Working Towards A Clean Fuel Strategy for Canada: Key Questions

How to make a Canadian Clean Fuel Strategy more than a cosmetic exercise to sanitize the image of the oil industry

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Friends of the Earth
Les Ami(e)s de la Terre

Member of / membre du
Friends of the Earth International

About Friends of the Earth Canada

Friends of the Earth Canada, founded in 1978, stands on guard for Mother Earth and her people — taking action to confront polluters, holding governments to account for their promises and insisting they enforce laws.

We insist that each and every resident of Canada deserves a clean, safe environment and can exercise his or her environmental rights to make it so.

We stand in solidarity with vulnerable people and communities to confront the impacts of climate change and toxic pollution.

We are the Canadian member of the world's largest grassroots environmental network — Friends of the Earth International — which has 75 national member groups and some 5,000 local activist groups on every continent.

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www.foecanada.org | foe@foecanada.org

Friends of the Earth Canada

251 Bank Street, 2nd floor

Ottawa, Ontario, Canada K2P 1X3

Tel: 613 241 0085

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Friends of the Earth Canada has retained the services of Dr. Terry McIntyre in support of the development of this Friends of the Earth submission.

We thank the individual and monthly donors to Friends of the Earth Canada who make it possible to address new and emerging issues such as the new Canadian Clean Fuel Strategy.

We look forward to discussions with donors and volunteers who may assist us in continuing this important work. | foe@foecanada.org

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Introduction

The Government of Canada has announced its intentions to develop a national clean fuel standard (CFS). The standard will require reductions in the carbon footprint of the transportation fuels supplied in Canada based on lifecycle analysis. Consultations will inform the development of a regulatory approach under the Canadian Environmental Protection Act (CEPA).

The stated overall objective of a clean fuel standard is to achieve annual reductions of 30 mega tonnes (Mt) of GHG emissions by 2030. This reduction will provide a significant contribution towards achieving Canada's commitment of 30 percent emissions reduction below 2005 levels, by 2030. This reduction is like removing over 7 million vehicles from the roads for a year.

Friends of the Earth Canada sees the development of a Clean Fuel Standard for Canada as, potentially, an important first step in reducing Canadian's reliance on carbon intensive fuels for transportation and heating and an important part of Canada's plan to meet its commitments to reduce greenhouse gas emissions. As well, a Clean Fuel Standard could provide important support for Canada's economic innovation strategy by stimulating the development of sustainable, alternative fuels and the infrastructure to produce them.

However, Friends of the Earth is concerned that an inadequately designed Clean Fuel Standard might become a cosmetic exercise that merely "sanitizes" the image of the oil industry and, therefore, prolongs the use of fossil fuels for transportation and heating uses rather than supporting a just transition off fossil fuels.

Further, Friends of the Earth believes greenhouse gas emission reductions cannot be the sole determinate of "clean" fuels. Rather, a "clean" fuel definition must address all emissions and other environmental factors associated with the growing or extraction, refining, transportation and combustion of fuel. This should include, though not be limited to, air emissions, land use implications, increased nutrient use and run-of, the prevalence of pesticide applications, impacts on water, uncertain ecosystem health and biodiversity implications and consideration of societal benefits.

Friends of the Earth Canada's wishes to engage in the consultation leading to a Canadian Clean Fuel Standard in order to:

- help build an inclusive and transparent 'science evidence base' that will provide the basis for decisions on policy and practice;
- learn from success and failure of earlier programs and policies; and,
- stimulate the replication, 'scaling up', and successful deployment of effective and sustainable alternative fuel technologies and approaches.

Environment and Climate Change Canada, to date, has not provided sufficient information on the science and policy underpinning a Clean Fuel Standard to give Canadians confidence that it will achieve its stated goals.

This paper puts forward 13 fundamental questions designed to assist Environment and Climate Change Canada in creating a Clean Fuel Standard based on science and evidence so that Canadians can be confident the CFS will reduce greenhouse gas emissions while improving the environment and the economy.

Background

Budget 2016 announced funding of $56.9 million over two years, starting in 2016–17, to Transport Canada and Environment and Climate Change Canada to support the transition to a cleaner transportation sector, including an emphasis on the development of regulations and standards for clean transportation technology. Funding was also to support Canada's continued participation in the development of international emissions standards for emissions from the international aviation, marine and rail sectors, including through the International Maritime Organization and the International Civil Aviation Organization

A variety of regulatory approaches are used throughout the world to reduce the emissions related to the use of fuel. Domestically, the provinces of Ontario and Saskatchewan have been Canadian leaders with effective renewable fuels requirements since 2007. Other provinces have followed and they have adopted renewable fuel mandates under which a minimum amount of renewable fuel is required to be blended into gasoline or diesel.

Some jurisdictions (e.g., Alberta, Ontario, U.S.) also require that the renewable fuels utilized meet a specific greenhouse gas (GHG) performance standard. British Columbia has led by implementing low carbon fuel standards that require a reduction in the lifecycle GHG emissions intensity of the fuels supplied in a given year.

The Clean Fuel Standard is envisioned to encourage the use of cleaner fuels in many sectors of the economy, including the fuels we use in transportation, in our homes and buildings, and the fuels that power our industries. It is to be designed so as to address a broad suite of fuels, which could include liquid fuels (e.g., gasoline, diesel, and heavy fuel oil), gaseous fuels (e.g., natural gas and propane), and solid fuels (e.g., petroleum coke).

The Clean Fuel Standard would set requirements to reduce the lifecycle carbon intensities of fuels supplied in a given year based on lifecycle analysis. By contrast to renewable fuel mandates, this approach would not prescribe the particular low carbon fuel or technology that must be used; instead, it would focus on greenhouse gas emissions reduction.

The Clean Fuel Standard would result in decreased emissions while minimizing compliance costs.

This approach, as envisioned, would foster the deployment of a broad range of lower carbon fuels and alternative technologies such as electricity, biogas, hydrogen, and renewable fuels.

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13 Fundamental Questions Designed to Assist Environment and Climate Change Canada in Creating a Clean Fuel Standard Based on Science and Evidence

1) What is the Definition of a Clean Fuel Standard (CFS)?

Currently neither the European Union nor the United States transportation fuel community have a working definition of what constitutes “clean fuel.”

- *So, how will clean fuel be defined by Environment Canada? NRCan? Transport Canada? Agri-Food and Agriculture Canada?*
- *Will the CFS require that fuel suppliers reduce the life cycle emissions of the fuels that they sell? This means that all emissions and other environmental factors associated with the extraction, refining transportation and combustion of fuel are taken into account.*
- *Will it require fuel providers to gradually reduce the carbon intensity of their products over time?*

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2) What are the perceived, targeted economic benefits of the Clean Fuel Standard and how will they be measured and substantiated?

There may be clear economic benefits to adopting a CFS but it will be important to identify what they are up front and how they were determined. For example, in the US, the Clean Air Association of the Northeast States, NESCAUM, that provides technical support to the states, recently issued an economic analysis that projects potential and clear economic benefits in the participating states engaged in clean energy. Some of these benefits are expected to include a reduction of dependence on imported oil, direct benefits for utilities, construction, manufacturing, forestry, and agricultural service sectors, energy diversity, and new jobs creation in the energy technology sector.

However, there is currently a dearth of representative technical, environmental, and economic data on generation, storage, transportation, use, and infrastructure requirements at scale associated with the development of the current CFS targeted transportation fuels (sp. largely novel energy sources like propane, hydrogen, renewable natural gas, and electrical vehicles) under representative Canadian conditions.

- *In the absence of this baseline empirical data, how will the economic benefits be determined? Can we expect an equivalent range of sectoral benefits like those anticipated by the US NESCAUM?*

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3) What are or will be the anticipated, projected costs of the Clean Fuel Standard and any subsequent regulations?

In late 2009, Environment Canada and the Department of Justice conducted a Regulatory Impact Analysis of Environment Canada's Renewable Fuels Regulations under the Canadian Environmental Protection Act. They posited that GHG emissions reduction target would require a total GHG reduction of 243 MT in 2020. Federal and provincial renewable fuels regulations, each responsible for 2 MT reductions (for a total of 4 MT) represent approximately 1.6% of the total reduction required

Environment Canada estimated emission reductions over 25 years of 47.4 MT at a cost of $4.8B to industry and consumers which translated into the following costs:

- 23.8 MT from ethanol at a cost of $1.9B ($75.2M annually) or $79 / tonne
- 23.6 MT from biodiesel at a cost of $2.9B (or $118.3M annually) or $121 / tonne

The 2009 IISD report, Biofuels: At What Cost? Government Support for Ethanol and biodiesel in Canada, demonstrated that federal and provincial governments made investments since the early 2000's in excess of $3.5B to support the development of renewable fuels in Canada. These costs were not included as part of Environment Canada's Regulatory Impact Analysis Statement and raised the total costs for CO_2 reduction via production of ethanol and biodiesel. Further, IISD discovered that the much touted benefits associated with the Renewable Fuels Strategy were relatively modest with less than 1% increase in income transfer to agricultural sector. Studies vary in estimation of job numbers (e.g. biodiesel production was estimated to generate up to 4000 jobs - if production occurs in Canada).

Course Correction: It's Time to Rethink Canadian Biofuel Policies, a study by Canada's Ecofiscal Commission in October 2016, found that ethanol and biodiesel policies cost consumers and governments about $640 million a year while cutting Canada's greenhouse gas emissions by about three million tonnes annually. Put another way, the report says that every tonne of carbon dioxide reduced by using ethanol costs at least $180 while biodiesel reductions cost at least $128.

