Advanced Biofuels Canada
Biocarburants avancés Canada

EU and US Policy: Lessons for Canada?

Scaling Up 2019 – Ottawa, ON

November 6, 2019

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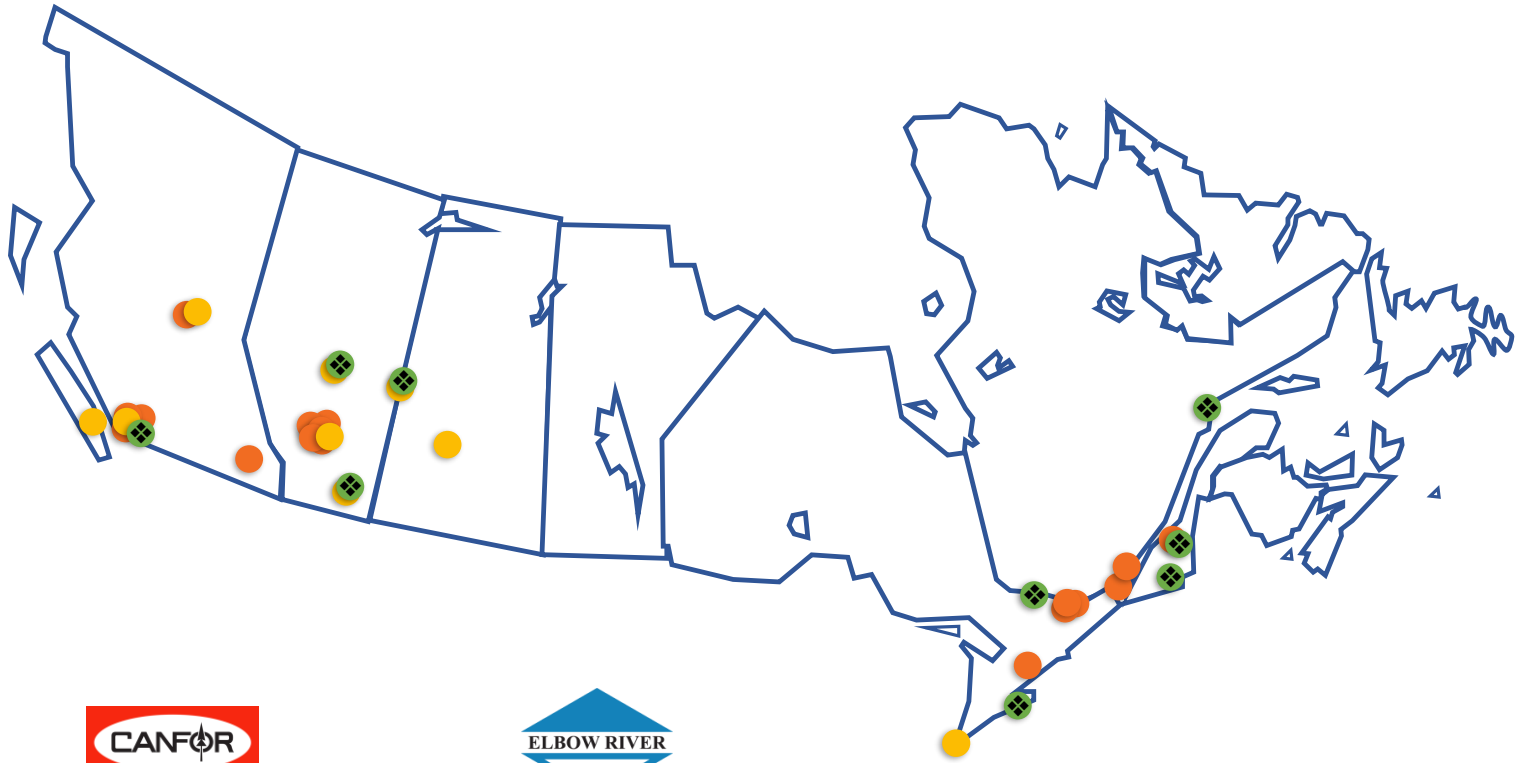
Advanced Biofuels Canada

