Energy Strategy).

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<sup>1</sup> [http://www.politiqueenergetique.gouv.qc.ca/wp-content/uploads/Fascicule\\_5\\_ANG.pdf](http://www.politiqueenergetique.gouv.qc.ca/wp-content/uploads/Fascicule_5_ANG.pdf)

Our staff has international expertise on biofuels policy, regulation, sustainability certification standards, carbon credit and trading systems, and fiscal programs (capital grants, production/use credits, R&D investments) for both traditional biofuel products (e.g. biodiesel and ethanol) and emerging, advanced biofuel technologies (e.g. biojet, renewable diesel and cellulosic ethanol). More recently, we worked to support all low carbon fuel alternatives (e.g. electricity, hydrogen, CNG, LNG, biogas and biofuels) in an extensive, year-long review of the BC LCFS. We work closely with Canada's agricultural sector, and increasingly with emerging opportunities in the forest biomass sector.

The WCBA supports policies and regulatory measures to decarbonize the transportation sector, expand market access for renewable fuels, and support competitive market conditions to transition to a low carbon, clean energy economy in Canada and along the US Pacific coast.

**Québec's New Energy Policy (2016-2025)** We support the principle objectives of Québec's *New Energy Policy* goals to:

1. *participate in a rapidly changing worldwide energy, economic and environmental context;*
2. *broaden its leadership in the realms of renewable energies, energy efficiency and innovation;*
3. *responsibly develop all of its resources and its shared energy heritage; and*
4. *pursue the development of an economy that is less dependent on fossil energy.*<sup>2</sup>

Taken together, these objectives will provide a strong foundation on which to implement a progressive, new energy strategy for the coming decade.

We acknowledge the *New Energy Policy* is a comprehensive effort that must address all energy system components, from the production, distribution and use of electricity through to transportation fuels and technologies, and opportunities to capture energy efficiency and improve literacy across all energy platforms. The transition that is underway in global energy markets today is truly *transformational* – it is clear that the energy systems of tomorrow will be far different from those in place today.

But, transformational change to a system as large, complex and capital intensive as our energy sectors will, by necessity, need to take place in gradual, incremental steps. In our attached analysis, we focus on the transportation sub-sector and the steps that can be taken by Québec to drive down carbon emissions, diversify fuel choices for consumers, and lesson economic costs of dependency on fossil fuels and associated health impacts in the near- to mid-term.

**Building a Clean Transportation Economy** Our recommendations are designed to present a pragmatic path to achieving a 10% reduction in the carbon intensity of transportation fuels by 2025, based on proven, market-based policies and regulations that have been successfully deployed in Canada, the United States and Europe. As noted in the analysis, using a suite of complementary measures, carbon emissions from road transportation could be reduced by 20% by 2030.

To achieve these reductions, a Québec *New Energy Policy* would need to implement policies to speed adoption of existing low carbon transportation fuels by 2020, and support the development of advanced, low carbon fuels, and the adoption of zero and low emission vehicles to meet its 2025 goals. Québec's leadership in biodiesel, ethanol and cellulosic ethanol production would be strengthened and

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<sup>2</sup> <http://www.politiqueenergetique.gouv.qc.ca/home/>

expanded to include the next generation of clean, low carbon biofuels. These market-based measures would also complement Québec's existing carbon reduction and taxation policies, and create a lasting framework for progressive decarbonization of road transportation beyond 2025.

*Recommendations:*

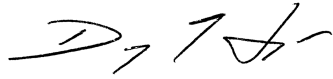
- 1. Implement renewable and/or low carbon fuel standards (RFS/LCFS). Progressively expand RFS blending levels beyond existing federal standards (5/2%) to increase low carbon biofuel levels. Implementation of an LCFS system can mirror efforts in California / BC to support adoption of renewable fuels (e.g. biodiesel, ethanol) and alternative fuels (e.g. electricity, renewable hydrogen, biogas, LNG, CNG).*
- 2. Assure carbon performance of biofuels through a minimum carbon intensity threshold standard. Mirror EU and US measures to require eligible biofuels (under the RFS/LCFS) to exceed 50% carbon reductions from fossil fuels. Québec's cap & trade program should amend eligibility for exemption from the transportation fuel cap to require compliance with a minimum carbon reduction threshold (i.e. eliminate current exemption for high-carbon renewable fuels) and consider adoption of biofuels offsets under the program for low carbon fuels produced and used in Quebec. Assessment of full lifecycle carbon intensities should be based on GHGenius and aligned with the science-based methodology in place in other Canadian fuel markets.*
- 3. Adopt supply-chain accountability to assure the sustainability of biomass resources. Measures, such as US EPA's 'renewable biomass' requirement can ensure renewable fuels are responsibly produced from sustainable biomass systems (e.g. avoid deforestation, impairment of sensitive ecosystems).*
- 4. Green Fund investments. Québec's Green Fund should strategically direct investments to build infrastructure and support the production and use of low carbon renewable and alternative fuels in Québec. Capital investment and production/use credit programs are necessary to draw private sector investment to the province to share upfront costs and risks through the sector transformation stage. On-going support for innovation, research and development will be needed across the supply chain.*
- 5. Ensure accountability and market efficiency through timely (quarterly) and comprehensive compliance reporting, and publication of the results.*

**Summary** Québec's commitment to decarbonize the road transportation system can vault the province to the forefront of progressive nations and sub-nations that have committed to address climate change today. Beyond the necessary carbon reductions, these market-based measures will drive private sector investment, economic growth and new clean tech jobs in the production and use of low carbon fuels, zero and near-zero vehicle/engine emission platforms, new fueling infrastructure, and support leading research in the province. Responsible use of forest and agricultural resources will also build resilience in Québec's rural communities, retain billions of dollars on fuel expenditures within the provincial economy, and significantly lesson dependency on imported crude oil. These are steps worth taking.

Thank you again for the opportunity to participate in the *New Energy Policy* review. We look forward to the results of your analysis and pledge to assist, as needed, in implementing sound and effective measures to reach all the stated objectives of the *New Energy Policy*.

Yours truly,

***Western Canada Biodiesel Association***



Doug Hooper  
Director, Policy & Regulation

*CC:*

Ms. Luce Asselin, Assistant Deputy Minister

Mr. Douglas Labelle, Transportation Program Manager

*Attachments:*

Schedule A: Assessment of Decarbonization of Road Transportation in Québec

Schedule B: Policy Tools to Decarbonize Transportation

Schedule C: Transportation Sector Regulations & Programs

## **SCHEDULE A: Assessment of Decarbonization of Road Transportation in Québec**

**Transportation Energy Sector** Within a broad ‘energy policy framework’ it is necessary to break out analysis and strategies between the primary energy systems: electricity, transportation and heat. The transportation sector requirements need to differentiate between an array of sub-sectors (e.g. road transportation, off-road, aviation, rail, marine) and engine/fuel platforms (e.g. gasoline, diesel, natural gas). Transportation energy systems predominantly rely on energy dense, liquid fossil fuels today; some of these systems are amenable to switching to alternative fuel/new engine technology options (e.g. electric vehicles), while others are more likely to remain reliant on existing platforms (e.g. diesel engines/liquid fuels).