Based on IISD's and Ecofiscal's estimates, biofuel policies have indeed reduced GHG emissions but at considerable costs. Overall, analysis suggests that average annual emissions reductions over the 2010–2015 periods were roughly 3 Mt.

To help put this estimate in perspective, emissions reductions from biofuel policies represent approximately 5.1% of Canada's agricultural emissions, 1.5% of Canada's transportation emissions, or 0.4% of Canada's total GHG emissions. These emissions reductions have been very costly. Using estimates of both fiscal and consumer costs, it is estimated that the cost of reducing emissions with ethanol policies was approximately $180 to $185 per tonne, and $128 to $165 per tonne with biodiesel policies. Further, these estimates represent a lower bound: if we use less optimistic estimates for the life-cycle emissions of biofuels, the estimated cost of ethanol policies increases to $238 to $284 per tonne, and $189 to $596 per tonne for biodiesel policies. Emissions reductions from these policies are very costly relative to the social cost of carbon, estimated at $41 per tonne and even those high price tags, according to Ecofiscal, may severely under represent the true cost per tonne of CO_2 reductions when the full lifecycle emissions of biofuels are taken into account.

- *What is or will be the projected cost per tonne of carbon reduction with the imposition of the Clean Fuels Standard and subsequent regulation(s) development and compliance?*
- *How will these costs vary amongst targeted alternative fuel technologies selected by Environment Canada?*
- *What methodologies will be used to determine this cost? Will this cost include federal government and provincial government subsidies? Infrastructure costs? Standards development? Demonstration projects? Public Consultations?*
- *What opportunities exist for public engagement in the determination of these costs?*

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4) What will be the environmental and social benefits of the Clean Fuel Standard and how will they be determined?

In late December 2006, the federal government of Canada announced a Notice of Intent to introduce a 5% average of renewable ethanol by 2010 and 2% biodiesel into Canadian ground transportation fuels by 2012 respectively. In 2008, it further announced its regulatory approach and specific program elements to fulfil the intent of this strategy via a Renewable Fuels Strategy (RFS).

The impetus for this RFS strategy, considered an important precursor to the Clean Fuel Strategy, was based on the building of biofuels' potential to revitalize a moribund rural agricultural sector and catalyze new market opportunities for farmers, remove upwards

of 2.7 Mt of GHG per year on a lifecycle basis (EC 2006), and commercialize next generation biofuels technologies.

A “Life Cycle Assessment Tool” called GHGenius was developed by Natural Resources Canada to evaluate life cycle greenhouse gas emissions, energy balances and emissions of existing and potential transportation fuels from the RFS.

A Strategic Environmental Assessment accompanied this initiative in 2008 with the stated commitment that the federal government would “assess environmental and socio-economic impacts that might arise in the upcoming years. In 2010, a Four year funding envelope was announced. It was designed to refine and implement the RFS regulations and attendant obligations; support scientific research and the generation of baseline environmental science evidence; identify attendant environmental consequences from the rolling out of program elements under the Renewable Fuels Strategy, and identify future environmental research needs and priorities for RFS managers of the environmental impacts likely to accrue from development of biofuels regulations, their implementation and operation.

We understand that this analysis was to be completed on a biannual basis commencing in 2010 and that a first draft of this analysis – Environmental Performance of First Generation Biofuels in Canada – A Life Cycle Perspective was completed in late 2012 but never released by Environment Canada.

The RFS reporting requirements, announced in 2010, were expected to provide for an objective analysis on the environmental impacts and unintended consequences of the Canadian government biofuels policy. The results of this analysis are important given existing, prevailing and conflicting scientific opinions that existed globally at the time - about biofuel impacts, potential impacts outside of Environment Canada’s regulatory control, divergent RFS interests, and recognizing that biofuels production was promoted globally in the attempt to address global warming and rural revitalization concerns.

Complementary to the Canadian federal government RFS announcement, the US government announced a comparable Renewable Fuels Strategy in 2008. The US strategy contained well defined obligations imposed upon the US EPA as directed by the U.S. Congress to report every three years on the environmental and resource conservation impacts of the RFS program. Specifically, the EPA Administrator, in consultation with the Secretary of Agriculture and the Secretary of Energy, was required to assess and report to Congress on present and likely future impacts on environmental issues, including air quality, effects on hypoxia, pesticides, sediment, nutrient and pathogen levels in waters, acreage and function of waters, and soil environmental quality; on resource conservation issues, including soil conservation, water availability, and ecosystem health and biodiversity, including impacts on forests, grasslands, and wetlands; and, on the growth and use of cultivated invasive or noxious plants and their impacts on the environment and agriculture.

In fact, the EPA’s 2011 Report to Congress recommended that future assessments would:

" … identify gaps and uncertainties in the knowledge base, inform the design and implementation of monitoring strategies and measures for evaluating impacts, provide comprehensive tools for comparing and evaluating development options, and provide the scientific bases for US regulatory agencies and the biofuel industry to make environmentally conscious decisions."

In the intervening period and since the promulgation of the Renewable Fuels Strategy and implementation of attendant biofuel support program elements in Canada and the United States, a number of areas of environmental concern and contention have evolved. They relate to:

Air emissions - Production and use of biofuels were found to release air pollutants other than GHG that affect people and their surroundings. The quantity of these emissions depended on various factors, including combustion technologies, emission controls, temperature, and the level at which biofuels are blended into petroleum-based fuels. Air pollutants from biofuels were found to include criteria air pollutants (for example, carbon monoxide [CO], sulfur dioxide [SO_2], nitrogen oxides [NO_x], particulate matter [PM], and ozone [O_3]); precursors to the atmospheric formation of PM or O_3 (including ammonia [NH_3] and volatile organic compounds [VOCs]); and other hazardous air pollutants, many of which are themselves VOCs (for example, acetaldehyde, benzene, 1,3-butadiene, and formaldehyde). These pollutants have varied effects, including damage to human health (for example, cancer, cardiovascular disease, respiratory irritation, and birth defects) and the environment (for example, reduced visibility, acidification of water and soils, and damage to crops).

Land use implications - The intensification of agricultural production systems for biofuel feedstocks and the conversion of existing and new croplands have had environmental effects beyond their impacts on greenhouse gas emissions. The nature and extent of these impacts are dependent on factors such as scale of production, type of feedstock, cultivation and land-management practices, location and downstream processing routes. Evidence remains limited on the impacts specifically associated with intensive biofuel production, although most of the problems are similar to those already associated with agricultural production – water depletion and pollution, soil degradation, nutrient depletion and the loss of wild and agricultural biodiversity.

Increased nutrient use and run-off - Commercial fertilizer usage was found to be quite high with nearly all large cropping regions across North America showing extensive commercial fertilizer use. Fertilizer use contributes to improved yield and maintains soil nutrient levels. Matching crop nutrient requirements with fertilizer application has been found to be a challenge to farmers in Canada to prevent over application and to manage costs. Over application has lead to excess nitrogen, phosphorus, or other nutrient deposition, and has already demonstrated increasing risks to waterways under some climate conditions such as algal blooms in Lake Erie and zones of hypoxia in the Gulf of Mexico.

The prevalence of pesticide applications - Nearly all grains destined for any use, biofuels, food, feed, or industrial use, have likely undergone pesticide application during production. Crops that are used in biofuel production are grown with the same

production practice as crops grown for other uses. Pesticides have been linked to various human health impacts as well as ecosystem impacts.

Impacts on water - Water scarcity, including fluctuations in water availability, may be the key limiting factor for biofuel feedstock production in many contexts. About 70 percent of freshwater withdrawn worldwide is used for agricultural purposes. Water resources for agriculture are becoming increasingly scarce in many countries as a result of increased competition with domestic or industrial uses. Moreover, the expected impacts of climate change in terms of reduced rainfall and runoff in some key producer areas across Canada, in particular, the Prairie Provinces, will place further pressure on already scarce resources.

Uncertain ecosystem health and biodiversity implications - Uncertain environmental factors such as nutrient and sediment runoff heavily impact ecosystem health including fish and wildlife. Assessments of nutrient loadings from row crop production into surface waters depend on many different factors including changes due to weather and are therefore widely variable. In addition to resolving uncertainties about those factors, more studies are called for on landscape level associations between corn and soybean production and terrestrial and aquatic biodiversity, as well as biodiversity-related services such as pollination and natural pest control. Global research results now suggest that the foraging behaviour of bumblebees on real flowers can be altered by sub-lethal exposure to field-realistic levels of pesticide (sp neonictinoids). This has implications for the foraging success and persistence of bumblebee colonies, but perhaps more importantly for the interactions between wild plants and flower-visiting insects and ability of bees to deliver the crucial pollination services to plants necessary for ecosystem functioning.

Consideration of societal benefits under RFS - According to the FAO (2013) the social impacts of biofuels certification schemes remain the weakest link in most sustainability initiative thus far. Most certification schemes, scorecards and regulations make mention of social impacts but only seek to mitigate few of the obvious negative impacts (minimum wage, compensation for lost land and resources) or call for adherence to national laws or international conventions. However, evidence of how these measures are actually implemented, or their impacts on the ground, has been very limited, and successful cases are rare. Among the reasons are the complexity of social impacts, and their inherently local context, often encompassing contrasting social norms, practices, capacity, community empowerment and varied levels of political participation. Clearly, the social sustainability dimension requires a qualitative rethink that goes beyond mitigating few negative impacts, but rather integrates participatory processes that ensure wider economic benefits to marginal stakeholders and local communities, and therefore guarantees broader acceptance and long-lasting stewardship of resources.