ABFC Objective:

Production and use of low carbon fuels:

- Fuel regulations (RFS & LCFS)
- Carbon pricing (production and use)
- Fuel taxation
- Capital investment



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LanzaTech
TARGRAY
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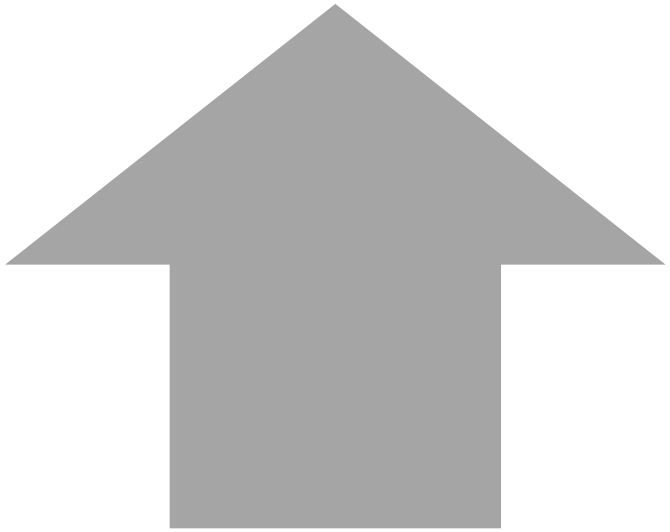
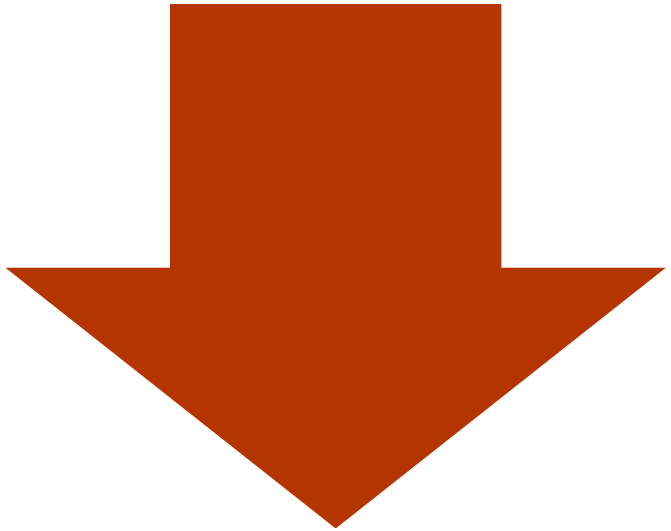
CONSOLIDATED BIOFUELS Ltd.
ENSYN
INVIGOR BIOENERGY CORPORATION
OPIS
Verbio
CANADA CLEAN FUELS
ecoengineers people-driven solutions
Honeywell UOP
IOGEN CORPORATION
REG Renewable Energy Group
WEST COAST REDUCTION LTD.

The EU and U.S. Are on Separate Trajectories

…For the moment anyway…compare the differences in approach



EU=Decarbonization Path



U.S.=Deregulation Path

Source: Tammy Klein

RED II came into effect on 24 December 2018 transposed into national law by 30 June 2021

RED II (Directive 2018/2001)	
Energy content from Renewable Sources	32%
Renewables in the Transport	14% (by energy, volume or by GHG Reduction)
Cap on Food/ Feed Crop Based Biofuels	2020 consumption level in each Member State plus 1%, up to 7% limit, based on energy
Target for Annex IX Part A (Advanced)	0.2 % (2022), 1 % (2025), 3.5 % (2030)
Limit for Annex IX Part B (UCO, animal fat)	Limit of 1.7%, modifiable by MS if approved by Commission
New fossil fuel comparator	94 instead of 83.8 gCO2eq/MJ
New GHG emission saving thresholds	50% for old installations 60% for new installations after 5 October 2015 65% for installations starting operation after 1 January 2021 70% for renewable fuels from non-biolog. origin after 1 January 2021