As noted in the report, *Decarbonization of Road Transport*, road transportation GHG emissions represent 33.8% of the provincial emissions in 2011, and grew by 32.9% between 1990 and 2011. The leading causes of emissions growth in the sector were light duty trucks (101.8% increase) and heavy-duty vehicles (93.6% increase). Rail emissions, while relatively minor, grew by 57.2%. Notably, the trade balance deficit from crude oil imports for transportation fuels was \$9.2 billion in 2012.<sup>3</sup>

In looking specifically at the high growth emission sectors, the report describes a rapid rise in vehicles per capita, the relative growth in the share of light duty SUV/trucks, an increase in distances travelled and combustion efficiency gains lost to power/weight upgrades. These light duty vehicles are predominantly gasoline powered, with a slight increase in diesel cars/trucks and electric cars over the past decade. On the heavy duty vehicle side, a relatively small market share of vehicles (2.6%) consumes 33% of the fossil fuels and emits 33% of greenhouse gas (GHG) and 80% of particulate emissions. Heavy duty road vehicles include buses and cargo trucks; they are predominantly powered by diesel engines.<sup>4</sup>

The Québec transportation sector data presents a clear depiction of the problem, which should guide critical areas for action in the *New Energy Policy*. The report summarizes the opportunity, as follows:

*“... the transportation sector offers the best potential to ensure that Québec society reduces its emissions, becomes more prosperous and innovative, and less dependent on fossil energies. ... [Heavy duty road vehicles] are thus an ideal target from the standpoint of decarbonization of transportation.”<sup>5</sup>*

**Transportation Sector Policy Framework** The report, *Decarbonization of Road Transport*, sets out a robust structure within which to analyze transportation sector energy issues and opportunities related to *New Energy Policy* objectives. The ‘avoid-shift-improve’ framework is a useful tool to define a matrix of measures that will be required to meet these objectives.

Given the growth in the light-duty SUV-truck use, there may be opportunities to achieve market transformation away from in this trend by inducing human behavioural changes. For instance, urban densification and design, coupled with mass transit/car-pooling, can avoid and shift transportation use patterns. These changes require integrated planning, with long-term implementation strategies.

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<sup>3</sup> [http://www.politiqueenergetique.gouv.qc.ca/wp-content/uploads/Fascicule\\_5\\_ANG.pdf](http://www.politiqueenergetique.gouv.qc.ca/wp-content/uploads/Fascicule_5_ANG.pdf)

<sup>4</sup> *Ibid*

<sup>5</sup> *Ibid*

It is in the third element of the framework, termed ‘improve’, that we can define concrete measures that can be adopted in the *New Energy Policy* to induce near-term (2020) and mid-term (2025) changes that achieve the overall energy plan objectives. As set out in the report, the ‘improve’ component comprises three core measures:

1. *the enhancement of the energy efficiency of existing motor vehicles;*
2. *the use of alternative fuels with lower [GHG] footprints, in particular biofuels and natural gas; and*
3. *the replacement or assistance of an ... engine powered by a battery or a [hydrogen] fuel cell.*<sup>6</sup>

As the report notes, it is critical to integrate planning efforts across all three components. In addition, these ‘improve’ component options will have differentiated strategies and impacts (efficacy), based on the specific transportation sub-sector (e.g. light-duty, heavy-duty).

**Transportation Policy Solutions** Using the above framework, we can summarize the primary policy/regulatory tools and give examples of existing standards and programs that are in place to target transportation energy use and GHG/air contaminant reduction objectives:

<i>Component</i>	<i>Primary Tools / Programs</i>
Energy efficiency & emissions	Fuel economy standards – fuel efficiency Vehicle/engine emission standards – emission reductions Fuel emission standards – emission limits Low carbon fuel standards – carbon reduction RFS GHG standards – carbon reduction Capital grants – innovation adoption
Renewable & alternative fuels	Renewable fuel standards – non-fossil content requirements Low carbon fuel standards – carbon reduction Capital grants – build production capacity Production/use credits – support use Carbon credits (cap & trade, offsets, LCFS) – carbon price signal Fossil fuel reduction targets – reduce fossil fuel use
Electric/hydrogen vehicles & infrastructure	Vehicle rebates (zero or near-zero emission vehicles) Fleet turnover (scrap) programs Capital grants – infrastructure build-out Carbon credits (cap & trade, offsets, LCFS) – carbon price signal
Innovation (R&D)	Capital grants/tax credits – innovation development (e.g. per all three components above)

<sup>6</sup> [http://www.politiqueenergetique.gouv.qc.ca/wp-content/uploads/Fascicule\\_5\\_ANG.pdf](http://www.politiqueenergetique.gouv.qc.ca/wp-content/uploads/Fascicule_5_ANG.pdf)

Over the past decade, governments have increasingly deployed strategies to reduce carbon and other toxic emissions from fossil fuel combustion, and reduce economic dependency on fossil fuels. In the transportation sector, policies are generally enacted by using a suite of regulatory and fiscal measures in order to drive positive change across the different points of the system (e.g. vehicles, engines, fuels). The most successful national/sub-national efforts have deployed these tools and fiscal programs as complementary components to an integrated strategy. Schedule B depicts a comparative assessment of the four primary tools (RFS, LCFS, cap & trade, carbon tax); Schedule C provides a more comprehensive list of regulatory and fiscal tools in place today.

As noted in the April 2015 draft report, *Heavy Duty Technology and Fuels Assessment*,<sup>7</sup> the California Air Resources Board has identified two primary strategies to meet the state's ambitious emissions and fossil fuel reduction goals:

- i. zero / near-zero emission vehicles and fuels (e.g. electric & renewable hydrogen/biogas)
- ii. renewable fuels in conventional, and zero / near-zero emission vehicles (e.g. biodiesel, hydro-treated renewable diesel or HRD)

The latter strategy is described in the CARB report, as follows:

*"Low or no-carbon renewable fuels can provide deep GHG reductions, and their development and use should be encouraged. Renewable fuels can be used in conventional combustion engines as well as advanced technology applications and provide immediate GHG benefits."*<sup>8</sup>

The next section focuses on renewable and alternative fuels.

**Renewable & Alternative Fuels** In addition to the ability to rapidly scale up transportation fuel decarbonization, expanded renewable and alternative fuel use will also to drive economic growth and increase the resilience and competitiveness of Québec's farming, forestry and clean energy sectors.

Specifically, we note the opportunity for Québec to:

- o demonstrate tangible climate action and leadership on transportation sector emissions
- o add value to its agriculture, forestry, and clean energy/clean technology sectors
- o decrease the economic costs of fossil fuel dependence
- o create market competition and lower overall costs of transport fuels
- o attract new economic investment, create jobs and growth in the clean energy sector

**Low Carbon Fuels** Biofuels, such as biodiesel, are a low carbon fuel alternative currently supporting Québec's climate actions and transportation policy. Québec has an installed base of approximately 70 million litres per year (mly) of biodiesel production capacity, using feedstocks processed in the province (rendered fats and used cooking oil). Biodiesel has proven fuel performance in Canadian climatic conditions, is commercially available, affordable, and delivers GHG emission reductions of up to 117% below high carbon fossil diesel fuel. Hydro-treated renewable diesel (HRD),

<sup>7</sup> [http://www.arb.ca.gov/msprog/tech/techreport/ta\\_overview\\_v\\_4\\_3\\_2015\\_final\\_pdf.pdf](http://www.arb.ca.gov/msprog/tech/techreport/ta_overview_v_4_3_2015_final_pdf.pdf)