- *Having said this, where is the environmental baseline data resulting from the prescribed obligations of the federal government under its RFS and CEAA obligations?*

- *What were the societal benefits of the RFS in addition to the targeted "rural revitalization" rationale. How were they derived?*
- *Was the Environmental Performance of First Generation Biofuels in Canada – A Life Cycle Perspective completed in late 2013 ever released by Environment Canada? If not, why not? If so, where can it be obtained? In addition, were subsequent updates completed and what is their status?*
- *What is revealed by the research into environmental consequences from the RFS and associated program elements and how has this data and considerations been used to support the responsible development of the Clean Fuels Strategy? What provisions will be given towards more proactive research in the determination of unintended environmental consequences of the CFS?*

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5) Determination of environmental criteria for assessment of alternative fuel sources

A number of different alternative fuels are under consideration within the CFS and globally - with a range of attendant feedstocks, conversion processes, GHG reduction potentials, large scale technology viability, environmental benefits and projected environmental consequences. These candidate fuels include propane, hydrogen, renewable natural gas, electrical vehicles, and higher blends of ethanol (E15-E85) and biodiesel (B10-B100). Projected environmental benefits appear significant but many of these alternative fuels have yet to be considered, developed and demonstrated yet-at scale and under representative Canadian conditions

Furthermore, some of the more attractive alternative fuels (in terms of GHG potential reduction) are based on the use of waste organic materials. Consider the following.

Conversion of waste organic materials from domestic animal rearing operations and biosolids from waste water treatment facilities across Canada are only now being explored for their inherent energy potential. They offer significant environmental benefits including:

- Substantial reduction of pathogens in manures and food wastes
- Nutrient recovery and recycling
- Reduction of methane emissions-a more potent GHG than CO2
- Reduction of odors during storage and decomposition
- Providing a natural waste treatment process
- Potential for phosphorous recovery
- Smaller physical footprint for organics waste processing versus composting
- Reduced volume of waste for transport and land application
- Efficient organic decomposition.

- *What are / will be the environmental criteria used to identify and differentiate amongst the various non biofuel alternative fuels types currently targeted by the CFS and how will they be prioritized for CFS*

consideration and assessed under representative Canadian conditions? Who will do the assessment? When will the assessments be undertaken? What assessment mechanisms will be utilized

- *As these and other non biofuel alternatives are / will be / have been targeted as priorities under the proposed CFS, what baseline empirical data currently exists within the federal government in such areas as viability, costs, environmental performance, and infrastructure requirements (at scale under representative Canadian conditions) and how will it be used for the generation and conversion of the starter materials necessary for the targeted alternative fuels under consideration?*

- *Further, what baseline empirical data currently exists within the federal government for the use of propane, hydrogen, renewable natural gas, and electrical vehicles in such areas as viability, costs environmental performance, and infrastructure requirements (again at scale under representative Canadian conditions) regarding their transportation, storage, distribution and use of the targeted alternative fuels, both individually and in combination (e.g. hybrid vehicles)?*

- *How will the priorities used to determine the mix of alternative fuels be determined and by whom?*

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6) Infrastructure Requirements for Alternative Fuels in Canada

Increased alternative fuel use in Canada due to CFS new mandates will have implications for fuel blending, transport, storage and distribution and dispensing infrastructure, that are likely to lead to calls for new subsidies in addition to those announced in the 2016 Budget.

Take the example of ethanol. Ethanol is both a solvent and hydroscopic, and therefore requires specialized transportation infrastructure requirements. Should threshold levels for ethanol production and use in Canada increase beyond their current 5% level, governments are likely to be called upon to develop and fund the infrastructure necessary to ensure that biofuels, (and possibly co-products), and also renewable natural gas vehicles, and electric vehicles can get out to their intended customers. The costs are likely to be significant.

Renewable fuels and petroleum refining industries must integrate operations. Refiners must retool to produce special petroleum stocks for downstream blending with renewable fuels. Rail and truck shipments will increase as ethanol blends cannot be run through normal steel pipelines (and there are significant distances between where biofuel is being produced and the Canadian market where the products and co-products are likely to be utilized). Distribution systems and storage tanks must be cleaned and dewatered (due to the hydroscopic nature of ethanol), including thousands of service stations. Some tanks at retail outlets may require replacing, as plastic tanks manufactured pre-1980 are not compatible with ethanol-blended fuels. In addition, most energy infrastructure (sp electrical corridors and pipelines) in Canada runs north to south, with little infrastructure extending eastward from Quebec (see McColl, 2009).

Thus provinces in the Atlantic Region who were originally disadvantaged in trying to fulfill federally mandated biofuels threshold levels under the 2010 RFS could be equally disadvantaged even further by increased biofuel mandates, let alone storage, transportation and distribution obligations for new sources of transportation fuels. They currently have little ability to produce the sufficient feedstocks to meet biofuel threshold levels and, in the case of Newfoundland and Labrador, still no access to rail infrastructure to bring in biofuels. Imports may thus be required. (IISD 2009)

- *What changes to existing and proposed infrastructure requirements are being proposed by the federal government so as to ensure a representative and equitable distribution of the proposed alternative fuels in support of the CFS. How much will it cost?*

- *What will be the role(s) of the federal government, provincial government, municipal government, industry, civil society and the public in terms of determination and sharing of infrastructure costs, routing selection, and timing?*

- *How will the provinces be engaged in expansion of alternative fuel production capacities and at higher levels? How will the "disadvantaged" provinces in the area of alternative energy (absence of feedstock, technology, infrastructure) be engaged and under what mechanism?*

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7) Metrology and the use of GHGenius life cycle assessment methodology for the CFS

The federal government rationale for supporting biofuels under the RFS and apparently for alternative fuels under the proposed CFS is predicated on there being significant environmental benefits in the form of GHG reductions throughout the use of life cycle assessment. Further, they assert that these reductions and environmental benefits can be derived and measured via the application of the GHGenius LCA tool.

GHGenius is a widely accepted carbon intensity reporting tool, developed through funding and research by Natural Resources Canada and used by a number of governments (BC Government in the management of the Low Carbon Fuel Standards Program. GHGenius takes into account the carbon life cycle of a fuel from point of origin through production, transportation, and end use. This means that a renewable fuel which hypothetically begins as a feedstock in South East Asia, will result in a high CI by the time it reaches BC, due to miles of transport on a vessel fuelled by marine diesel.

GHGenius measures the carbon intensity of liquid fuels using key measures of grams of carbon dioxide equivalent per megajoule (MJ) (gCO2e/MJ). The standards could be set at the facility level, at a sector-wide average, or set on some other basis. Carbon

intensity is the measure of how much carbon is emitted into the atmosphere relative to the amount of energy in the fuel consumed.

The problem with the use of GHGenius as an LCA tool is its single focus on GHG emissions and reduction (sp. carbon intensity) solely. It does not routinely consider a more representative range of environmental parameters (nor was it designed to) - representative of the broad range and likely impacts from the biofuels life cycle in Canada. For example, the USEPA currently employs four different LCA analytical tools in combination, to determine the range of environmental implications from large scale biofuels production (GREET, FASOM, FAPRI, and MODIS). In addition, some provinces use different approaches to determination of GHG LCA's with the BC government seen to be favouring Sima Pro.

Finally, there was no evidence of any efforts required by a proponent to demonstrate a "positive" GHG impact to qualify for particular subsidy programs under the RFS. These gaps not only undermine core justifications for the previous RFS but for any new biofuels subsidization or other alternative fuels in Canada as proposed under the CFS.

In addition, and as evidenced by 2008 audit by the Commissioner on the Environment and Sustainable Development, this absence of GHG data appears consistent with low priorities given to the conduct of robust environmental impact assessment. The EC audit found that, in regards to federal government environment programs, it appears that the government did not have the architecture or framework in place to conduct a systematic assessment of the sustainability of all federal government activities.

New consideration is now being given to an assessment tool called ecoLCA developed by the University of Ohio for the US National Academy of Sciences and the USEPA. Typically most LCAs tend to focus on emissions and their impact, and they will account for some natural resources, maybe some fossil fuels, maybe some minerals. But the ecoLCA tool also tries to account for and accommodate a range of other services that ecosystems offer.

Those services are divided into four areas: Supporting services (soil, pollination, sunlight, hydro potential, geothermal, wind), regulating services (flood protection, disease regulation, carbon sequestration), provisioning services (fuels, ores, water, timber, cropland), and cultural services (spiritual and recreational benefits).

EcoLCA is not aimed at any specific type of user. Rather, it's for people who are interested in understanding the broader environmental implications of products with possible users as varied as industrial practitioners, consumers, researchers and policymakers.