REDII Actual Market Impact will be Different…

	REDI	REDII
	2020	2030
Nominal Blending	10%	14%
Physical Blending	**7%**	**7.35%**

	Physical Blending	Multiplier	Result
Annex IV A	1.75%	2	3.50%
Annex IV B	1.70%	2	3.40%
Renewable Electricity: Road	0.90%	4	3.60%
Renewable Electricity: Rail	1.00%	1.5	1.50%
Conventional Biofuels	2.00%	1	2.00%
Total:	**7.35%**		**14%**

Calculation analysis derived from Verband der Deutschen Biokraftstoffindustrie e.V (VDB)

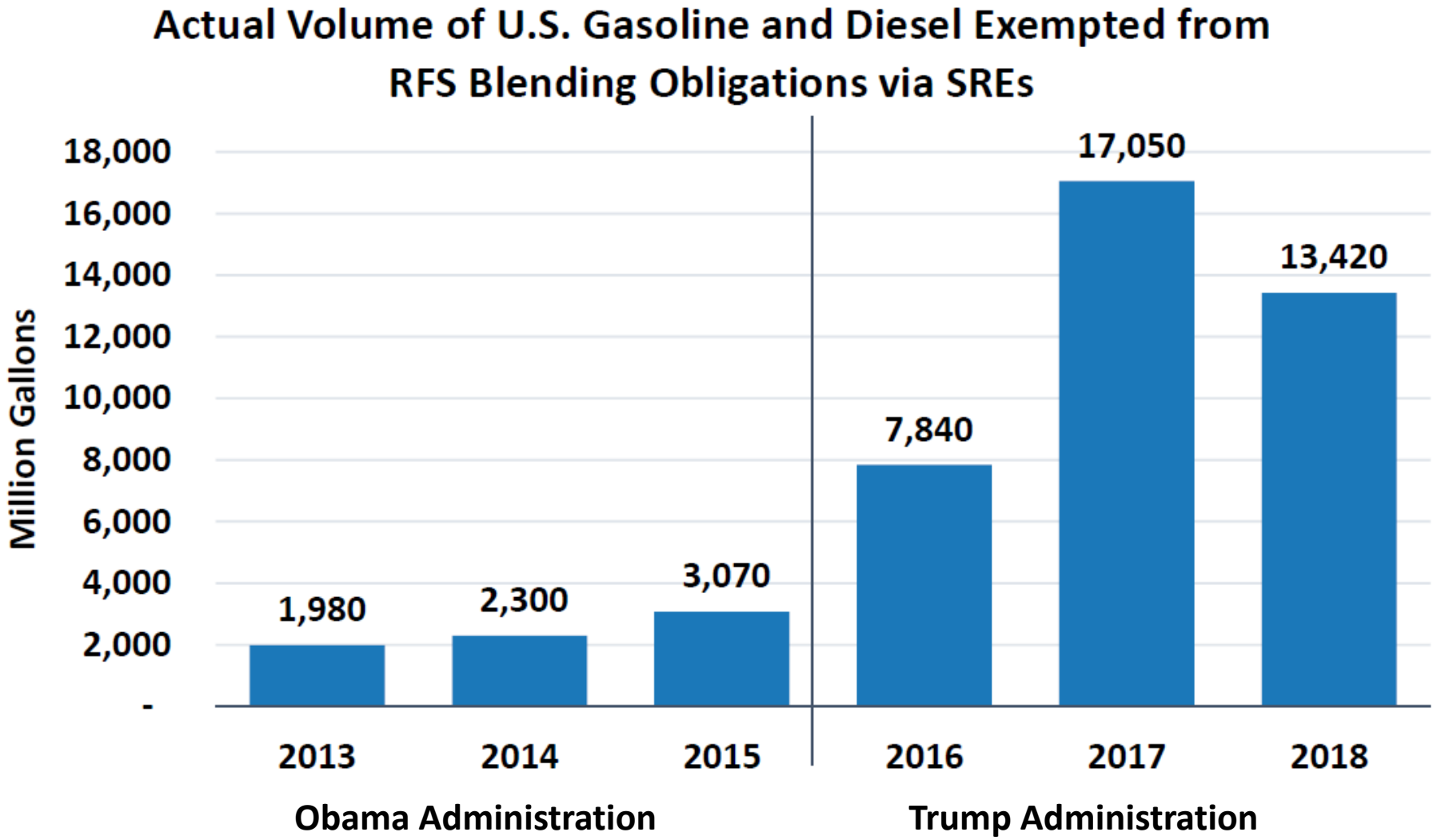
Policies only as effective as their demand signal is clear.