<sup>8</sup> *Ibid*

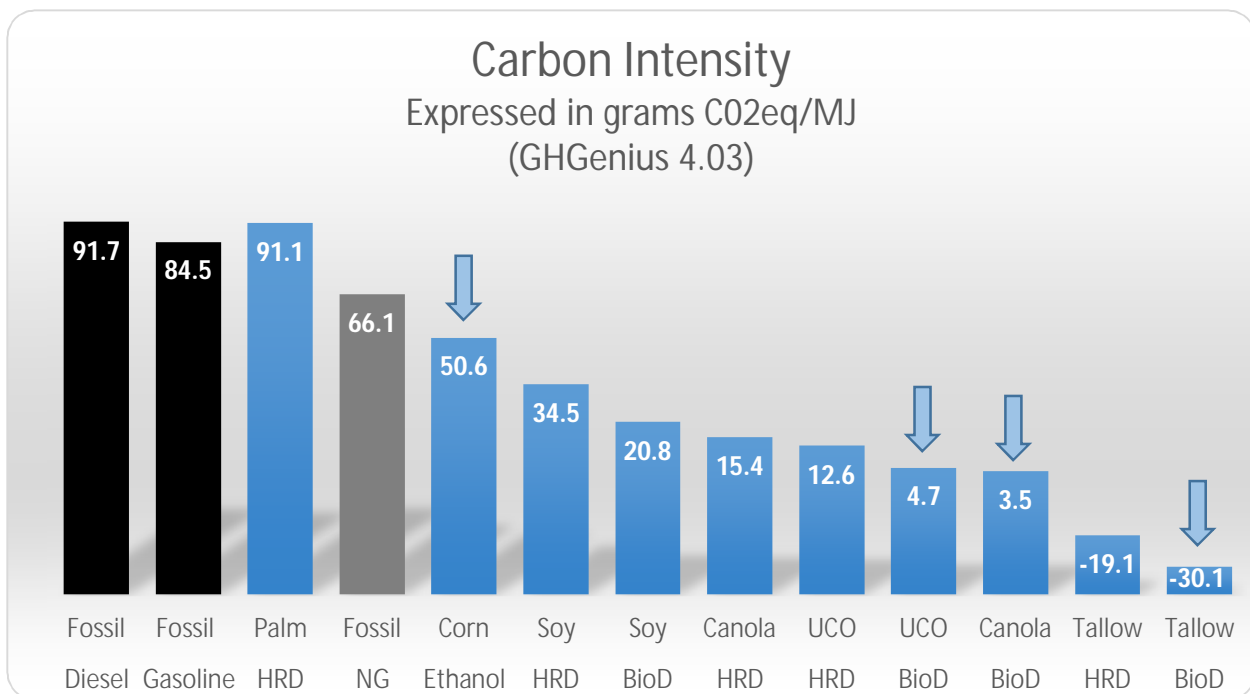


made from palm oils and other vegetable oils and rendered fats, is also widely used across Canada. However, recent updates to the GHGenius' full lifecycle assessment analysis of carbon emissions for palm-based fuels has demonstrated negligible reductions compared to fossil diesel fuels. There are no commercial scale HRD production plants in Canada.

Renewable diesel fuels, both biodiesel and fats-based HRD, are commercially available and highly effective decarbonization tools in the heavy-duty transportation sector and, to a limited extent, in the light-duty diesel passenger car and truck fleet.

In the light-duty gasoline fleet, ethanol plays an important role in both decarbonizing fuels and as an octane enhancer. Québec has approximately 175 mly of traditional ethanol capacity, made from industrial corn. Enerkem has installed 5 mly of cellulosic ethanol/methanol capacity from urban waste and used utility poles. Enerkem's ethanol reduces carbon emissions in Québec gasoline by 70%.

The chart below portrays the full lifecycle carbon intensity of fuels that could be broadly adopted for use in Québec. The arrows depict biofuels that are currently manufactured at industrial scale facilities in Québec, Ontario and western Canada.



The Pacific Coast Collaborative jurisdictions (BC-WA-OR-CA) commissioned a third-party study to assess the ability of low-carbon fuels to meet the aggregate requirements under a region-wide clean fuels regime. The January 2015 report by the International Council on Clean Transportation showed that these regulations will incent sufficient production of low-carbon fuels to replace over 25% of the gasoline and diesel fuel used by vehicles in the Pacific Coast region by 2030.<sup>9</sup> (This region represents the

<sup>9</sup> <http://www.theicct.org/potential-low-carbon-fuel-supply-pacific-coast-region-north-america>



fifth largest economy in the world.) The study further noted that these fuels could reduce the overall carbon intensity of on-road transportation fuels in the region by 14%–21% in the period. The study noted that:

*"De-carbonization goals do not require a dramatic breakthrough in any one particular technology; many different technologies exist and are emerging that can be deployed for similar oil-saving and climate mitigation benefits."*<sup>10</sup>

Compliance under the BC and California RFS and LCFS regulations has also demonstrated a significant, and continuing decrease in the carbon intensity of renewable and alternative low carbon fuels; industry is responding to the market-based carbon signal to steadily improve GHG emissions over time.

Advanced biofuels, such as hydro-treated esters and fatty acids (HEFA), biojet and cellulosic ethanol, have reached technical maturity and could be manufactured from feedstocks grown or processed in Québec (e.g. canola, soy, animal fats, used cooking oil, agricultural and forestry residues, municipal waste). Enerkem is developing a full-scale ethanol project expected to use urban waste from the industrial, commercial and institutional sector, as well as construction and demolition wood. Agricultural and forest residues have emerged as important low-cost feedstocks for advanced biofuel technologies; industry progress indicates that these technologies will mature in the 2025 timeframe and provide an important platform for future growth of low carbon, sustainable fuel use.

*Economic Growth* Studies of existing carbon-price mechanisms demonstrate the economic development impact potential of low carbon fuels. For example, in California, the LCFS is helping California become a clean-tech hub, attracting more than 50 percent of North America's clean-tech investments.<sup>11</sup> And in Washington State, cellulosic ethanol production is expected to create more jobs than expanding dependence on imported fossil fuels.<sup>12</sup>

Advanced biofuels have considerable potential in Québec. Whereas these biofuels existed until recently only at the demonstration scale, policies such as the LCFS regulations in California and BC have catalyzed development of a number of commercial-scale advanced biofuel plants. Four cellulosic ethanol plants were commissioned in the US in 2014, and more plants will come online this year in the US and Canada.

In addition to GHG emission reductions, renewable fuel production and use in many jurisdictions has created economic diversification benefits in rural economies, providing farm producers with additional revenues and reducing their export market dependency risks. In addition to producing sustainable biomass feedstocks for liquid biofuel and biogas production, there are a number of opportunities for the agriculture sector to assist Québec's transition to a lower carbon economy. By utilizing best management practices and precision technology, farmers can reduce their fertilizer use (and costs) and thereby reduce life cycle carbon intensities. Public investments in innovation to support deployment of emerging technologies can assist farmers in further optimizing on-farm GHG performance. In Alberta,

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<sup>10</sup> <http://www.theicct.org/potential-low-carbon-fuel-supply-pacific-coast-region-north-america>

<sup>11</sup> <http://www.nrdc.org/globalwarming/ca/files/low-carbon-fuel-standard-fs.pdf>

<sup>12</sup> <http://www.ucsusa.org/sites/default/files/attach/2015/02/Clean-Fuels-Washington.pdf>

farm-based carbon emission offsets have been created under the *Climate Change Emissions Management Act (CCEMA)* that provide real, near-term actions to reduce on-farm GHG emissions.<sup>13</sup>

Advances in the renewable fuel technology platforms will expand market supply beyond crop-based fuels, through increased utilization of agricultural and forestry residues and waste feedstocks. These new fuels could provide new structural economic support for Québec's agriculture and forestry sectors.