- *Given that the RFS in 2006 was marketed on its ability to use the GHGenius LCA as a tool so as to ensure that the targeted reduction threshold levels of 2.7 million tonnes of GHG per year were measured, met (and ideally reduced) on a life-cycle basis, what GHG gases were measured?*

- *Were these targeted / anticipated reduction figures ever measured? Met? If so by whom? At what costs? If not, then why not (given the estimated costs of the RFS at ~$2.5 billion Canadian)?*

- *Were the measurements ever validated / confirmed by a 3rd party entity (Important given that NRCan was both the promoter of the RFS and responsible for its governance vis-a-vis housing the GHGenius office).*

- *How can NRCan justify the use of a single LCA approach when US counterparts routinely use four different LCA methodologies?*

- *Was the data ever shared with the public?*

- *Were the results ever used to optimize the GHG reduction throughout the five year mandate of the RFS. How were the results used?*

- *What reductions of GHG occurred in complementary provincial government RFSs.*

- *How will / has the data been used to inform the CFS? Will GHGenius be used to verify carbon intensity and reduction targets under the CFS? Should additional LCA methodologies like ecoLCA be utilized to augment / replace GHGenius?*

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8) Need for Potential Verifiers and Verification Bodies in Support of the CFS

In the development of the Renewable Fuels Strategy, Environment Canada, Natural Resources Canada, and Agriculture and Agri-Food Canada executed a number of pivotal and simultaneous roles in the areas of regulatory development, regulatory enforcement, national program management, technology demonstration, environmental impact assessment and biofuels promotion. These multiple promotional / regulatory / governance roles are likely to continue under the CFS – compounded by the addition of Transportation Canada to the mix and the introduction of a suite of new, complex, and unproven technologies in the transportation sector. Governance and impartiality are critical to the successful development and implementation of the CFS. Correspondingly there should be a pressing need to consider a 3rd party verification of various program aspects anticipated under the CFS including, but not limited to:

- fuel pathway carbon intensities,
- reported fuel quantities (for both high and low carbon fuels), and
- chain-of-custody information (for some feedstocks and finished products).
- adherence to environmental assessment obligations.

- *Key questions to address re: authority / due diligence over the delivery of the CFS program need to include: verification requirements, provisions to allow for continual improvement in the detection, prevention, and correction of errors, identification and implementation of cost reducing strategies while*

maintaining verification rigor, policy consistency with other Clean Fuel Standard verification programs, and, consideration of the unique attributes of fuel carbon intensities and fuels marketing structure.

- *Additional questions include: which model or program elements best respond to the geographic breadth and range of pathway complexity of the CFS program in Canada; stakeholder feedback on whether certification bodies that audit GHG lifecycle emissions and mass balance conformance should be accredited consistent with ISO 14065: 2007 (Greenhouse gases – Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition), ISO 17065: 2012 (Conformity assessment -- Requirements for bodies certifying products, processes and services), or some other standard?*

- *What prior experience with GHG lifecycle emissions calculations, the mass balance conformance approach, and/or particular fuel-specific production operations and common supply chains should verification entities specify for individual auditors? If accredited should verification/certification bodies select audit team members based on competency requirements consistent with ISO 14066: 2011—Competence requirements for greenhouse gas validation teams and verification teams?*

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9) Need for Measurement Criteria for Continuous Improvement of the CFS

Evaluating and measuring the goals and recommended actions of the CFS as they are developed, implemented and completed will demonstrate the value of the policies / programs by providing precise and consistent appraisals of their performance. As an exercise, evaluation, measurement and verification (EM&V) serves three distinct purposes: confirm energy savings and verify cost-effectiveness and reduction in carbon intensity, facilitate energy efficiency into integrated resource planning, and inform energy efficiency investments going forward.

- **Evaluation**: The performance of studies and activities aimed at determining the effects of a program; any of a wide range of assessment activities associated with understanding or documenting program performance, assessing program or program-related markets and market operations; any of a wide range of evaluation efforts including assessing program-induced changes in energy efficiency markets, levels of demand or energy savings, and program cost-effectiveness.

- **Measurement and Verification (M&V):** Data collection, monitoring, and analysis associated with the calculation of gross energy and demand savings from the use and operation of individual / alternative energy technologies.

The need for standardized and ubiquitous EM&V practices has increased as has gas funding for energy efficiency and alternate forms of energy globally. Further, it has grown over the years so that efficiency program administrators, policymakers, and the public can have a better understanding of the energy savings resulting from energy

efficiency investments. From 2005 to 2011, energy efficiency budgets for ratepayer-funded programs increased from $1.6 billion to $6.8 billion in the US. Currently, EM&V for ratepayer-funded programs range from 0.5% to 5% of the total program costs with a mean of 2.8%. In addition, as government across North America search for ways to meet existing and new federal air regulations, EM&V can provide a means of making energy efficiency a credible means of meeting air quality goals (aiding in the translation of energy savings into greenhouse gas or pollution reduction). Streamlined, standardized, and transparent EM&V enhances the credibility of these investments and potentially enables federal-provincial jurisdictional comparisons of efficiency programs, integration of energy efficiency into portfolio planning and forecasting processes, and informed infrastructure investments.

There are several challenges to implementing EM&V frameworks however. EM&V is often viewed as an expensive, time-consuming, unreliable, and opaque process. The appropriate level of effort for an EM&V initiative will vary depending upon the program's complexity and whether it is a commonly offered program. In the US, the National Action Plan for Energy Efficiency's Model Energy Efficiency Impact Evaluation Guide has detailed the process for implementing an EM&V framework:

1) Defining evaluation goals and scale, including which program benefits to evaluate.
2) Setting a time frame for evaluation and reporting expectations.
3) Setting a spatial boundary for evaluation.
4) Defining a program baseline, baseline adjustments, and data collection requirements.
5) Establishing a budget in the context of expectations for the quality of reported results.
6) Selecting impact evaluation approaches for gross and net savings calculations, and avoided emissions calculations.
7) Selecting who (or which type of organization) will conduct the evaluation.

- *Is there a commitment to continuous improvement of the CFS and what is planned as measurement criteria?*

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10) Will there be other federal and provincial government regulatory and policy mechanisms announced to reduce GHG reduction and carbon intensity?

In the push to subsidize biofuels at ever greater levels, policy makers appear to have forgotten that there are other ways to reduce GHG emissions or the amount of imported oil per vehicle-mile travelled. Alternative fuels beyond ethanol and biodiesel, alternative drive trains such as plug-in hybrids, better fleet maintenance, and even more efficient

gasoline and diesel engines offer great promise. Yet Canadian biofuel policies continue to earmark benefits and mandates for specific technologies over a specific time frame.

This replaces market choices with political ones, and makes it more difficult for other oil substitutes to enter the marketplace. Policy tools such as R&D tax credits and carbon taxes would promote the desired policy goals without putting the Environment Canada (sic federal government) into the position—picking winners.

- *What other regulatory, policy, economic, or technology options are being considered by Environment Canada to reduce GHG emissions and carbon intensity by the Canadian transportation sector. How are they being developed and by whom?*

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11) Who will co-ordinate Environment Canada's Clean Fuels Strategy with the Provinces and Municipalities?

Using the example of Canada's current Renewable Fuels Strategy, current biofuel support policies are poorly coordinated. In fact, Canada does not have a national biofuel strategy, but rather a federal strategy and six provincial ones in British Columbia, Alberta, Manitoba, Saskatchewan Ontario, and Quebec. Further, individual vehicle electrification strategies and biogas strategies are evolving in BC, Ontario, and Quebec. Many programs are overlapping, with little apparent coordination between governments. It is also unclear how new policy measures, such as Ontario's, BC's and Alberta's low carbon fuel standard or provincial carbon taxes, will interact with biofuel policies. In recent years, both the provincial and federal governments in Canada had introduced a growing list of new subsidies to biofuels, with rising financial support.

The Canadian federal government strategy for supporting renewable fuels has four components:

- increasing the retail availability of renewable fuels through regulation;
- supporting the expansion of Canadian production of renewable fuels;
- assisting farmers to seize new opportunities in the sector;
- and accelerating the commercialization of new technologies.

Several provincial governments have introduced similar support packages. Subsidies are delivered through a range of mechanisms including direct payments, tax exemptions, interest-free loans, grants and—increasingly—consumption mandates.

As part of the Federal government budget announced late last year, the Government committed to provide leadership as Canada works towards reducing greenhouse gas emissions and improve air quality. There is recognition that a collaborative approach between provincial, territorial and federal governments is important to reduce greenhouse gas emissions and enable sustainable economic growth. Canada is moving towards a Pan-Canadian Framework on Clean Growth and Climate Change that will

meet or exceed Canada's international greenhouse gas emissions targets. Pricing carbon will be a key element to transition Canada to a stronger, more resilient low-carbon economy while also improving our quality of life.

At the First Ministers' Meeting on March 3, 2016, the Government, along with provincial and territorial partners, agreed to work together to create the Vancouver Declaration on Clean Growth and Climate Change. The Declaration is the first step in developing a concrete plan to achieve Canada's international commitments to reduce greenhouse gas emissions and build on the momentum of the United Nations Paris Agreement.

Budget 2016 also pledged to provide almost $2.9 billion over five years, starting in 2016–17, to address climate change and air pollution issues. This funding will:

- Support the development of the Pan-Canadian Framework, including a Low Carbon Economy Fund;
- Help ensure that Canada meets its international obligations;
- Take action to reduce emissions from Canada's largest sources—transportation and energy;
- Advance science and programming activities to better understand and adapt to the changing climate; and
- Enable evidence-based decisions to address air pollution.

On January 11, 2017, the Government of Ontario released a discussion paper titled “Developing a Modern Renewable Fuel Standard For Gasoline in Ontario,” which provides context for the new RFS requirements. The discussion paper explains that Ontario aims to keep the following considerations in mind when designing the RFS policy:

- Ensure a level playing field for fuels, regardless of technology or origin;
- Set ambitious but achievable goals;
- Support near and long-term GHG emissions;
- Improve diversity among low-carbon fuel options for consumers;
- Provide a clear performance standard and necessary certainty to support investments;
- Consider the overall impact on fuel suppliers and consumers;
- Offer flexible methods for compliance supported by transparent platforms;
- Complement other related policies; and
- Collaborate with the federal government to coordinate renewable fuels programs.

