The Clean Fuel Standard and Implications for Agriculture

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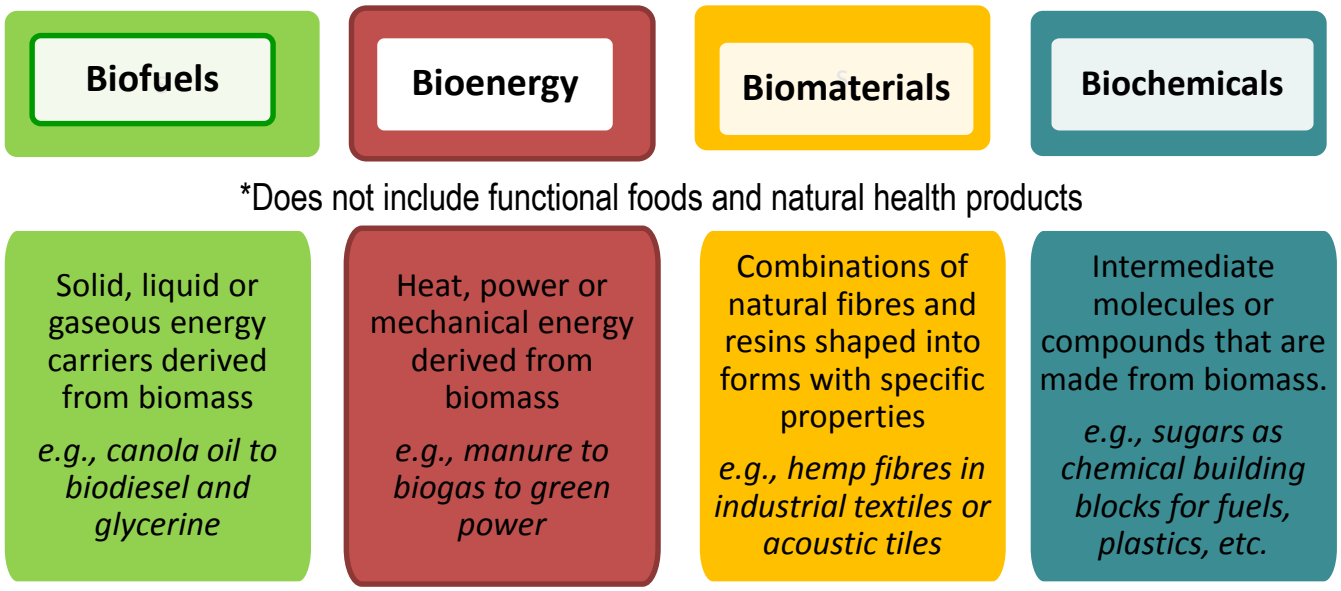
Patrick Verreault,
Senior Analyst, Agriculture and Agri-Food Canada, Bioeconomy Policy

Outline

- Clean Fuel Standard (CFS) in agricultural context
  - Biofuels history and industry overview
  - AAFC's mandate on environment and GHG emissions reduction
  - Comparison between CFS and Renewable Fuels Strategy
  - Broader bioeconomy
- Opportunities and challenges for agriculture
  - Implications for policy
  - AAFC models and analytical capacity
  - Industry perspectives
  - Decision making and analytical needs