*Fossil Fuel Dependency* Québec's fossil fuel dependence comes with an opportunity cost, in addition to the estimated \$9.2 billion net deficit transport fuels in 2012. Even with its mature petroleum refining assets, Québec remains dependent on imports for 100% of its crude oil and natural gas demand. The vast majority of any economic benefits arising from fuels spending leaves the province, representing a significant export of wealth generation opportunity.

The low economic value-added impact of gasoline and diesel production in Québec contrasts with the powerful, economy-building impact of low carbon fuels production in jurisdictions with developed renewable/alternative fuel industries. While oil refining's contribution to Québec's economy has steadily declined, and is expected to decline further as assets reach end-of-life stage, the production of biofuels and alternative fuels is a value-adding growth and economic development opportunity. Advanced biofuels from forest and mill residues have recently created critical revenue streams for forest-industry firms in Europe and the US. Québec firms are likewise looking to increase their competitiveness, and the health of forest-based resource communities, by investing in low-carbon fuel production.

*Fuels Competition* Low-carbon fuels have had an unexpected impact beyond GHG reductions: there is a price-moderating benefit for consumers from the additional supply of biofuel content in diesel and in gasoline blends. Studies of North American fuel markets have repeatedly shown that increased supply of renewable fuels puts downward pressure on fossil fuel prices. Over time, traditional renewable fuels such as ethanol and biodiesel have been priced below market prices for gasoline and diesel, respectively. In addition to this benefit, new fuel suppliers create new competition for traditional fuel markets, where high levels of industry concentration have existed for over a century. (The impact of these benefits have been catalogued in BC and other jurisdictions.) Consumers and businesses in Québec will be the beneficiary of price-moderating supply, and new competition.

#### *Expanding Use of Renewable & Alternative Fuels*

From our experience in developing Canada's renewable diesel sector, we have noted two primary requirements to catalyze the production and use of clean, renewable and alternative fuels:

- i. Market access (market-based signals to assure market access)
- ii. Competitive financial returns (capital investors will locate production assets in jurisdictions with the highest potential returns and least risk)

The two primary market access tools are *renewable fuel standards (RFS)* and *low carbon fuel standards (LCFS)*. Although they have different regulatory signals, in combination they have proven to be a powerful inducement to stimulate production capacity build-out and rapid adoption of low carbon fuels

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<sup>13</sup> [http://www1.agric.gov.ab.ca/\\$Department/deptdocs.nsf/all/cl15121](http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/cl15121)

(e.g. renewable fuels, electricity and natural gas) in the heavy-duty transport sector. Extensive studies have been conducted to assess and affirm the technical and economic viability of RFS and LCFS regulations.<sup>14 15</sup>

Competitive financial returns are achieved by improving investment leverage and sharing project risk (particularly in the early payback period phase). In addition to the financial impact of public investment or tax credit programs, public investment sends a clear signal to private capital markets on the stability and determination of the government's energy and climate plans. Carbon pricing, such as emission offset credits and compliance credits (e.g. RINs, LCFS credits) earned from the use of low carbon, renewable fuels, will support overall returns on investment in the province.<sup>16 17 18</sup>

***Transforming the Transportation Sector*** It is beyond the scope of this paper to review in detail the results to date of the aforementioned policies, regulatory tools, standards and fiscal programs. Most of the transportation sector regulations and fiscal programs that have targeted GHG reductions and/or decreased fossil fuel dependency have been in place for less than a decade and, although they have minimal operational life amidst a period of considerable policy uncertainty and economic turmoil (2008 recession), there are documented results which can inform the efficacy of the respective instruments. General comments on the two primary carbon price systems (cap & trade and carbon tax) and two primary regulatory tools (RFS, LCFS) for addressing transportation GHG emissions are discussed below. A summary of these is provided in Schedule B.

***Cap & Trade Systems*** The Québec and California cap & trade system included transportation sector emissions effective January 1, 2015. Accordingly, the impact of this form of carbon price signal on the transportation system in the province has yet to be documented.

One indication of price impacts on transportation fuels, is the 'cap & trade system charge' posted by Suncor/Petro-Canada on its public fuel rack price system.<sup>19</sup> As at March 3, 2015, the charges were:

- 3.22 cents per litre (cpl) on E10 gasoline
- 3.57 cpl on conventional gasoline
- 4.55 cpl on diesel
- 4.14 cpl on furnace oil

As currently structured, the California and Québec cap & trade system relieves all renewable fuels from the transportation fuel cap, regardless of carbon intensity. Given the range of carbon intensities, and the fact that some biofuels can have carbon intensities comparable to fossil fuels, it is necessary to re-

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<sup>14</sup> <http://www.ceres.org/resources/reports/california2019s-low-carbon-fuel-standard-compliance-outlook-for-2020>

<sup>15</sup> <http://www.ucsusa.org/sites/default/files/attach/2015/02/California-LCFS-Study.pdf>

<sup>16</sup> <http://esrd.alberta.ca/focus/alberta-and-climate-change/regulating-greenhouse-gas-emissions/alberta-based-offset-credit-system/offset-credit-system-protocols/default.aspx>

<sup>17</sup> <http://www.em.gov.bc.ca/RET/RLCFRR/Pages/default.aspx>

<sup>18</sup> <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>

<sup>19</sup> <http://www.petro-canada.ca/en/rack-pricing/6687.aspx>

consider the application of this exemption. Regulations in Europe and the United States require a 50% GHG reduction for advanced biofuels to be eligible in their respective RFS systems.

AB's *CCEMA* and underlying *Specified Gas Emitters Regulation* enables the use of emission reduction credits for GHG reductions that *exceed* the regulatory requirement under the province's RFS (25% minimum reduction requirement).<sup>20</sup> Biofuels that are produced and used in the province are eligible to qualify credits that can be sold into the AB market. Similar measures under Québec's cap and trade system would incent deeper GHG reductions.

The Québec Green Fund<sup>21</sup> is an important funding facility that could be used to spur investment in infrastructure and the production and use of low carbon fuels in the province.

Carbon Tax British Columbia's 'revenue-neutral' carbon tax was implemented on July 1, 2008 with tax rates for each fuel equal to \$10 per tonne of CO<sub>2</sub>e emissions. The rates were increased by \$5/T each year until reaching \$30/T on July 1, 2012. Following a review of the carbon tax in 2013, the government announced its intention to freeze the tax to protect economic competitiveness until other jurisdictions introduce similar carbon pricing regimes.<sup>22</sup> Since July 2012, the carbon taxes on each fuel have been:<sup>23</sup>

- 6.67 cpl on gasoline
- 7.67 cpl on diesel (includes clear, marked, marine, locomotive)
- 9.45 cpl on bunker fuel
- 7.83 cpl on jet fuel

Analysts have noted that BC's economic growth and fuel use statistics support the conclusion that the carbon tax is effective. From 2008 to 2013, fuel use dropped by 16.1% (rest of Canada increased by 3%), while the BC economy slightly outperformed the rest of Canada.<sup>24</sup>

As currently structured, the BC carbon tax applies to all fuels equally, regardless of energy density or carbon intensity. For instance, the tax is applied to ethanol and biodiesel at the same rate as gasoline and diesel fuels, respectively. Given the different energy densities and carbon intensities, this results in the carbon tax being *punitively* applied to lower carbon fuels (i.e. lower carbon fuels are more heavily taxed, which is adverse to the intended policy signal). The government recognizes this failure, which should be addressed by an amendment to the carbon tax regime in the future.