Ontario is seeking comments on the design options outlined in the discussion paper, including targets and blending requirements, flexibility mechanisms, assessing lifecycle emissions, and transparency.

- *How will the complementary program elements of Environment and Climate Change Canada and NRCan (under the Clean Energy Program) be managed and co-ordinated.*

- *How will the provinces be engaged in expansion of alternative fuel production capacities?*

- *How will the "disadvantaged" provinces in the area of alternative energy (current absence of feedstock, technology, infrastructure etc.) be engaged and under what mechanisms?*

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12) How will ECCC integrate the CFS alternate energy focus as "One Plank" into the Canadian Energy Strategy?

At the July 2012 Council of the Federation meeting, Premiers agreed on the need for the development of a Canadian Energy Strategy, which was being co-lead by Alberta, Manitoba, and Newfoundland and Labrador. It was recognized that work to proceed must recognizing regional strengths and priorities, respect provincial jurisdiction over natural resources, as well as address a more integrated approach to climate change, including reducing greenhouse gas emissions and managing the transition to a lower carbon economy.

A Progress Report on the Canadian Energy Strategy was presented by the co-chair premiers of Alberta, Manitoba, and Newfoundland and Labrador on July 25, 2013 at the Council of the Federation (COF) Annual Summer Meeting in Niagara-on-the-Lake, Ontario.

Cross-provincial and territorial teams worked on the strategy's 10 areas of focus, which have been collected together into three larger working groups:

Sustainability and Conservation (led by Manitoba);

- Promoting Energy Efficiency and Conservation
- Transition to a Lower Carbon Economy
- Enhance Energy Information and Awareness

Technology and Innovation (led by Newfoundland and Labrador); and

- Accelerate the development and deployment of energy research and technologies that advance more efficient production, transmission and use of clean and conventional energy sources
- Develop and implement strategies to meet energy sector workforce needs now and in the future
- Facilitate the development of renewable, green and/or cleaner energy sources to meet future demand and contribute to environmental goals and priorities

Delivering Energy to People (led by Alberta).

- Develop and enhance a modern, reliable, environmentally safe, and efficient series of transmission and transportation networks for domestic and export/import sources of energy

- Improve the timeliness and certainty of regulatory approval decision-making processes while maintaining rigorous protection of the environment and public interest
- Promote Market Diversification
- Pursue formalized participation of provinces and territories in international discussions and negotiations on energy.

- *What steps are being taken by Environment Canada to ensure consistency and collaboration with other federal government departments and provincial departments efforts in the establishment of a National Energy Strategy?*

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13) Will ECCC, Transport Canada and others acquire and evaluate best practices for energy efficiency as an integral part of the CFS?

The CFS will influence fuels that have to power existing and future vehicles all of which are subject to rules and regulations of other jurisdictions beyond Canada. What can Canada do to ensure best practices for energy efficiency in the transportation sector?

Recently, the US Government, along with the International Energy Agency, released analytical tools and best practices for optimizing energy efficiency in the transportation sector.

The US Model - An Energy Efficiency Primer for Governors - describes successful actions governors have taken to further cost-effective energy efficiency.
Examples of recent actions include:

- Conducting energy planning to analyze potential energy savings and explore best practices;
- Improving energy efficiency rules and standards for buildings and appliances;
- Incentivizing spending by utilities to provide increased energy efficiency to homes, businesses and industries;
- Supporting innovative financing and repayment mechanisms to encourage private sector investment;
- Creating new efforts that use information technology to spur enhanced energy savings by consumers and businesses; and
- Supporting research and development through partnerships with universities and the private sector to encourage the next generation of energy efficiency initiatives. Don't forget to celebrate your success. Take pride in your energy efficiency achievements - boast about them to make sure that your building occupants and customers know what you've accomplished.

Not to be outdone, the IEA released a document designed to help improve energy efficiency in a number of industrial sectors. According to the IEA, the transport sector remains one of the most challenging areas for improving energy efficiency and they estimate that the potential energy savings achievable through improved efficiency in the transport sector, as of 2009, are in the range of 30 EJ per year by 2030, or the equivalent of the current annual oil consumption of the European Union.

The IEA recommends several measures to tap energy savings in this sector. Notably, governments should:

- Implement and periodically strengthen mandatory fuel-efficiency standards for light- and heavy-duty vehicles.

- Put in place policies to improve the performance of tires, air conditioning, lighting and other non-engine components that affect a vehicle's fuel efficiency.

- Adopt measures such as labelling, incentives and taxes to encourage the sale of more efficient vehicles.

- Promote eco-driving by making it a required element of driver's education programmes and requiring feedback instruments in new vehicles.

- Enable policies that increase the overall energy efficiency of national, regional and local transport systems, and promote shifts of passengers and freight to more efficient modes.

To achieve significant energy savings in this sector, the IEA further recommends:

Mandatory vehicle fuel efficiency standards

- Governments should adopt and regularly update fuel-efficiency standards for road vehicles.

Fuel-efficiency standards should:

- Introduce and regularly strengthen mandatory fuel-efficiency standards for light-duty vehicles.
- Establish testing procedures for measuring fuel efficiency of heavy
- duty vehicles and adopt fuel-efficiency standards for those vehicles
- Harmonise or increase the comparability of vehicle fuel-efficiency test methods.

Measures to improve vehicle fuel efficiency

- In addition to mandatory vehicle fuel-efficiency standards, governments should adopt measures such as labelling, incentives and taxes to boost vehicle efficiency and accelerate the market penetration of new efficient vehicle technologies.
- Vehicle fuel economy labels.
- Vehicle taxes to encourage the purchase of more fuel-efficient vehicles.

- Infrastructure support and incentive schemes for very low CO2emitting and fuel-efficient vehicles.

Fuel-efficient non-engine components

- Governments should adopt measures to reduce the negative impact on fuel efficiency of vehicle components, such as tires and air-conditioning systems, that are often excluded from vehicle fuel-efficiency testing and requirements.

- To improve the performance of non-engine components, governments should:
- Adopt new international test procedures for measuring the rolling resistance of tires, and establish labelling and maximum rolling resistance limits for road-vehicle tyres.
- Adopt measures to promote proper tire inflation levels. This should include mandatory fitting of tire-pressure monitoring systems on new road vehicles.
- Introduce energy efficiency requirements for air-conditioning systems or include the energy efficiency of such systems in fuel-economy testing.

Improving vehicle operational efficiency through eco-driving and other measures. Governments should ensure that measures to increase the operational efficiency of light- and heavy-duty vehicles, such as eco-driving, are a central component of initiatives to improve energy efficiency and reduce CO2 emissions.

Governments should adopt a range of measures to improve vehicle operational efficiency, including:

- Making eco-driving a required element of driver training.
- Requiring manufacturers to provide in-car feedback instruments in new cars.

Transport system efficiency

Governments should enable policies that increase the overall energy efficiency of national, regional and local transport systems and promote shifts of passengers and freight to more efficient modes.

To achieve these objectives, government should adopt transport policies that ensure:

- Users pay the economic, environmental and energy security-related costs of the transport system.
- The transport infrastructure is built and maintained to support the most energy efficient, economically efficient and environmentally benign transport modes.
- Urban and commercial development planning takes into account the likely implications for transport and energy demand.

- *Against this backdrop, what steps is Environment and Climate Change Canada pursuing to ensure optimal energy efficiency as one target under the Clean Fuels Standard. With whom will they collaborate? How will these energy efficiency goals be captured in the CFS? How will they be determined? Measured? Verified? And by whom?*

APPENDIX I – REFERENCES

Acemoglu, D., Akcigit, U., Hanley, D., & Kerr, W. (2016). Transition to clean technology. Journal of Political Economy, 124(1).

Adusumilli, N., Lacewell, R., Taylor, R., & Rister, E. (2016). Economic assessment of producing corn and cellulosic ethanol mandate on agricultural producers and consumers in the United States. Economics Research International, 2016.

Agriculture & Agri-food Canada (AAFC). (2011). Evaluation of ecoAgriculture biofuels capital initiative: Final report. Government of Canada. Retrieved from http://publications.gc.ca/collections/collection_2011/agr/A22-536-2011-eng.pdf

Auld, D. (2008). The ethanol trap. Toronto, Ontario, Canada: C.D. Howe Institute. Retrieved from https://www.cdhowe.org/public-policyresearch/ethanol-trap-why-policies-promote-ethanol-fuel-need-rethinking

Auld, D., & McKitrick, R. (2014). Money to burn: Assessing the costs and benefits of Canada's strategy for vehicle biofuels. Ottawa, Ontario, Canada: MacDonald-Laurier Institute. Retrieved from http://www.macdonaldlaurier.ca/files/pdf/MLIbiofuelspaper0626.pdf

Barrios, S., Pycroft, J., & Saveyn, B. (2013). The marginal cost of public funds in the EU: The case of labour versus green taxes. Taxation Papers, Working Paper N. 35, European Commission.

Bedsworth, L. W., & Taylor, M. (2007). Learning from California's zero-emission vehicle program. Public Policy Institute of California. California Economic Policy, 3(4). Retrieved from http://www.ppic.org/content/pubs/cep/EP_907LBEP.pdf

Bielen, D., Newell R., & Pizer, W. (2016). Working Papers: Who did the ethanol tax credit benefit? An event analysis of subsidy incidence. Working Paper No. 21968. National Bureau of Economic Research.

Böhringer, C., Rivers, N., Rutherford, T., & Wigle, R. (2015). Sharing the burden for climate change mitigation in the Canadian federation. Canadian Journal of Economics, 48(4), 1350-1380.