Defining the Bioeconomy

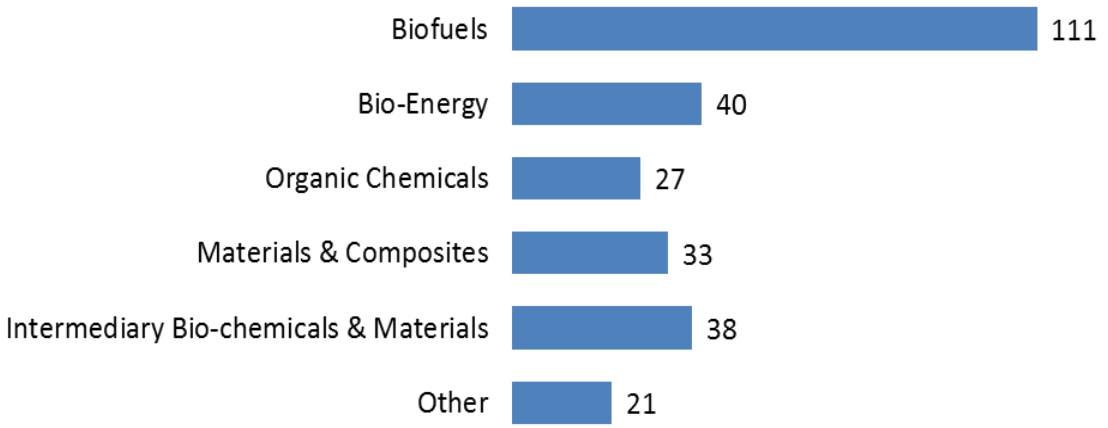
- Definitions vary – some including all of conventional production as well as non-conventional applications of biological resources (e.g. Europe)
- In Canada, we have focused on Industrial Bioeconomy separate from traditional agriculture or forestry.
- Industrial Bioproducts are classified into four broad end-use categories:



Canada's Industrial Bioeconomy

- In 2015, 190 firms were involved in the production or development of non-conventional industrial bioproducts in Canada with estimated revenues of bioproducts at $4.27 billion and employment of 5,618

Firms reporting production or development activity



Source: 2015 Bioproducts Survey

- Biofuels is the largest subcategory of the bioproduct industry in Canada - estimated revenues of $2.72 billion (or 63.7% of total bioproduct revenues), 111 firms
- Many firms indicate activity without sales. Many are in pre-commercial stages (research or product development)
- Traditional focus has been on biofuels that tend to be high volume, greater reach across the sector, and lower value. Future growth areas in biomaterials and biochemicals bring lower volume but higher value, serving to complement efforts in biofuels

Canada's biofuels history

2000

- Action Plan 2000 on Climate Change
- Triple Canada's ethanol production capacity to 750 ML

2003

- $100-million Ethanol Expansion Program
- Funding for new or expanded plants
- Plants now built – over 1BL/year

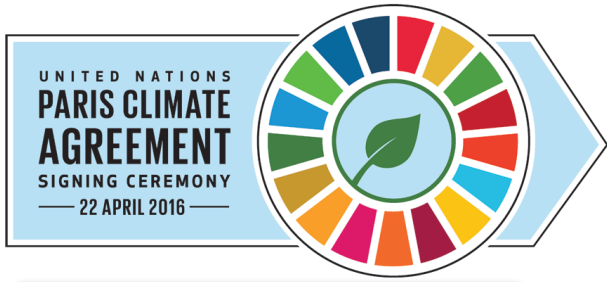
2006

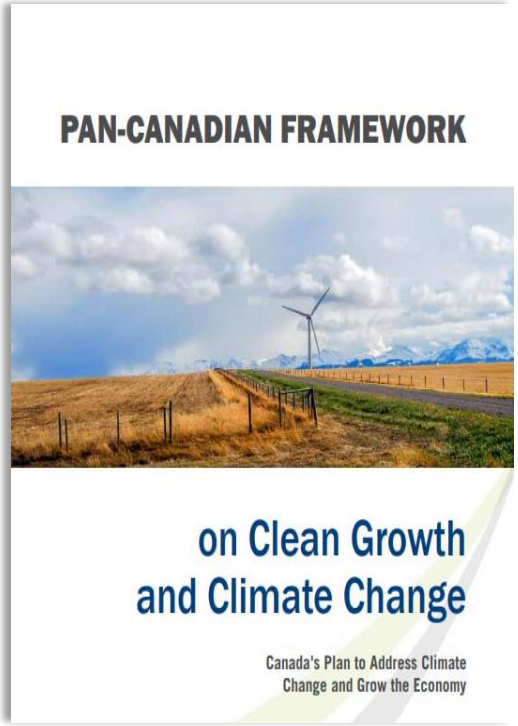
- Renewable Fuels Strategy
- 4 pillars – blending **mandates**, production **incentives**, assistance to farmers, and support for large scale **next-gen demo-plants**