### Renewable Fuel Standards

Saskatchewan was the first Canadian jurisdiction to implement a RFS for ethanol in 2002. Since then, ethanol mandates were adopted across all provinces from Ontario to BC, and federally in 2010.

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<sup>20</sup> <http://esrd.alberta.ca/focus/alberta-and-climate-change/regulating-greenhouse-gas-emissions/alberta-based-offset-credit-system/offset-credit-system-protocols/documents/ProtocolBiofuelProduction-Nov2014.pdf>

<sup>21</sup> <http://www.mddelcc.gouv.qc.ca/ministere/fonds-vert/index-en.htm>

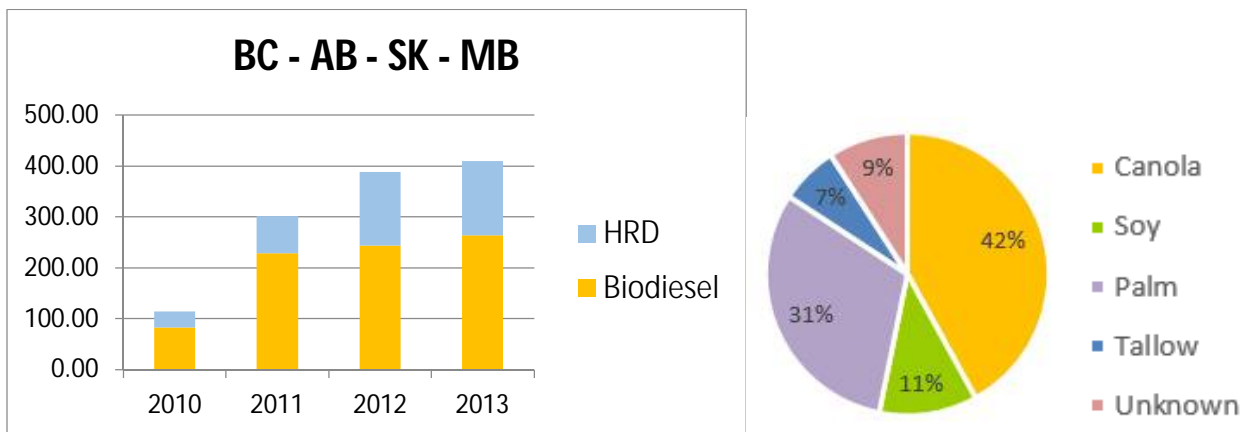
<sup>22</sup> [http://www.fin.gov.bc.ca/tbs/tp/climate/Carbon\\_Tax\\_Review\\_Topic\\_Box.pdf](http://www.fin.gov.bc.ca/tbs/tp/climate/Carbon_Tax_Review_Topic_Box.pdf)

<sup>23</sup> [http://www.sbr.gov.bc.ca/documents\\_library/bulletins/mft-ct\\_005.pdf](http://www.sbr.gov.bc.ca/documents_library/bulletins/mft-ct_005.pdf)

<sup>24</sup> <http://www.sustainableprosperity.ca/article3912>

RFS regulations for the diesel pool were slower to emerge due to the relative immaturity of biodiesel production, use and handling experience, and the lack of recognized fuel quality specifications under CGSB or ASTM. Diesel RFS regulations were first implemented in MB in 2009 and followed by BC (2010), AB (2011), Canada (2011), SK (2012) and Ontario (2014). Biodiesel fuel quality standards are now in place for B1-B5 (e.g. blends of 1-5% biodiesel), B6-B20 and B100 under both CGSB and ASTM certification standards.

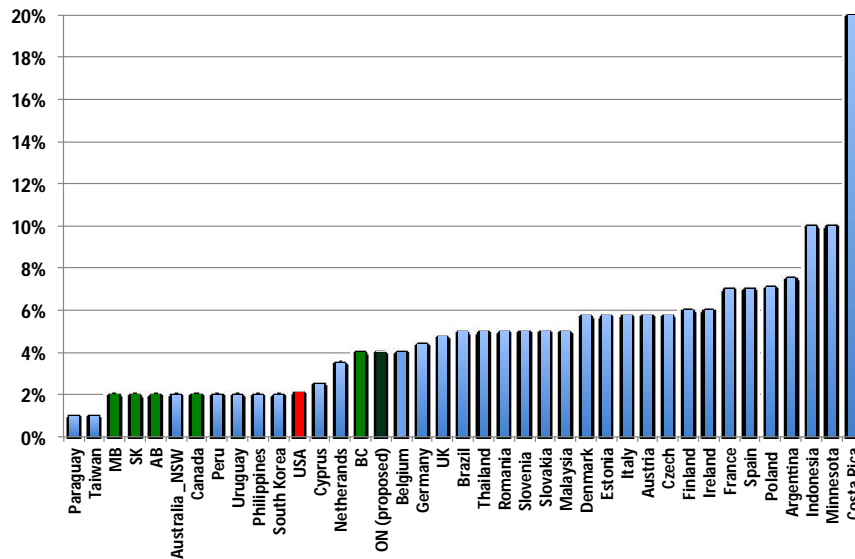
Compliance reports from the provinces have documented successful use of renewable diesel fuels (biodiesel and HRD) from 2010 to 2013. Over 400 million litres per year are now used annually in western Canada; the use ratio is approximately 2/3<sup>rd</sup>s biodiesel and 1/3<sup>rd</sup> HRD, and BC data demonstrates that the biofuels are predominantly made from canola/soy (biodiesel) and palm/fats (HRD).



Ethanol blending in Canada exceeds regulatory requirements by approximately 1 billion litres per year; E10 (or 10% ethanol) blends are the common regular and mid-grade gasoline fuel in most Canadian markets now. Ethanol adoption has been driven by its use as an octane enhancer, and by virtue of its (energy adjusted) lower cost than gasoline blendstock.

Renewable diesel RFS and blending levels in Canada are lagging adoption rates in most other jurisdictions. As renewable diesel (biodiesel and HRD) blending is the primary decarbonization strategy in the heavy duty fleet, there is significant room to expand use of lower carbon diesel fuels.