Brunner, S., Flachsland, C., & Marschinski, R. (2012). Credible commitment in carbon policy. Climate Policy, 12(2), 255-271.

California Air Resources Board (CARB). (2016a). Low carbon fuel standard credit trading activity reports. California Environmental Protection Agency. Retrieved from https://www.arb.ca.gov/fuels/lcfs/credit/lrtcreditreports.htm

California Air Resources Board (CARB). (2016b). Low carbon fuel standard program background. California Environmental Protection Agency. Retrieved from http://www.arb.ca.gov/fuels/lcfs/lcfs-background.htm

Campbell, H., Anderson, J., & Luckert, M. (2016). Public policies and Canadian ethanol production: History and future prospects for an emerging industry. Biofuels, 7(2), 1-20.

Canadian Renewable Fuel Association. (2015). Impact of the decline in the global price of oil on the Canadian economy. Presentation to the House of Commons Standing Committee on Finance. Retrieved from http://www.parl.gc.ca/Content/HOC/Committee/412/FINA/WebDoc/ WD7864616/412_FINA_lLOPCE_Briefs/CanadianRenewableFuelsAssociation-9083618-e.pdf

Cassidy, E. (2015). Better biofuels ahead: The road to low-carbon fuels. Environmental Working Group. Retrieved from http://static.ewg.org/ reports/2015/better-biofuels-ahead/BetterBiofuelsAhead.pdf?_ga=1.151914685.544859938.1466688099

Chacra, M. (2002). Oil-price shocks and retail energy prices in Canada. Working Paper 2002-38. Bank of Canada. Retrieved from http://www. banqueducanada.ca/wp-content/uploads/2010/02/wp02-38.pdf

Chen, X., Huang, H., Khanna, M., & Onal, H. (2014). Alternative transportation fuel standards: Welfare effects and climate benefits. Journal of Environmental Economics and Management, 67(3), 241-257.

City of Edmonton. (2014). Edmonton waste-to-biofuels initiative. Fact sheet. Retrieved from http://www.edmonton.ca/programs_services/ documents/PDF/Fact_Sheet_June_2014.pdf#search=enerkem

Clancy, M., & Moschini, G. C. (2015). Mandates and the incentives for environmental innovation. CARD Working Papers, Paper 556. Retrieved from http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1575&context=card_workingpapers

Climate Leadership Team. (2015). Recommendations to government. Retrieved from https://engage.gov.bc.ca/climateleadership/files/2015/11/ CLT-recommendations-to-government_Final.pdf

Competition Bureau of Canada. (2005). Gasoline empirical analysis: Update of four elements of the January 2001 Conference Board study: “The final fifteen feet of hose”. Retrieved from http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/Empirical_analysis_Eng.pdf/$file/ Empirical_analysis_Eng.pdf

Crawley, M. (2016, May 5). Should taxpayers keep subsidizing the ethanol industry? CBC News. Retrieved from http://www.cbc.ca/news/ canada/toronto/taxpayers-ontario-canada-ethanol-subsidies-1.3566564

Croezen, H. J., Bergsma, G. C., Otten, M. B. J., & van Valkengoed, M. P. J. (2010). Biofuels: Indirect land use change and climate impact. Delft, Netherlands: CE Delft.

Cruetzig, F., Popp, A., Plevin, R., Luderer, G., Minx, J., & Edenhofer, O. (2012). Reconciling top-down and bottom-up modelling on future bioenergy deployment. Nature Climate Change, 2, 320-327.

Dahlby, B. (2008). The marginal cost of public funds: Theory and applications. Cambridge, MA: MIT Press. Retrieved from http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=11511

DeCicco, J. (2013). Biofuel's carbon balance: Doubts, certainties, and implications. Climate Change, 121, 801-814.

De Gorter, H., Drabik, D., & Just, D. (2014). The economics of biofuel policies: Impacts on price volatility in grain and oilseed markets. New York, NY: Palgrave Macmillan.

De La Torre Ugarte, D., & English, B. (2015). 10-year review of the renewable fuels standard: Impacts to the environment, the economy, and advanced biofuels development. Knoxville, TN: Institute of Agriculture, University of Tennessee.

Delucchi, M. A. (2006). Lifecycle analyses of biofuels. Institute of Transportation Studies, University of California, Davis. Available at http://escholarship.org/uc/item/1pq0f84z

Egenhofer, C., Marcu, A., Rizos, V., Behrens, A., Nunez-Ferrer, J., Hassel, A., & Elkerbout, M. (2016). Towards an effective EU framework for road transport and GHG emissions. Centre for European Policy Studies. Energy Climate House, 141. Retrieved from https://www.ceps.eu/ publications/towards-effective-eu-framework-road-transport-and-ghg-emissions

Environment Canada. (2010). Regulatory impact analysis statement: Renewable fuels regulations. Canada Gazette, 144(15). Retrieved from http://publications.gc.ca/gazette/archives/p1/2010/2010-04-10/pdf/g1-14415.pdf

Environment Canada. (2011). Regulatory impact analysis statement: Regulations amending the renewable fuels regulations. Canada Gazette, 145(15). Retrieved from http://canadagazette.gc.ca/rp-pr/p2/2011/2011-07-20/html/sor-dors143-eng.html

Environment and Climate Change Canada (ECCC). (2016a). Renewable fuels regulations performance report: December 2010 – December 2012. Government of Canada. Retrieved from https://www.ec.gc.ca/energie-energy/default.asp?lang=En&n=3B70EEBF-1&offset=3&toc=show

Environment and Climate Change Canada (ECCC). (2016b). National inventory report: Greenhouse gas sources and sinks in Canada, 1990–2014. The Canadian Government's submission to the UN Framework Convention on Climate Change. Government of Canada.

Environment and Climate Change Canada (ECCC). (2016c). Technical update to Environment and Climate Change Canada's social cost of greenhouse gas estimates. Government of Canada. Retrieved from http://www.ec.gc.ca/cc/default.asp?lang=En&n=BE705779-1

Environment and Climate Change Canada (ECCC). (2016d). Pollution sources: Transportation. Government of Canada. Retrieved from https://www.ec.gc.ca/Air/default.asp?lang=En&n=800CCAF9-1

European Commission. (2012). ILUC impact assessment. Commission Staff Working Document. Retrieved from https://ec.europa.eu/energy/ sites/ener/files/swd_2012_0343_ia_en.pdf

European Environment Agency Scientific Committee. (2011). Opinion of the EEA Scientific Committee on GHG accounting in relation to bioenergy. Retrieved from http://www.eea.europa.eu

FAO, IFAD, IMF, OECD, UNCTAD, WFP … UN HLTF. (2011). Price volatility in food and agricultural markets: Policy responses. Retrieved from http://www.oecd.org/agriculture/pricevolatilityinfoodandagriculturalmarketspolicyresponses.htm

Fargione, J., Hill, J., Tilman, D., Polasky, S., & Hawthorne, P. (2008). Land clearing and the biofuel carbon debt. Science, 319(5867), 1235-1238.

Ferede, E., & Dahlby, B. (2016). The costliest tax of all: Raising revenue through corporate tax hikes can be counter-productive for the provinces. SPP Research Paper, 9(11). University of Calgary School of Public Policy. Retrieved from http://www.policyschool.ucalgary.ca/sites/default/ files/research/estimating-tax-base-ferede-dahlby.pdf

Finkbeiner, M. (2014). Indirect land use change—help beyond the hype? Biomass and Bioenergy, 62, 218-221.

Fischer, C. (2009). The role of technology policies in climate mitigation. Resources for the Future. Retrieved from http://www.rff.org/files/ sharepoint/WorkImages/Download/RFF-IB-09-08.pdf

Fischer, C., & Newell, R. (2008). Environmental and technology policies for climate mitigation. Journal of Environmental Economic Management, 55, 142-62.

Flachsland, C., Brunner, S., Edenhofer, O., & Creutzig, F. (2011). Climate policies for road transport revisited (II): Closing the policy gap with cap-and-trade. Energy Policy, 39(4), 2100-2110.

Fridfinnson, B., & Rude, J. (2009). The effects of biofuels policies on global commodity trade flows. Canadian Agricultural Trade Policy Research Network. Retrieved from http://www.uoguelph.ca/catprn/PDF-WP/Working_Paper_2009-1_Fridfinnson.pdf

Gerlagh, R., & van der Zwaan, B. (2006). Options and instruments for a deep cut in CO2 emissions: Carbon dioxide capture or renewables, taxes or subsidies? Energy, 27(3), 25-48.