- Greenfield Global announced in August 2017 that it has commenced a feasibility study to significantly expand operations for sustainable biofuel production at its bio-refinery in Varennes, Quebec. The expansion could increase the facility's annual ethanol production capacity from 175 million liters per year to 300 million
- IGPC invested $120 million in an expansion of its ethanol plant in Ontario that will double its production capacity to 378 ML/year
- The Enerkem waste to energy facility in Edmonton Alberta converts MSW to methanol and in 2017, started to produce ethanol. At full capacity the facility should produce 38 ML of ethanol

Government of Canada's Clean Growth Agenda – Opportunities for Bioeconomy

- Pan-Canadian Framework (PCF) on Clean Growth and Climate Change is focused on achieving GHG reductions and transitioning to a low-carbon economy
  - Carbon pricing
  - Clean Fuel Standard
  - $2B Low Carbon Economy Fund
- PCF activities for Agriculture include working with Natural Resources Canada to identify opportunities for renewable fuels and bioproducts
- Agricultural Clean Technology Program will provide $25M/3 years (2018-2021) to support clean technologies with transformative potential:
  - Agricultural bioeconomy
  - Precision agriculture





Clean Fuel Standard - Intent

On November 25, 2016, the Government of Canada announced its intent to develop a Clean Fuel Standard (CFS)

- Goal is to reduce **30 Mt** of GHGs by **2030**
- Will be **performance based** requiring a percentage reduction in carbon intensity
  - Carbon intensity values will be based on lifecycle analysis
- Unlike a traditional low carbon fuel standard, the CFS will **apply to liquid, gaseous and solid fuels used across the transportation, buildings and industrial sectors** in Canada – the first of its kind
- Incent the creation of lower carbon fuel pathways and **drive technology and innovation** to achieve the desired outcomes
- **Non-prescriptive, market-based** approach that includes a crediting and trading system
  - Design to provide maximum flexibility to fuel suppliers
- The CFS presents potential opportunities for the agriculture sector as providers of agricultural biomass for use in the manufacture of low-carbon fuels