*Renewable Fuel Standards: Diesel Pool*



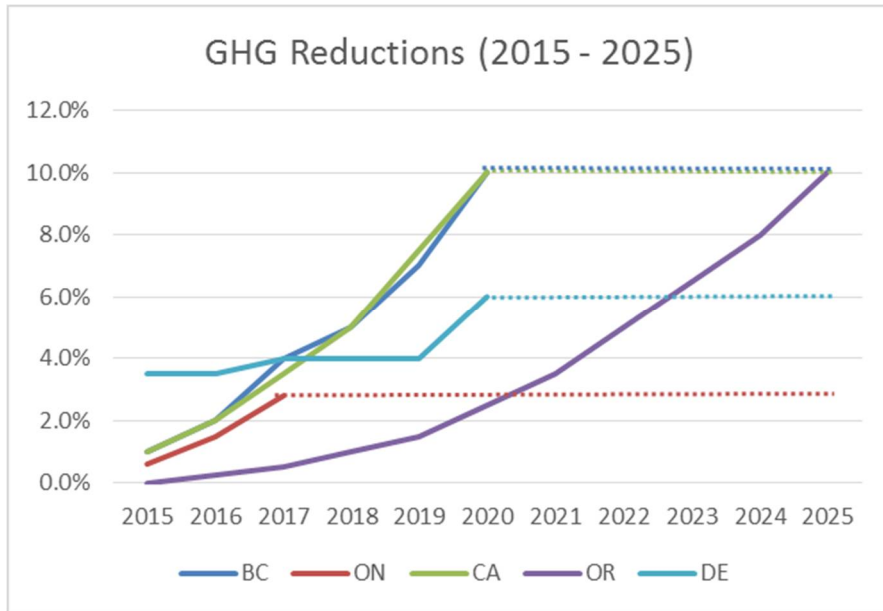
In Canada, only AB and Ontario have set carbon performance requirements in their RFS regulations. AB requires all biofuels to reduce GHG emissions by at least 25%, and Ontario pro-rates eligible volumes under its *Greener Diesel* regulations based on biofuel carbon intensities (note – the ON system is not likely to exceed 2% renewable diesel by volume until 2017). Québec remains the only major economic region in Canada to not adopt renewable fuel regulations.

Low Carbon Fuel Standards

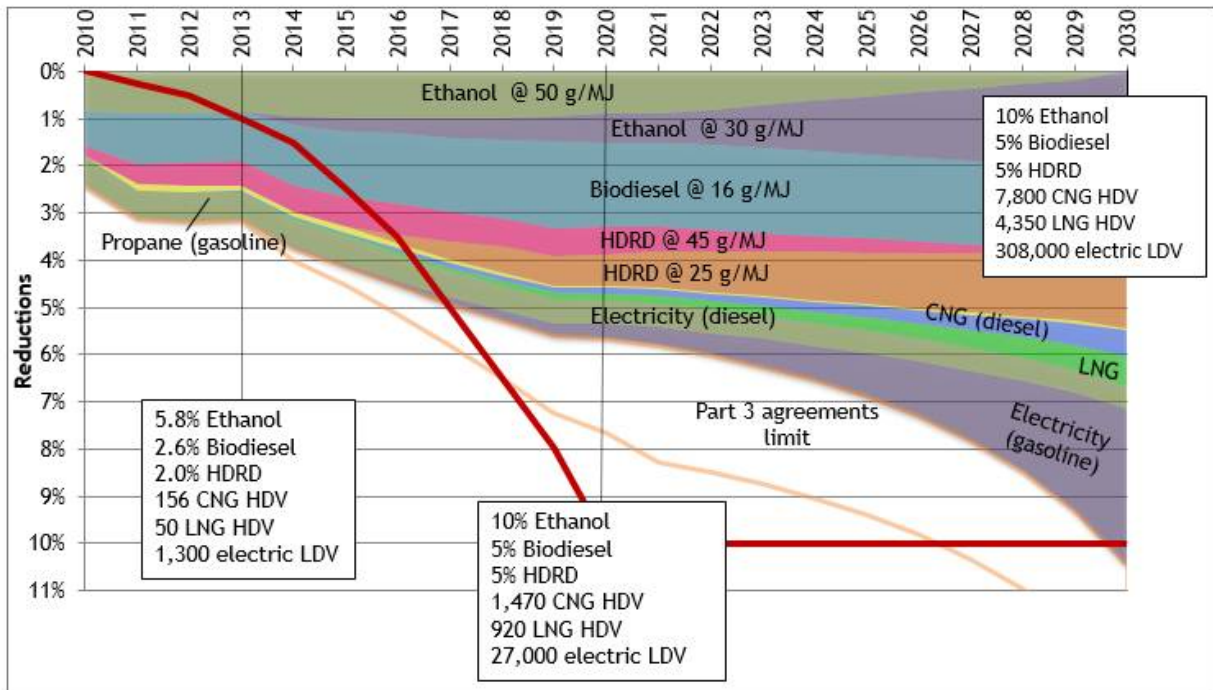
Low carbon fuel standards (LCFS) were first implemented by California and BC in 2010. As a ‘technology-forcing’ regulation, the early period requirements have been very modest with respect to GHG reduction requirements. LCFS regulations are both technology and feedstock neutral. They are a market-based system, which rewards carbon reduction per unit of energy and energy efficiency. LCFS regulatory systems are inherently complex, but flexible and well suited to meeting broad carbon reduction goals across all transportation sectors. Early results demonstrate that the LCFS regulations have: induced carbon intensity reductions through rapid adoption of 1<sup>st</sup> generation biofuels, incented new production capacity of 2<sup>nd</sup> generation biofuels, and stimulated fuel switching to electric vehicles and LNG/CNG platforms.

Germany recently shifted from a ‘volumetric blending’ (energy-based) regulatory structure to a ‘carbon-based’ system in 2015. CA, BC and Germany have not prescribed carbon reduction requirements beyond 2020. Oregon became the newest sub-national region to adopt an LCFS through its *Clean Fuel Standard* in March 2015. As noted above, Ontario’s *Greener Diesel* regulation has a carbon intensity market signal as well. A comparison of the carbon intensity reductions under the noted LCFS standards is below:





The compliance modeling for the BC LCFS through its first compliance period (2010-2020), and beyond to 2030, gives a good overview of likely compliance strategies for fuel suppliers. Under the BC model, fuel suppliers are expected to increase blend levels of renewable fuels and biofuel producers are expected to deliver lower carbon intensity fuels over time. While LNG and CNG use expands, it remains a niche fuel overall. The adoption of electric vehicles becomes significant in the post 2020 timeframe.



British Columbia: Ministry of Energy & Mines July 2014



Primary Market Impacts of Carbon Pricing Systems & Regulations on Transportation Emissions

A summary matrix, comparing the market signals and impacts of the primary carbon price systems (cap & trade, carbon tax) and fuel regulations (RFS, LCFS) is set out in Schedule B. Based on experience in Europe and the US, where renewable fuel use and transportation decarbonization strategies are more mature, the following primary market impacts on transportation system emissions have been observed:

<i>Regulatory Tool</i>	<i>Acronym</i>	<i>Primary Market Impacts</i>
Renewable Fuel Standard	RFS	<ul style="list-style-type: none"> <li>- sets firm volumetric market signal</li> <li>- builds supply chain (production, distribution) capacity</li> <li>- assured shift to lower carbon renewable fuels</li> <li>- assured reduction in fossil fuel use</li> <li>- GHG standard required to assure emission reductions</li> <li>- biomass sustainability assurance required</li> </ul>
Low Carbon Fuel Standard	LCFS/CFS	<ul style="list-style-type: none"> <li>- sets firm carbon reduction market signal</li> <li>- assured reduction in carbon emissions</li> <li>- supports innovation to decarbonize supply chain</li> <li>- supports 'shift' / 'improve' to lower carbon fuels</li> <li>- supports supply chain capacity buildout</li> <li>- complimentary with RFS (volume/carbon signals)</li> <li>- complex and flexible, graduated implementation</li> </ul>
Cap & Trade	C&T	<ul style="list-style-type: none"> <li>- sets cap on emissions and price on carbon</li> <li>- price deterrent on fuel use</li> <li>- price signal for all carbon reduction strategies</li> <li>- offsets incent early adoption / innovation</li> <li>- creates funding to assist market transformation</li> <li>- exemptions should be differentiated (based on low carbon intensity)</li> </ul>
Carbon Tax	n/a	<ul style="list-style-type: none"> <li>- sets price on carbon per unit of energy</li> <li>- price deterrent on fuel use</li> <li>- price signal for fuel carbon reduction strategies</li> <li>- no funding (if revenue neutral) to assist market transformation</li> <li>- tax should align with carbon intensity</li> </ul>

**Summary Conclusions** The CARB report identifies two primary strategies for decarbonization of transportation to 2030.<sup>25</sup> We support these conclusions, and reference them here in context to Québec's opportunity with its strength in clean, renewable hydro-electricity and wind power production, and its installed base and future potential to expand low carbon biofuel production capacity.