Government of British Columbia. (2008). BC bioenergy strategy. Ministry of Energy, Mines and Petroleum Resources. Retrieved from

http://www.energybc.ca/cache/usage/usage3/www.energyplan.gov.bc.ca/bioenergy/PDF/BioEnergy_Plan_005_0130_web0000.pdf

Government of British Columbia. (2014). Budget and fiscal plan 2014/15–2016/17. Ministry of Finance. Retrieved from http://bcbudget.gov.bc.ca/2014/bfp/2014_budget_and_fiscal_plan.pdf

Government of Ontario. (2005). McGuinty government takes next steps on cleaner air. Ministry of Agriculture, Food and Rural Affairs. Retrieved from https://news.ontario.ca/archive/en/2005/10/07/McGuinty-Government-Takes-Next-Step-On-Cleaner-Air.html

Government of Ontario. (2006). New gasoline regulations fight climate change, improve air quality. Ministry of Environment and Climate Change. Retrieved from https://news.ontario.ca/archive/en/2006/12/21/New-gasoline-regulations-fight-climate-change-improve-airquality.html

Government of Ontario. (2016a). Greener diesel regulations. Ministry of Environment and Climate Change. Retrieved from https://www.ontario. ca/page/greener-diesel-regulation

Government of Ontario. (2016b). Ontario's Five Year Climate Change Action Plan. Ministry of the Environment and Climate Change. Retrieved from http://www.applications.ene.gov.on.ca/ccap/products/CCAP_ENGLISH.pdf

Government of Quebec. (2016). Zero-Emission Vehicles Bill: Summary of measures in the bill tabled in the National Assembly. Retrieved from http://www.mddelcc.gouv.qc.ca/changementsclimatiques/vze/feuillet-vze-enbref-en.pdf

Grier, K., Mussell, A., & Rajcan, I. (2012). Impact of Canadian ethanol policy on Canada's livestock and meat industry. George Morris Centre. Retrieved from http://www.georgemorris.org/publications/Impact_of_Ethanol_Policies_January_2012.pdf

Health Canada. (2010). Health risks and benefits associated with the use of 10% ethanol-blended gasoline in Canada. Retrieved from http://publications.gc.ca/collections/collection_2013/sc-hc/H128-1-10-597-eng.pdf

Health Canada. (2012). Human health risk assessment for biodiesel production, distribution and use in Canada. Government of Canada. Retrieved from http://publications.gc.ca/collections/collection_2012/sc-hc/H129-14-2012-eng.pdf

Hertel, T., Golub, A., Jones, A., O'Hare, M., Plevin, R., & Kammen, D. (2010). Effects of US maize ethanol on global land use and greenhouse gas emissions: Estimating market-mediating responses. Bioscience, 60(3), 223-231.

Hill, J., Polasky, S., Nelson, E., Tilman, D., Huo, H., Ludwig, L. … Bonta, D. (2009). Climate change and health costs of air emissions from biofuels and gasoline.

Proceedings of the National Academy of Sciences of the United States of America. Retrieved from http://www.ncbi.nlm.nih. gov/pmc/articles/PMC2634804/?tool=pmcentrez

Holland, S., Hughes, J., & Knittel, C. (2009). Greenhouse gas reductions under low carbon fuel standards? American Economic Journal: Economic Policy, 1(1), 106-146.

Holland, S., Hughes, J., Knittel, C., & Parker, N. (2011). Some inconvenient truths about climate change policy: The distributional impacts of transportation policies. Working Paper 17386, National Bureau of Economic Research.

Holland, S., Hughes, J., Knittel, C., & Parker, N. (2015). Unintended consequences of carbon policies: Transportation fuels, land-use, emissions, and innovation. Energy, 36(3).

Hughes, S., Gibbons, W., & Kohl, S. (2010). Advanced biorefineries for the production of fuel ethanol. In A. Vertes, N. Qureshi, H. Blaschek, & H. Yukawa (Eds.), Biomass to biofuels: Strategies for global industries. Hoboken, NJ: Wiley.

Infrastructure Canada. (2016). Growth for the middle class: Investing in infrastructure. Government of Canada. Retrieved from http://www.infrastructure.gc.ca/prog/budget2016-infrastructure-eng.php

International Energy Agency (IEA). (2011). Technology roadmap: Biofuels for transport. Paris, France: IEA Publications. Retrieved from http://www.iea.org/publications/freepublications/publication/biofuels_roadmap_web.pdf

International Energy Agency (IEA). (2013). Production costs of alternative transportation fuels: Influence of crude oil price and technology maturity. Paris, France: IEA Publications. Retrieved from https://www.iea.org/publications/freepublications/publication/FeaturedInsights_AlternativeFuel_FINAL.pdf

International Energy Agency (IEA). (2014). World Energy Outlook 2014. Paris, France: IEA Publications.

International Energy Agency (IEA). (2016). Oil medium-term market report: Market analysis and forecasts to 2021. Paris, France: IEA Publications.

International Energy Agency–Energy Technology Systems Analysis Programme, & International Renewable Energy Agency (IEA–ETASAP & IRENA). (2013). Production of liquid biofuels: Technology brief. Paris, France: IEA Publications.

International Panel of Climate Change (IPCC). (2006). 2006 IPCC guidelines for national greenhouse gas inventories Vol. 1: General guidance and reporting. Prepared by the National Greenhouse Gas Inventories Programme. H. S. Eggleston, L. Buendia, K. Miwa, T. Ngara, & K. Tanabe (Eds). Japan: Institute for Global Environmental Strategies (IGES). Retrieved from http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol1.html

International Panel on Climate Change (IPCC). (2011). Special report on renewable energy sources and climate change mitigation. A Report of Working Group 3 of the IPCC. Retrieved from https://www.ipcc.ch/pdf/special-reports/srren/SRREN_FD_SPM_final.pdf

Irwin, S., & Good, D. (2016). The competitive position of ethanol as an octane enhancer. farmdoc daily (6):22, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign.

Jaccard, M. (2016, February 2). Want an effective climate policy? Heed the evidence. Institute for Research on Public Policy. Policy Options. Retrieved from http://policyoptions.irpp.org/magazines/february-2016/want-an-effective-climatepolicy-heed-the-evidence/

Jaffe, A., Newell, R., & Stavins, R. (2005). A tale of two market failures: Technology and environmental policy. Ecological Economics, 54(2-3), 164-174.

Khanna, M., Wang, W., Hudiburg, T., & Dulucia, E. (2016). The economic cost of including the indirect land use factor in low carbon fuel policy: Efficiency and distributional implications. Prepared for the 2016 Agricultural and Applied Economics Association Annual Meeting. Retrieved from http://ageconsearch.umn.edu/bitstream/235774/2/AAEA2016_Khanna%205%2025.pdf

Knoll, K., West, B., Clark, W., Graves, R., Orban, J., Przesmitzki, S., & Theiss, T. (2009). Effects of intermediate ethanol blends on legacy vehicles and small non-road engines. National Renewable Energy Laboratory.

Kopp, A., Block, A., & Limi, A. (2012). Turning the right corner: Ensuring development through a low-carbon transport sector. The World Bank. Washington, DC: International Bank for Reconstruction and Development/The World Bank.

Laan, T., Litman, T., & Steenblik, R. (2011). Biofuels—At what cost? Government support for ethanol and biodiesel in Canada. International Institute for Sustainable Development: Global Subsidy Initiative.

Lade, G., & Lawell, C. (2015a). The design and economics of low carbon fuel standards. Research in Transportation Economics, 52, 91-99.

Lade, G., & Lawell, C. (2015b). Mandating green: On the design of renewable fuel policies and cost containment mechanisms. University of California, Davis Working Paper. Retrieved from http://www.des.ucdavis.edu/faculty/Lin/mandate_cost_containment_paper.pdf

Larsen, U., Johansen, T., & Schramm, J. (2009). Ethanol as a fuel for road transportation. International Energy Agency—Advanced Motor Fuels. Technical University of Denmark. Retrieved from http://www.iea-amf.org/app/webroot/files/file/Annex%20Reports/AMF_Annex_35-1.pdf

Lemoine, D. (2013). Escape from third-best: Rating emissions for intensity standards. University of Arizona Working Paper 12-03.

Le Roy, D., & Klein, K. (2012). The policy objectives of a biofuel industry in Canada: An assessment. Agriculture, 2, 436-451.

Lutsey, N., & Sperling, D. (2009). Greenhouse gas mitigation supply curve for the US for transport versus other sectors. Transportation Research Part D: Transport and Environment, 14(3), 222-229.

McCormick, R. (2007). The impact of biodiesel on pollutant emissions and public health. Inhalation Toxicology, 19(12), 1033-1039.

McKone, T., Nazaroff, W., Berck, P., Auffhammer, M., Lipman, T., Torn, M. S. … Horvath, A. (2011). Grand challenges for life-cycle assessment of biofuels. Environmental Science & Technology, 45, 1751-1756.

Moorhouse, J., & Wolinetz, M. (2016). Biofuels in Canada: Tracking progress in tackling greenhouse gas emissions from transportation fuels. Clean Energy Canada. Retrieved from http://cleanenergycanada.org/wp-content/uploads/2016/03/FINAL-Report-Biofuel-Policy-ReviewMarch-2016.pdf

Mullins, K., Griffin, M., & Matthews, S. (2011). Policy Implications of uncertainty in modelled greenhouse gas emissions from biofuels. Environmental Science & Technology, 45(1), 132–138.

Murray, B., & Rivers, N. (2015). British Columbia's revenue-neutral carbon tax: A review of the latest "grand experiment" in environmental policy. NI WP 15-04. Durham, NC: Duke University. Retrieved from https://nicholasinstitute.duke.edu/sites/default/files/publications/ni_wp_1504_full.pdf

National Renewable Energy Laboratory. (2008). The Impact of Ethanol Blending on U.S. Gasoline Prices. Golden, Colorado: National Renewable Energy Laboratory. Retrieved from http://www1.eere.energy.gov/vehiclesandfuels/pdfs/ethanol_blending_rpt-nov08.pdf

National Research Council. (2011). Renewable fuel standard: Potential economic and environmental effects of U.S. biofuel policy. Committee on Economic and Environmental Impacts of Increasing Biofuels Production. Washington, DC: The National Academies Press.