Comparison of RFS to CFS

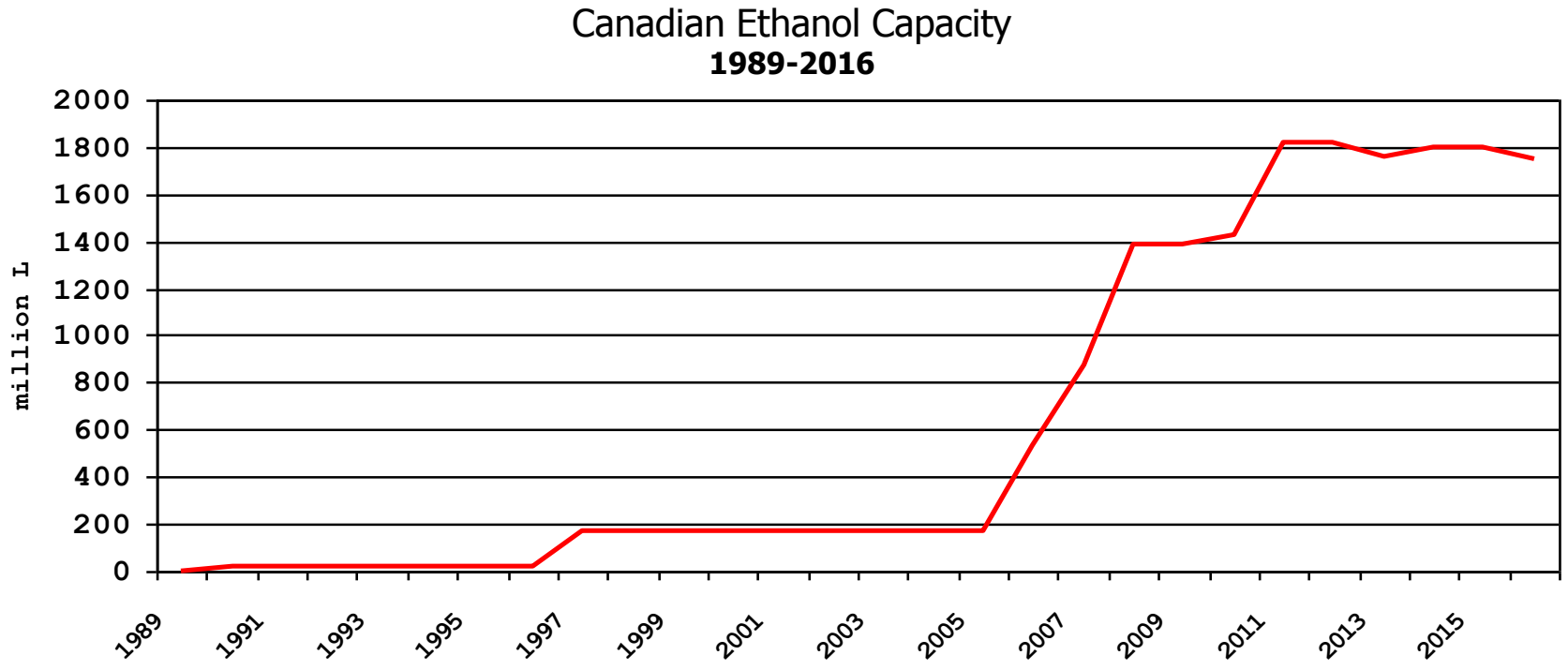
	Renewable Fuel Strategy (2006)	Clean Fuel Standard (proposed)
Legislation and Authority	Canadian Environmental Protection Act, 1999; Minister of Environment and Climate Change Canada	
Purpose	Reduce GHGs, encourage domestic production of biofuels; Provide new markets for agricultural commodities; Create jobs in rural communities; and Accelerate the development of advanced biofuel technologies	Reduce GHGs, through broad flexibility, and cost effectiveness Reduce 30 Mt of GHGs by 2030
Method	Volumetric mandates for biofuel content (5 % gasoline, 2 % diesel and heating distillate oil)	Lower carbon intensity of fuels over time, i.e. reduce GHGs produced over life cycle of fuels
Applicability/ Fuels in scope	Transportation fuels (gasoline, diesel), heating distillate oil	liquid(e.g. gasoline, diesel), gaseous (natural gas, propane), solid fuels (petroleum coke) used in transportation, industry, buildings;
Exemptions	Aviation, heating oil for homes	To be determined (TBD)
Compliance	Sufficient compliance units must be owned by primary suppliers to demonstrate they have the required volume of renewable fuel. Tradeable. One compliance unit = 1 litre of renewable fuel.	Compliance flexibilities will be included (specifics TBD). A credit trading system will be considered.

Provincial actions on renewable content

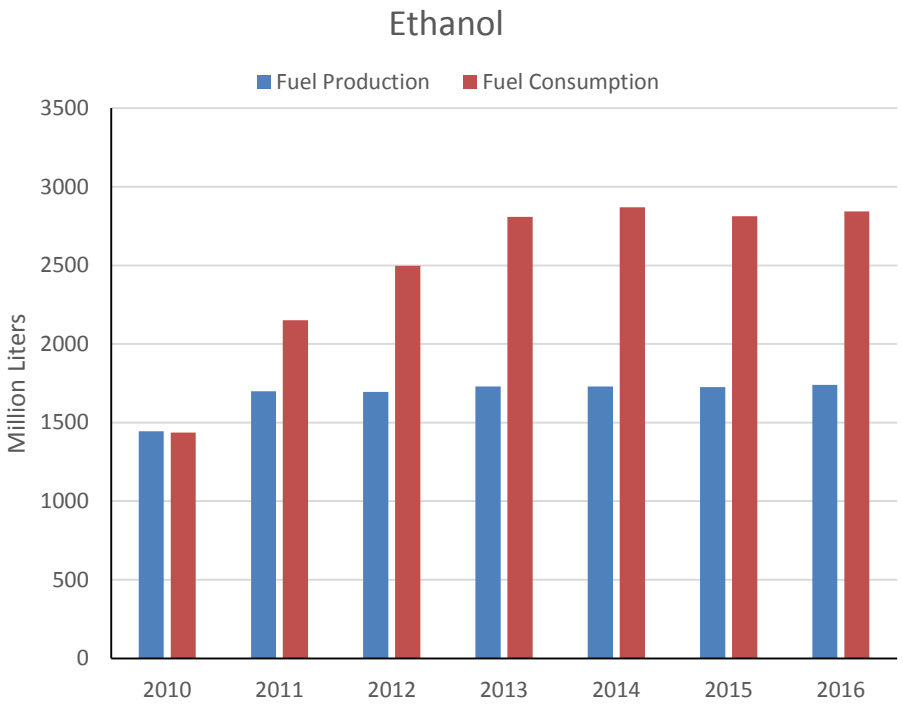
Province	Blending mandates		Policies	Programs	Fuel-Tax Exemption
	Renewable gasoline (%)	Renewable diesel (%)			
British Columbia	5	4	Mandates are part of a Low Carbon Fuel Standard (10% reduction in the carbon intensity relative to 2010 levels by 2020)	Innovative Clean Energy Fund (capital incentives to biofuels projects)	Phased out in 2010
Alberta	5	2	GHG intensity of renewable fuels must be 25% lower than baseline fossil fuels – in place since 2011		Phased out in 2007
Saskatchewan	7.5	2	In place since 2007 – ethanol, 2012 – diesel		Phased out in 2007
Manitoba	8.5	2	In place since 2008 – ethanol, 2009 - diesel		N/A
Ontario	5	4*	Green diesel standard – the renewable content requirements were phased in over three years, from 2014-2017.	The Ontario Ethanol Growth Fund (capital assistance to ethanol industry, 2005 – 2017)	Phased out in 2005
Quebec	N/A	N/A	Announced as part of *Climate Change Plan* (2017)		Biodiesel exempt