EU: Unfettered multiplier use changes that signal

US: SRE abuse changes that signal

What Does that Translate into in Terms of Volume?

Roughly 8-10% of U.S. gasoline and diesel production exempted from RFS requirements in 2017-2018



Source: Pacific Ethanol, 2019

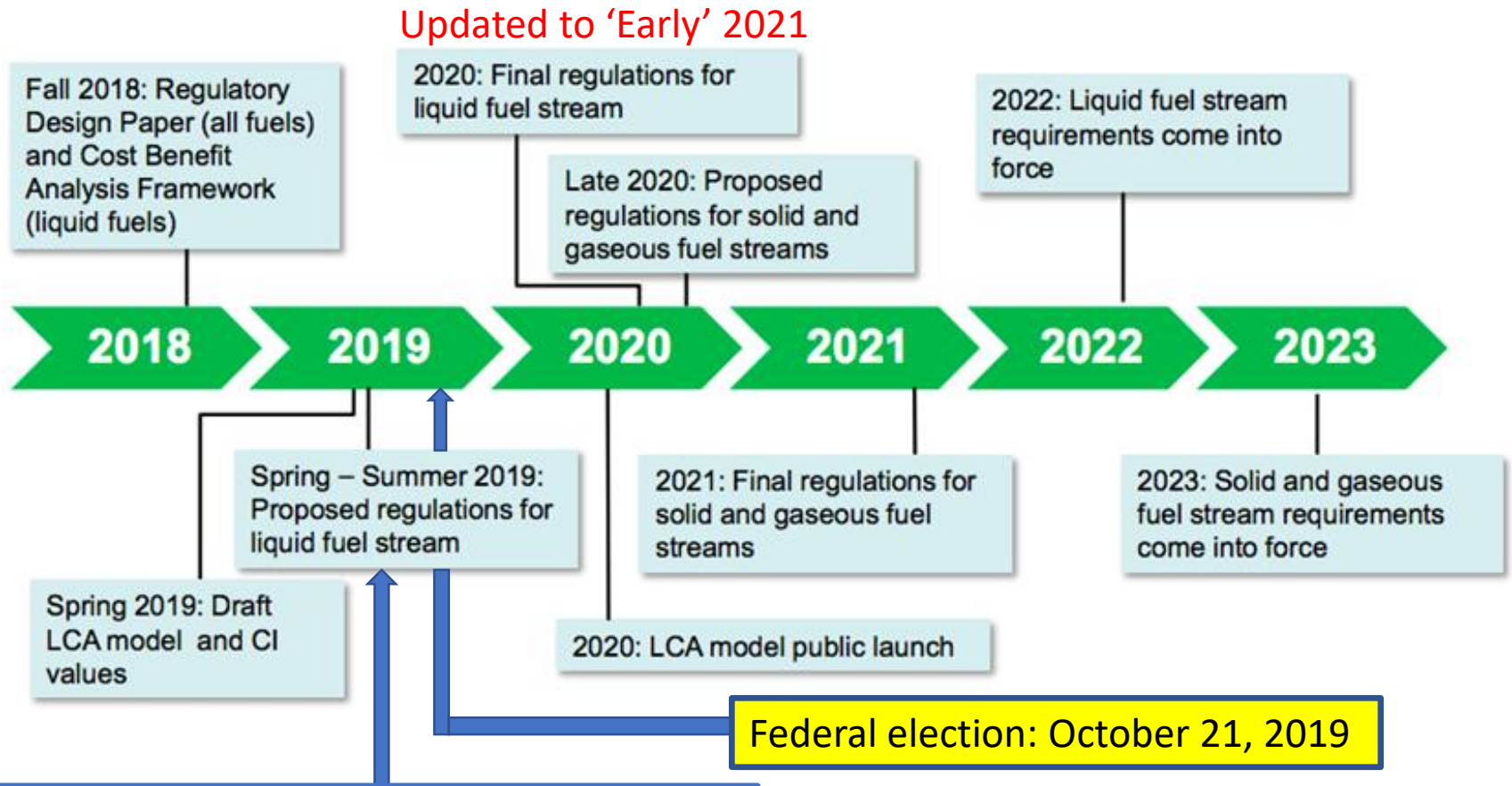
Proposed federal Clean Fuel Standard

- Liquid fuels (eff. 2022) followed by solid, gaseous fuels (eff. 2023 est.)
- 10gm CO2e/MJ carbon intensity reduction requirement in Liquids in 2030
- LCA – new model under development
- ILUC — EU Delegated Act approach

Compliance Options - Liquids:

Category 1:	Actions to reduce CI throughout the lifecycle of fossil fuel production (e.g. CCS, process efficiency, NG electric drive compression, co-processing, etc.)
Category 2:	Supply low carbon-intensity fuels (biofuel)
Category 3:	Selected end use fuel switching in transportation (EV, RNG, CNG, etc.)

Clean Fuel Standard – Process/Timeline



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OBJ: "Achieve annu
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***"The CFS will ...incent th
fuels, alternative energy
electricity, hydrogen, an
natural gas."***

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Clean Fuel Standard

The Government of Canada announced in late 2016 that it would consult with provinces and territories, Indigenous peoples, industries, and non-governmental organizations to develop a Clean Fuel Standard to reduce Canada's greenhouse gas emissions (GHG) through the increased use of lower carbon fuels, energy sources and technologies.