*Strategy One: Renewable fuels in conventional and zero / near-zero emission vehicles (2016-2025)*

- Vehicles:
  - Light duty: existing cars, trucks, SUVs
  - Heavy duty: on-road, off-road, locomotive, marine, aviation
- Fuels:
  - Light duty: low carbon ethanol, modest adoption of renewable diesel
  - Heavy duty: biodiesel, HRD, modest adoption of CNG, LNG, biogas, renewable hydrogen
- Timing:
  - Immediate reduction potential based on proven fuels, existing vehicle fleets

*Strategy Two: Zero / Near-zero emissions vehicles and fuels (> 2020)*

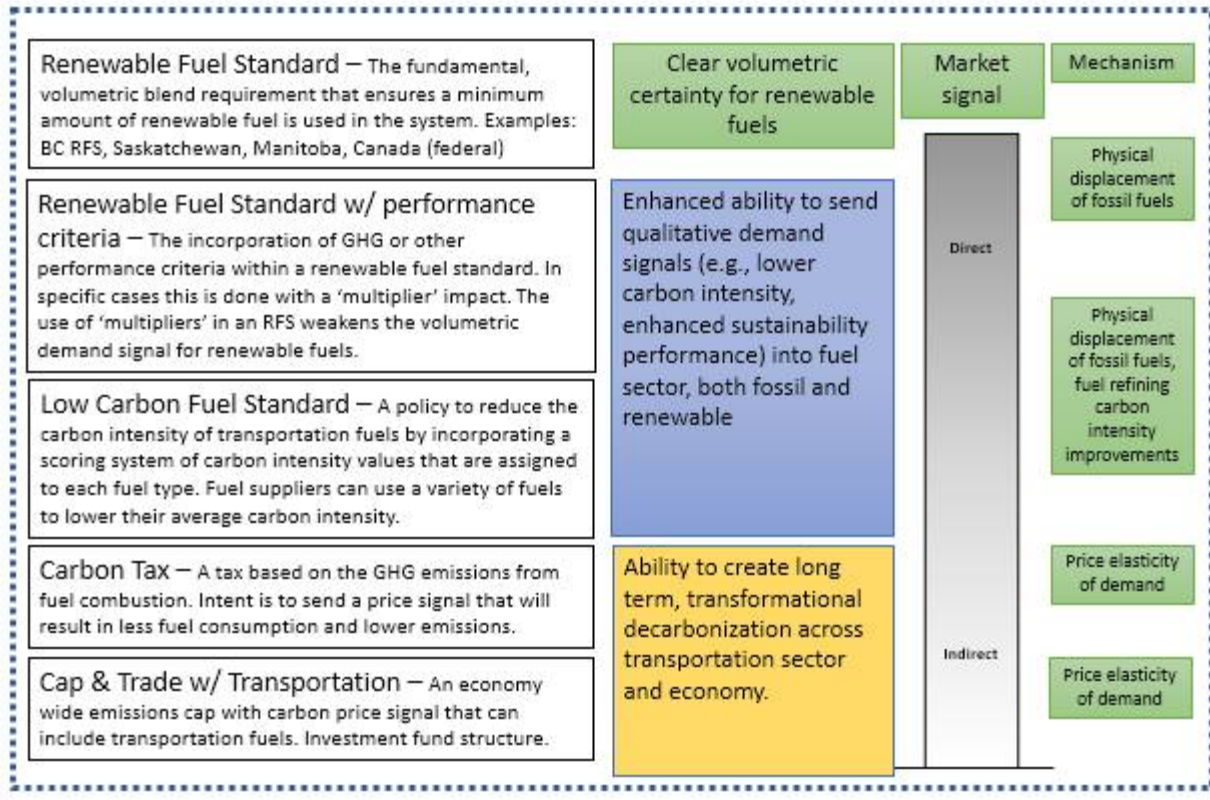
- Vehicles:
  - Light duty: electric cars & transit, modest adoption of fuel cell vehicles
  - Heavy duty select markets: modest adoption of electric (forklifts, urban transport) and fuel cells
- Fuels:
  - Light/heavy duty: renewable electricity, renewable hydrogen, biogas
- Timing:
  - Gradual fleet conversion over time – needs vehicles, infrastructure
  - Accelerated impact beyond 2020

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<sup>25</sup> [http://www.arb.ca.gov/msprog/tech/techreport/ta\\_overview\\_v\\_4\\_3\\_2015\\_final\\_pdf.pdf](http://www.arb.ca.gov/msprog/tech/techreport/ta_overview_v_4_3_2015_final_pdf.pdf)

**SCHEDULE B: Policy Tools to Decarbonize Transportation**

**Policy Tools to Decarbonize Transport**



Decarbonization Tool in Focus:

## Renewable Fuel Standard

Policy Tool Details:	
<b>Acronyms:</b>	RFS
<b>Regulated metric:</b>	Blend level (volumetric or energy basis) of renewable fuels in non-renewable fuel supply
<b>Regulated party:</b>	Fuel producers + importers (CDN federal) or fuel suppliers (CDN provinces)
<b>Potential GHG reductions:</b>	-14% to -25%
<b>Implementing jurisdictions:</b>	BC, AB, SK, MB, ON, CDA, EU, USA
<b>Timeline:</b>	2020 to 2030 as established target dates

Market Signals of RFS		
Market Signals to Regulated Parties	Secondary Market Signals	Tertiary Market Signals
Introduction of minimum renewable content	Production of new renewable, alternative and lower carbon fuels	More sustainable renewable fuels
Reduction in fossil fuel use	New biomass production systems	Biofuels with established, improved GHG reduction performance
Blending of lower carbon fuel additives (e.g., ethanol, biodiesel)	New biofuel refineries	Biofuels with established, improved biomass sustainability performance
Infrastructure upgrades (storage, blending, distribution assets)		
R&D Investments		
Investment in new supply chain assets		

Decarbonization Tool in Focus:

## Low Carbon Fuel Standard

Policy Tool Details:	
<b>Acronyms:</b>	LCFS, CFS
<b>Regulated metric:</b>	CI of transportation fuels sold
<b>Regulated party:</b>	Fuel suppliers
<b>Potential GHG reductions:</b>	-10% to -20% over 10 years
<b>Implementing jurisdictions:</b>	CA, BC, OR, WA
<b>Timeline:</b>	10 year initial program length, 2020 to 2025 as established target dates

Market Signals of LCFS		
Market Signals to Regulated Parties	Secondary Market Signals	Tertiary Market Signals
Reduction in CI of fuels	Production of new renewable and alternative or lower CI fuels	More efficient transportation technology platforms
Blending of lower carbon fuel additives (e.g. ethanol, biodiesel)	Incentive for biomass production systems	Improvements in existing combustion technology platforms
Reduction in transportation fuel CI (improved efficiency of crude oil production, refining, and distribution)	New biofuel refineries	Improvements in new combustion, drive-train, vehicle design technologies
Infrastructure upgrades (storage, blending, distribution assets)	Reduction in renewable and alternative fuel carbon intensity (production, refining energy/process efficiency) at existing biofuel refineries	
R&D Investments		
Investment in new supply chain assets		

**SCHEDULE C: Transportation Sector Regulations & Programs**

The following is a (non-exclusive) set of policies, regulations and fiscal programs in place in North America to incent the production and use of clean, renewable and alternative transportation vehicles and fuels.