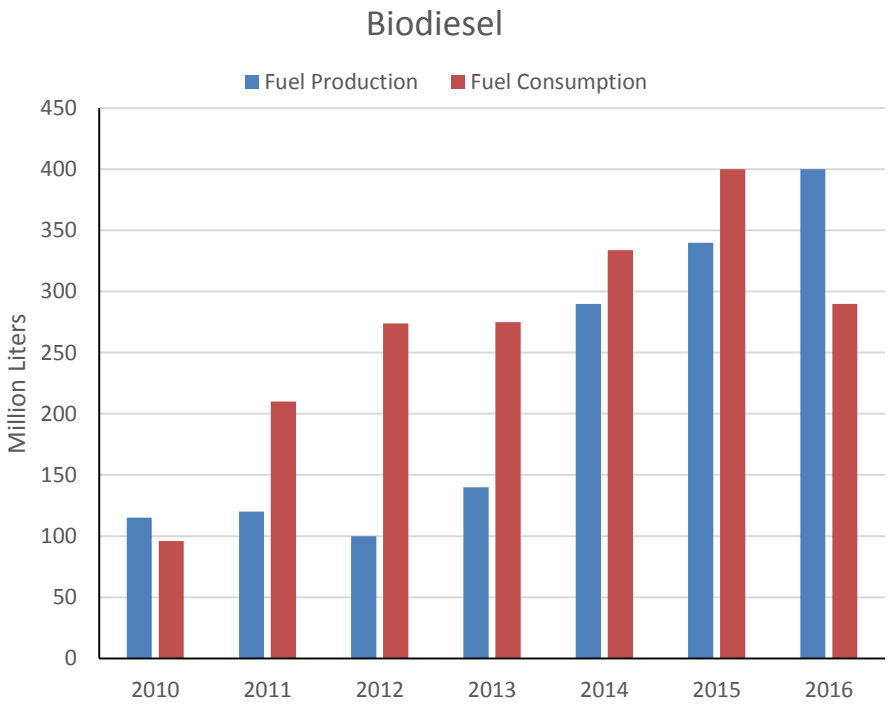
Domestic production capacity of Biodiesel and Ethanol

- In 2017, there were nine commercial biodiesel production facilities in operation, ranging in capacity from 200,000 to 265 million liters per year, with total national biodiesel production capacity of 591 million liters per year
- A federal use mandate of 5 percent renewable fuel blended into the gasoline supply required an estimated 2,346 million liters of ethanol in 2016. In 2016, Canadian fuel ethanol utilization reached 2,843 million liters