Natural Resources Canada (NRCan). (2013). Ethanol: Safety and performance. Energy Sources and Distribution. Retrieved from http://www.nrcan.gc.ca/energy/alternative-fuels/fuel-facts/ethanol/3493

Natural Resources Canada (NRCan). (2014). EcoEnergy program for biofuels. Retrieved from http://www.nrcan.gc.ca/energy/alternative-fuels/ programs/12358

References continued

Natural Resources Canada (NRCan). (2016a). ecoENERGY for Biofuels program: Successful applicants. Government of Canada. Retrieved from http://www.nrcan.gc.ca/energy/alternative-fuels/programs/ecoenergy-biofuels/3599

Natural Resources Canada (NRCan). (2016b). Evaluation of the alternative transportation fuels sub-sub-activity. Government of Canada. Retrieved from http://www.nrcan.gc.ca/evaluation/reports/2012/792

Natural Resources Canada (NRCan). (2016c). Sustainable Development Technology Canada (SDTC) for the NextGen Biofuels Fund. Government of Canada. Retrieved from https://www.nrcan.gc.ca/plans-performance-reports/rpp/2016-17/18145

Organisation for Economic Co-operation and Development (OECD). (2006). Subsidy reform and sustainable development: Economic, environmental, and social aspects. OECD Sustainable Development Studies. Retrieved from https://www.cbd.int/financial/fiscalenviron/ several-subsidiesreform-oecd.pdf

Organisation for Economic Co-operation and Development (OECD). (2008). Biofuels: Linking support to performance. International Transport Forum.

Organisation for Economic Co-operation and Development–Food and Agricultural Organization of the United Nations (OECD–FAO). (2016). OECD–FAO Agricultural Outlook: 1970–2025. Retrieved from http://stats.oecd.org/Index.aspx?datasetcode=HIGH_AGLINK_2016

Plevin, R., O'Hare, M., Jones, A., Torn, M., & Gibbs, H. (2010). Greenhouse gas emissions from biofuels' indirect land use change are uncertain but may be much greater than previously estimated. Environmental Science and Technology, 44(21), 8015-21.

Popp, D. (2016). A blueprint for going green: The best policy mix for promoting low-emission technology. C.D. Howe Institute: E-Brief. Retrieved from https://www.cdhowe.org/sites/default/files/attachments/research_papers/mixed/e-brief_242.pdf

Pratt, S. (2014). Now: Biodiesel industry gets boost with new western expansion; Then: Canola oil tried in diesel engines. The Western Producer. Retrieved from http://www.producer.com/2014/01/now-biodiesel-industry-gets-boost-with-new-western-expansion-then-canola-oil-triedin-diesel-engines/

Rajagopal, D., Hochman, G., & Zilberman, D. (2011). Multi-criteria comparison of fuel policies: Renewable fuel standards, clean fuel standards, and fuel GHG tax. Journal of Regulatory Economics, 18(3), 217-33.

Renewable Energy Policy Network for the 21st Century (REN21). (2015). Renewables 2015: Global status report. Paris, France: REN21 Secretariat.

Renewable Industries Canada (RIC). (2016). Environment and Climate Change Canada: Let's talk climate change. Retrieved from http://ricanada.org/wp-content/uploads/2016/06/RICCanadasApproachtoClimateChange.pdf

Rubin, J., & Leiby, P. (2013). Tradable credit system design and cost savings for a national low carbon fuel standard for road transport. Energy Policy, 56(May), 16-28.

Speight, J., & Singh, K. (2014). Environmental management of energy from biofuels and biofeedstocks. Hoboken, NJ: John Wiley & Sons, Inc.

Statistics Canada. (2016a). Canadian international merchandise trade database. Government of Canada. Retrieved from http://www5.statcan. gc.ca/cimt-cicm/home-accueil?lang=eng&fpv=1130

Statistics Canada. (2016b). Table 002-0076: Direct payments to agriculture producers, annual. Government of Canada. Retrieved from http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=20076

Statistics Canada. (2016c). Table 134-0004: Supply and disposition of refined petroleum products, annual. Government of Canada. Retrieved from http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1340004

Stephen, J., Mabee, W., & Saddler, J. (2011). Will next-generation ethanol be able to compete with first-generation ethanol? Opportunities for cost reduction. Biofuels, Bioproducts, and Biorefining, 6(2), 159-176.

Stephen, J. D., Mabee, W. E., & Saddler, J. N. (2013). Lignocellulosic ethanol production from woody biomass: The impact of facility siting on competitiveness. Energy Policy, 59, 329-340.

Swenson, D. (2006). Input-outrageous: The economic impacts of modern biofuels production. Ames, IA: Iowa State University.

Tombe, T. (2016, February 9). How to create two jobs for every Canadian worker. Financial Post. Retrieved from http://business.financialpost. com/fp-comment/trevor-tombe-how-to-create-two-jobs-for-every-canadian-worker

Treasury Board of Canada Secretariat. (2007). Canadian cost-benefit analysis guide: Regulatory proposals. Government of Canada. Retrieved from https://www.tbs-sct.gc.ca/rtrap-parfa/analys/analys-eng.pdf

Twomey, P. (2012). Rationales for additional climate policy instruments under a carbon price. Economic and Labour Relations Review, 23(1), 7.

United States Department of Agriculture (USDA). (2006). Biofuels annual: Canada. Global Agricultural Information Network. Retrieved from http://apps.fas.usda.gov/gainfiles/200609/146208865.pdf

United States Department of Agriculture (USDA). (2014). Farm economy: Bioenergy. Economic Research Service. Retrieved from http://www.ers.usda.gov/topics/farm-economy/bioenergy/findings.aspx

United States Department of Agriculture (USDA). (2015). Biofuels annual: Canada. Global Agricultural Information Network. Retrieved from http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Ottawa_Canada_8-19-2015.pdf

United States Department of Energy. (2015). Alternative fuels data center: Fuels and vehicles. Energy Efficiency and Renewable Energy. Retrieved from http://www.afdc.energy.gov/fuels/

United States Energy Information Administration (USEIA). (2016a). Biofuels: Ethanol and biodiesel explained. Government of the United States of America. Retrieved from http://www.eia.gov/energyexplained/?page=biofuel_biodiesel_home - tab1

United States Energy Information Agency (USEIA). (2016b). Hydrogenation-derived renewable diesel. Government of the United States of America. Retrieved from http://www.afdc.energy.gov/fuels/emerging_green.html

United States Energy Information Agency (USEIA). (2016c). International energy statistics. Retrieved from http://www.eia.gov/beta/ international/

United States Environmental Protection Agency (USEPA). (2009). Life cycle analysis of greenhouse gas emissions for renewable fuels. Office of Transportation and Air Quality, Environmental Protection Agency.

United States Environmental Protection Agency (USEPA). (2015). Air toxics: Acetaldehyde. Retrieved from http://www3.epa.gov/airtoxics/hlthef/ acetalde.html

Unnasch, S., Riffel, B., Sanchez, S., Waterland, L., & Life Cycle Associates, LLC. (2011). Review of transportation fuel life cycle analysis. Coordinating Research Council Project E-88. Retrieved from http://www.crcao.com/reports/recentstudies2011/E-88/E-88 Report v8 Final 2011.03.02.pdf

Wang, M., Wu, M., & Huo, H. (2007). Life-cycle energy and greenhouse gas emission impacts of different corn ethanol plant types. Environmental Research Letters, 2(2).

Warner, E., Zhang, Y., Inman, D., & Heath, G. (2013). Challenges in the estimation of greenhouse gas emissions from biofuel-induced global land-use change. National Renewable Energy Laboratory. Biofuels, Bioproducts, & Biorefining, 8(1), 114-125.

Webb, A., & Coates, D. (2012). Biofuels and biodiversity. Technical Series No. 65. Montreal, Quebec, Canada: Secretariat of the Convention on Biological Diversity.

Western Canada Biodiesel Association (WCBA). (2015). Climate leadership plan – Decarbonization of road transport. Retrieved from https://engage.gov.bc.ca/climateleadership/files/2015/12/149_-Western-Canada-Biodiesel-Association.pdf

Worldwatch Institute. (2007). Biofuels for transport: Global potential and implications for energy and agriculture. Sterling, VA: Earthscan.

Wright, B. (2014). Global biofuels: Key to the puzzle of grain market behaviour. Journal of Economic Perspectives, 28(1), 73-97.

Yeh, S., & Sperling, D. (2010). Low carbon fuel standards: Implementation scenarios and challenges. Energy Policy, 38(11), 6955-6965.

Appendix II – 13 Fundamental Questions Designed to Assist Environment and Climate Change Canada in Creating a Clean Fuel Standard Based on Science and Evidence

1) **What is the Definition of a Clean Fuel Standard (CFS)?**

2) **What are the perceived, targeted economic benefits of the Clean Fuel Standard and how will they be measured and substantiated?**

3) **What are or will be the anticipated, projected costs of the Clean Fuel Standard and any subsequent regulations?**

4) **What will be the environmental and social benefits of the Clean Fuel Standard and how will they be determined?**

5) **Determination of environmental criteria for assessment of alternative fuel sources**

6) **Infrastructure Requirements for Alternative Fuels in Canada**

7) **Metrology and the use of GHGenius life cycle assessment methodology for the CFS**

8) **Need for Potential Verifiers and Verification Bodies in Support of the CFS**

9) **Need for Measurement Criteria for Continuous Improvement of the CFS**

10) **Will there be other federal and provincial government regulatory and policy mechanisms announced to reduce GHG reduction and carbon intensity?**

11) **Who will co-ordinate Environment Canada's Clean Fuels Strategy with the Provinces and Municipalities?**

12) **How will ECCC integrate the CFS alternate energy focus as "One Plank" into the Canadian Energy Strategy?**

13) **Will ECCC, Transport Canada and others acquire and evaluate best practices for energy efficiency as an integral part of the CFS?**