<i>Component</i>	<i>Light-Duty Sector</i>	<i>Heavy-Duty Sector</i>
Energy Efficiency & Emissions	<ul style="list-style-type: none"> <li>Fuel economy standards (phase 1: 2012-2016)<sup>i</sup></li> <li>Fuel economy standards (phase 2: 2017-2025)<sup>ii</sup></li> <li>Vehicle/engine emission standards<sup>iii</sup></li> <li>GHG emission standards<sup>iv</sup></li> </ul>	<ul style="list-style-type: none"> <li>Fuel economy standards (phase 1: 2014-2018)<sup>v</sup></li> <li>Fuel economy standards (phase 2: post-2018)<sup>vi</sup></li> <li>Vehicle/engine emission standards<sup>vii</sup></li> <li>GHG emission standards<sup>viii</sup></li> </ul>
Renewable & Alternative Fuels	<ul style="list-style-type: none"> <li>Renewable fuel standards<sup>ix</sup></li> <li>Low carbon fuel standards<sup>x</sup></li> <li>Cap &amp; trade system<sup>* xi</sup></li> <li>Cap &amp; trade offset credits<sup>xii</sup></li> <li>Carbon tax<sup>** xiii</sup></li> <li>LCFS carbon credits<sup>xiv</sup></li> <li>Cellulosic ethanol credit<sup>xv</sup></li> <li>Bioenergy production credit (biofuels, biogas, bio-power)<sup>xvi</sup></li> <li>ecoEnergy for Biofuels<sup>xvii</sup></li> <li>Alternative fuels incentive programs<sup>xviii</sup></li> </ul>	<ul style="list-style-type: none"> <li>Renewable fuel standards</li> <li>Low carbon fuel standards</li> <li>Cap &amp; trade system<sup>*</sup></li> <li>Cap &amp; trade offset credits</li> <li>Carbon tax<sup>**</sup></li> <li>LCFS carbon credits</li> <li>Bioenergy production credit (biofuels, biogas, bio-power)</li> <li>Renewable diesel program<sup>xix</sup></li> <li>Alternative fuels incentive programs</li> </ul>
Electric/Hydrogen Vehicles & Infrastructure	<ul style="list-style-type: none"> <li>Drive Electric program<sup>xx</sup></li> <li>Scrap-It program<sup>xxi</sup></li> <li>Clean Energy Vehicle program<sup>xxii</sup></li> <li>ZEV program<sup>xxiii</sup></li> <li>Alternative vehicle, infrastructure, air quality incentives<sup>xxiv</sup></li> </ul>	<ul style="list-style-type: none"> <li>Fortis incentive program<sup>xxv</sup></li> <li>Alternative vehicle, infrastructure, air quality incentives</li> </ul>
Innovation (Research & Development)	<ul style="list-style-type: none"> <li>SDTC Tech Fund<sup>xxvi</sup></li> <li>Climate Change Emissions Management Corporation<sup>xxvii</sup></li> <li>BC Innovative Clean Energy Fund<sup>xxviii</sup></li> </ul>	<ul style="list-style-type: none"> <li>SDTC Next Generation Biofuels Fund<sup>xxix</sup></li> <li>BioFuelNet Canada<sup>xxx</sup></li> </ul>

\* As currently structured, the California and Québec cap & trade system relieves all renewable fuels from the transportation fuel cap (regardless of carbon intensity)

\*\* As currently structured, the BC carbon tax applies to all fuels equally (regardless of energy density or carbon intensity)

References / examples:

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- i <http://www.epa.gov/oms/climate/regs-light-duty.htm>
- ii <http://www.epa.gov/oms/climate/regs-light-duty.htm#2017-2025>
- iii <http://www.epa.gov/otag/standards/light-duty/index.htm>
- iv <http://www.epa.gov/oms/climate/documents/420f12051.pdf>
- v <http://www.epa.gov/oms/climate/regs-heavy-duty.htm>
- vi *Ibid*
- vii <http://www.epa.gov/otag/standards/heavy-duty/index.htm>
- viii <http://www.epa.gov/otag/climate/documents/hd-ghg-workshop-overview.pdf>
- ix <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-189/index.html>  
and <http://www.epa.gov/otag/fuels/renewablefuels/regulations.htm>
- x <http://www.em.gov.bc.ca/RET/RLCFRR/Pages/default.aspx>  
and <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>
- xi <http://www.mdelcc.gouv.qc.ca/changements/carbone/Systeme-plafonnement-droits-GES-en.htm>
- xii *Ibid*
- xiii [http://www.fin.gov.bc.ca/tbs/tp/climate/carbon\\_tax.htm](http://www.fin.gov.bc.ca/tbs/tp/climate/carbon_tax.htm)
- xiv <http://www.em.gov.bc.ca/RET/RLCFRR/Documents/BC%20RLCFRR%20Part%203%20Agreements%20Policy.pdf>
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- xvi [http://www.energy.gov.ab.ca/BioEnergy/pdfs/Guideline\\_March\\_2013\\_Including\\_3\\_Yr\\_Budgets.pdf](http://www.energy.gov.ab.ca/BioEnergy/pdfs/Guideline_March_2013_Including_3_Yr_Budgets.pdf)
- xvii <http://www.nrcan.gc.ca/energy/alternative-fuels/programs/ecoenergy-biofuels/3607>
- xviii <http://www.afdc.energy.gov/laws>
- xix <http://finance.gov.sk.ca/budget2011-12/ESNR.pdf>
- xx <http://vehiculeselectriques.gouv.qc.ca/english/>
- xxi <https://scrapit.ca/>
- xxii <https://www.cevforbc.ca/clean-energy-vehicle-program>
- xxiii <http://www.arb.ca.gov/msprog/zevprog/zevprog.htm>
- xxiv <http://www.afdc.energy.gov/laws>
- xxv <http://www.fortisbc.com/NaturalGas/Business/NaturalGasVehicles/Howwecanhelp/Incentives/Pages/default.aspx>
- xxvi <https://www.sdtc.ca/en/apply/sd-tech-fund>
- xxvii <http://ccemc.ca/>
- xxviii <http://www.empr.gov.bc.ca/EAED/ICEFund/Pages/About.aspx>
- xxix <https://www.sdtc.ca/en/funding/funds/nextgen>
- xxx [http://www.nce-rce.gc.ca/NetworksCentres-CentresReseaux/NCE-RCE/BioFuelNet\\_eng.asp](http://www.nce-rce.gc.ca/NetworksCentres-CentresReseaux/NCE-RCE/BioFuelNet_eng.asp)