Biofuels production and consumption 2012-2016 in Canada





- Feedstock use for ethanol production is roughly 80% corn grain and 20% wheat grain
- Feedstock for biodiesel production is mainly used cooking oil, canola oil, animal fats and soybean oil

GHG policy impacts on the sector

- Land use impacts
  - Practices that benefit from improving CO_2 sequestration can generate emission offset credits.
    - Land management decisions, such as tillage choice, annual vs. perennial, dedicated energy crops or agro-forestry
  - Land clearing must consider the cost of carbon emissions released
    - When land is converted there can be a very large one time emission of carbon
    - Clearing Forest land releases up to 500 tonnes/hectare
    - Clearing shrub land releases up to 250 tonnes/hectare
- The carbon market has impacts on input prices
  - It affects general energy prices and agricultural inputs, such as farm fuel and fertilizer
  - Renewable energy benefits from displacing fossil fuel based energy and reducing emissions
- Potential expanded domestic markets for new or existing agricultural feedstocks

Outstanding questions

- Calculation of carbon intensities for different crops on a regional basis
- Allocation of GHG emissions among the liquid, gaseous and solid streams
- Treatment of aviation and marine sectors
- Interplay with Carbon pricing and other clean growth initiatives
- Potential future changes to treament of iLUC an continuation of volumetric mandates across the timeline of the CFS

AAFC Models

- Biomass Inventory Mapping and Analysis Tool (BIMAT):
  - Project lead by AAFC, NRC, ECCC, and NRCan (CFS) developing Municipal Solid Waste (MSW), agriculture and forestry residue and purpose grown biomass inventories for Canada
  - Current work is looking to update data and build forestry and agricultural sustainability indices and add new information on MSW
- Canadian Regional Agricultural Model (CRAM):
  - Static partial equilibrium model of the Canadian agriculture sector, covering all of primary production (crops and livestock) and some processing activities
  - Divided into 55 regions and can provide a very detailed regional breakdown of scenario results
  - The underlying strength of CRAM is the specification of production responses at the regional level and linking of output with provincial demand and world markets through a transportation matrix
  - The model uses the Positive Mathematical Programming (PMP) methodology to calibrate marginal cost curves for all cropping and livestock activities except for supply managed industries

Industry stakeholders perspectives

- Questions about how the CFS LCA model will be designed and how to reconcile with a potential patchwork of LCA models across federal and provincial regulations
- Future review of the CFS could include further consideration of the inclusion of indirect land use change. Agricultural industry stakeholders have concerns around the impact of iLUC factors on LCA values for agricultural derived biofuels
- The continuation of volumetric mandates seen as imperative to biofuels stakeholders and feedstock suppliers as a stable and clear market and investment signal
- Implications of the modelling results in terms of needed infrastructure and supply chain

Ongoing analytical needs

- Understanding availability and cost for a large variety of biomass feedstocks at the regional and sub-regional level
- Cost comparisons between finished fuels are also required as are market access conditions, blending limitations, and infrastructure requirements
- Allocations of land to meet demands for food, feed, livestock, and fuel simultaneously, and the effects of those allocations on market prices, supplies, and nonmarket environmental services
- Evaluation of supply chain logistics and costs at a local scale
- Impacts on water quality, wildlife habitat, other environmental indicators, job creation (job quality, duration, distribution, etc.), use of marginal lands
- Canada is potentially well placed for a shift towards second-generation ethanol, as woody biomass and agricultural waste are readily available
- Modelling Canada's ethanol production within the context of international trade is crucial to understanding Canada's future in biofuels
- Impact of foreign policies on local market (e.g. RIN situation in the US and potential excess production)

Conclusions

- Climate objectives call for lower carbon fuel mix - Canada has a strong interest in transitioning to a lower carbon economy which will undoubtedly have implications for the broader **bioeconomy** (e.g. biochemical, bioproducts)
- Canada has a biomass and technology advantage - **Innovation** will be play a key role in Canada's prosperity and how we use our renewable resources most sustainably
- The Clean Fuel Standard sends a signal to all sectors of the economy to create a suitable framework so that ecology, economy and society are perceived as a single entity and not as rivals

Annex

- Further information of Government of Canada and AAFC support for Bioeconomy

Agricultural Clean Technologies Science Strategy