The objective of the Clean Fuel Standard is to achieve 30 million tonnes of annual reductions in greenhouse gas emissions by 2030, making it an important contribution to the achievement of Canada's target of reducing national emissions by 30% below 2005 levels by 2030. The CFS will be a performance-based approach designed to incent the innovation and adoption of clean technologies in the oil and gas sector and the development and use of low-carbon fuels throughout the economy.

The Clean Fuel Standard regulations will cover all fossil fuels used in Canada, but will set separate requirements for liquid, gaseous and solid fossil fuels. It is being developed in a phased approach, with liquid fuel class regulations being developed first followed by gaseous and solid fuel class regulations. The Clean Fuel Standard is complementary to other climate policies and investments being made under the Pan Canadian Framework on Clean Growth and Climate Change – including carbon pollution pricing. These policies work in concert to reduce emissions across the economy, and create incentives for innovation and clean growth.

Proposed Regulatory Approach: June 2019

On June 28, 2019 Environment and Climate Change Canada released the Proposed Regulatory Approach for the Clean Fuel Standard. This document presents the full regulatory design for the liquid fossil fuel regulations of the Clean Fuel Standard, developed with extensive engagement and consultations with stakeholders. It builds upon the Regulatory Design Paper published in December 2018 as well as the Clean Fuel Standard Regulatory Framework published in December 2017. The Proposed Regulatory Approach is a key step in the development of the Clean Fuel Standard, as it provides the full set of requirements and credit creation opportunities that will be included in the liquid class regulations. Comments on the paper are requested by August 26, 2019.

We also encourage interested stakeholders to check out the Clean Fuel Standard backgrounder.

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December 2018

30Mt CFS

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7Mt
Gaseous, Solid

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Fossil improvement credits plausibly >20Mt

Category 1 Examples (Mt)	Low	High	Notes
Alberta Carbon Trunk Line (CCS)	3.9	14.6	2020 – 2030
Canadian Oilsands Industry Alliance (COSIA) projection	7.3	21.9	10-30% lower in 5 years
Cumulative	**11.2**	**36.5**	
IHS Markit oilsands study*	11.7	16.8	16-23% lower by 2030
Canadian Energy Research Institute (estimates to 2030)	~40	~50	80% lower by 2036
Environment and Climate Change Canada (CFS TWG estimates)	**8.8**	**11.3**	ECCC TWG Jan 2019

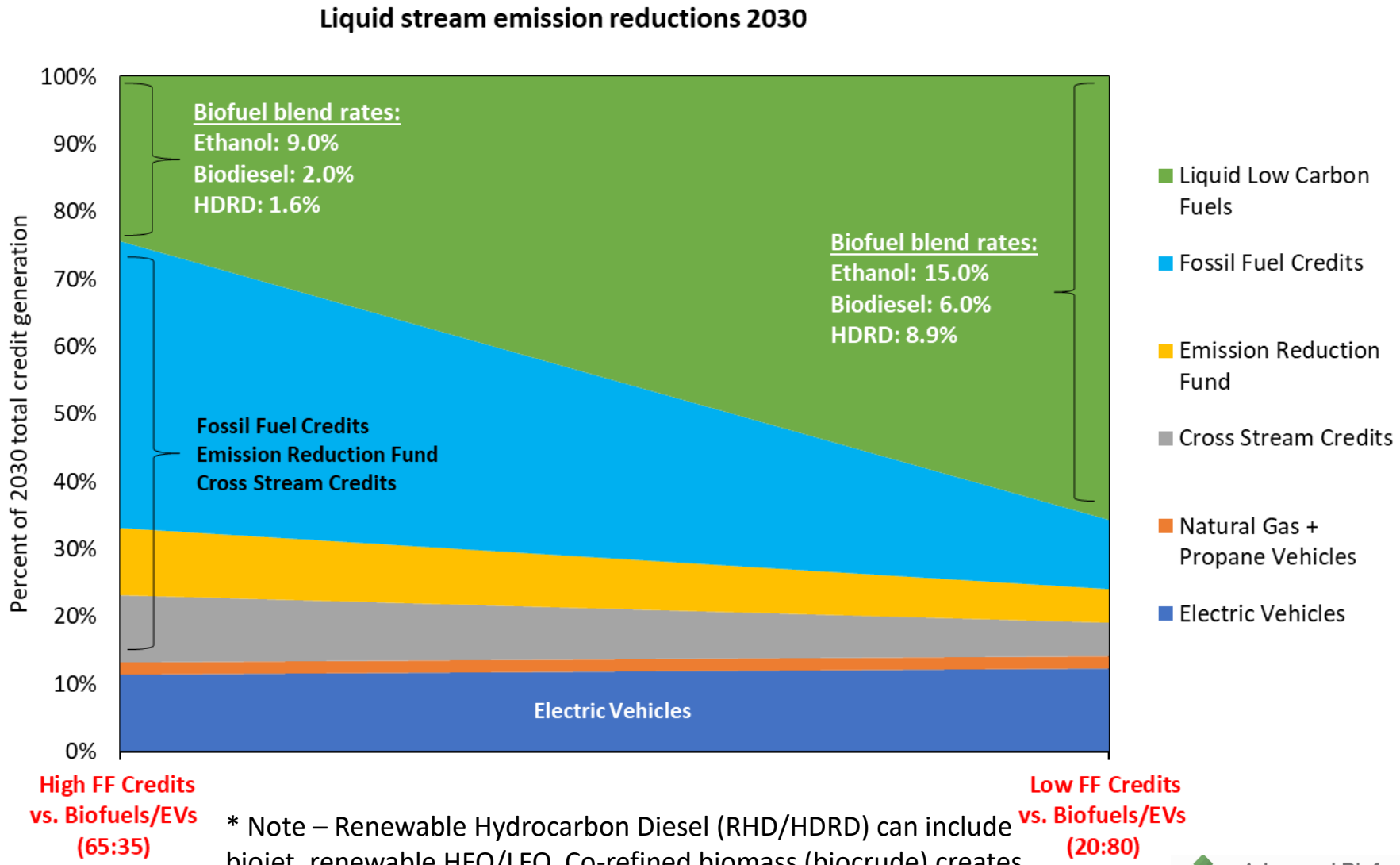
*IHS Markit: "… intentionally excluded any transformational technologies under development in the oilsands…only factored for the deployment of commercial or near-commercial technologies or efficiencies, only existing trends."

CFS Liquid Stream Credit Generation

Demand for biofuels will depend on final CFS design.

Significant dilution potential from:

- Fossil fuel credits
- Fund payments
- Cross-stream credits



* Note – Renewable Hydrocarbon Diesel (RHD/HDRD) can include biojet, renewable HFO/LFO. Co-refined biomass (biocrude) creates fossil fuel offset credits.

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CFS Liquid Stream Scenarios (23MT)

Credit Source	ABFC High Biofuels	ABFC Mid Biofuel	ABFC Low Biofuels	ABFC Low Biofuels	ECCC - Jan TWG	ECCC - May TWG
Fossil fuel credits - Bucket 1 (MT)	2.5	5	7.5	11.2	8.8 - 11.2	5.0 - 7.5
Ethanol blend %	15.0% (5.7 BL)	15.0% (5.7 BL)	10.0% (3.8 BL)	9.0% (3.4 BL)	10 - 15%	10 - 15%
HDRD blend %	8.9% (2.9 BL)	4.7% (1.6 BL)	3.5% (1.2 BL)	1.6% (0.6 BL)	5 - 6 - 10%	3 - 6%
Biodiesel blend %	6.0% (2.0 BL)	5.0% (1.7 BL)	4.0% (1.4 BL)	2.0% (0.7 BL)	5.0%	5.0%
Pyrolysis oil %	10%	10%	10%	10%	10%	10%
Biojet %	1%	1%	1%	1%	1%	1%
EV credits (MT)	3	3	3	3	1.0 - 2.0	2.0 - 4.6
NG fuel switching credits (MT)	0.2	0.2	0.2	0.2	N/A	0.2
Propane fuel switching credits (MT)	0.2	0.2	0.2	0.2	N/A	0.2
Aggregate: Emission Reduction Fund + Cross-Stream Credits	10%	15%	20%	20%	Carry Forward - 10% ERF - tbd Cross-Stream - 10%	0 - 20%
Existing Actions 2021 (MT)	5.9	5.9	5.9	5.9	N/A	5.7
Compliance 2022 (g/MJ)	3.6	3.6	3.6	3.6	N/A	3.6
Curve	Linear (0.8 g/year)	Linear (0.8 g/year)	Linear (0.8 g/year)	Linear (0.8 g/year)	N/A	Linear (0.8 g/year)
Compliance 2030 (g/MJ)	10.0	10.0	10.0	10.0	10.0	10.0
2030 Debits (MT)	24.5	25.0	25.8	26.3	N/A	25.1 - 25.9
2030 Total Annual Credits (MT)	24.5	25.0	25.5	26.4	25.7	
% of credits renewable (incl. EV)	78% (19.1 MT)	63% (15.7 MT)	49% (12.4 MT)	36% (12.4 MT)	14.4 - 16.8 MT	12.5 - 19.4 MT
% of credits Other	22% (5.4 MT)	37% (9.2 MT)	51% (13.2 MT)	64% (13.2 MT)	8.8 - 11.3 MT	Varies
Credit Bank at End 2030	2.0 MT	2.0 MT	2.0 MT	2.0 MT	N/A	0.2 - 5.0

Looking forward…

- Clean Fuel Standard retains significant potential for non-fossil clean fuels, with limited simple fixes, such as:
  - A partition in the Liquids stream, with separate requirements for fossil fuels (category 1) and non-fossil clean fuels (categories 2 & 3)
  - Expand the CFS reduction target >30Mt
- Canada needs two separate regulatory tracks

per NRCan ‘Generation Energy Council’ report:

1. Use more renewable fuels
2. Producing cleaner oil and gas

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