Environment and Climate Change Canada
Environnement et Changement climatique Canada
Canada

Modelling the Clean Fuel Standard

Economic Analysis Directorate
Environment and Climate Change Canada

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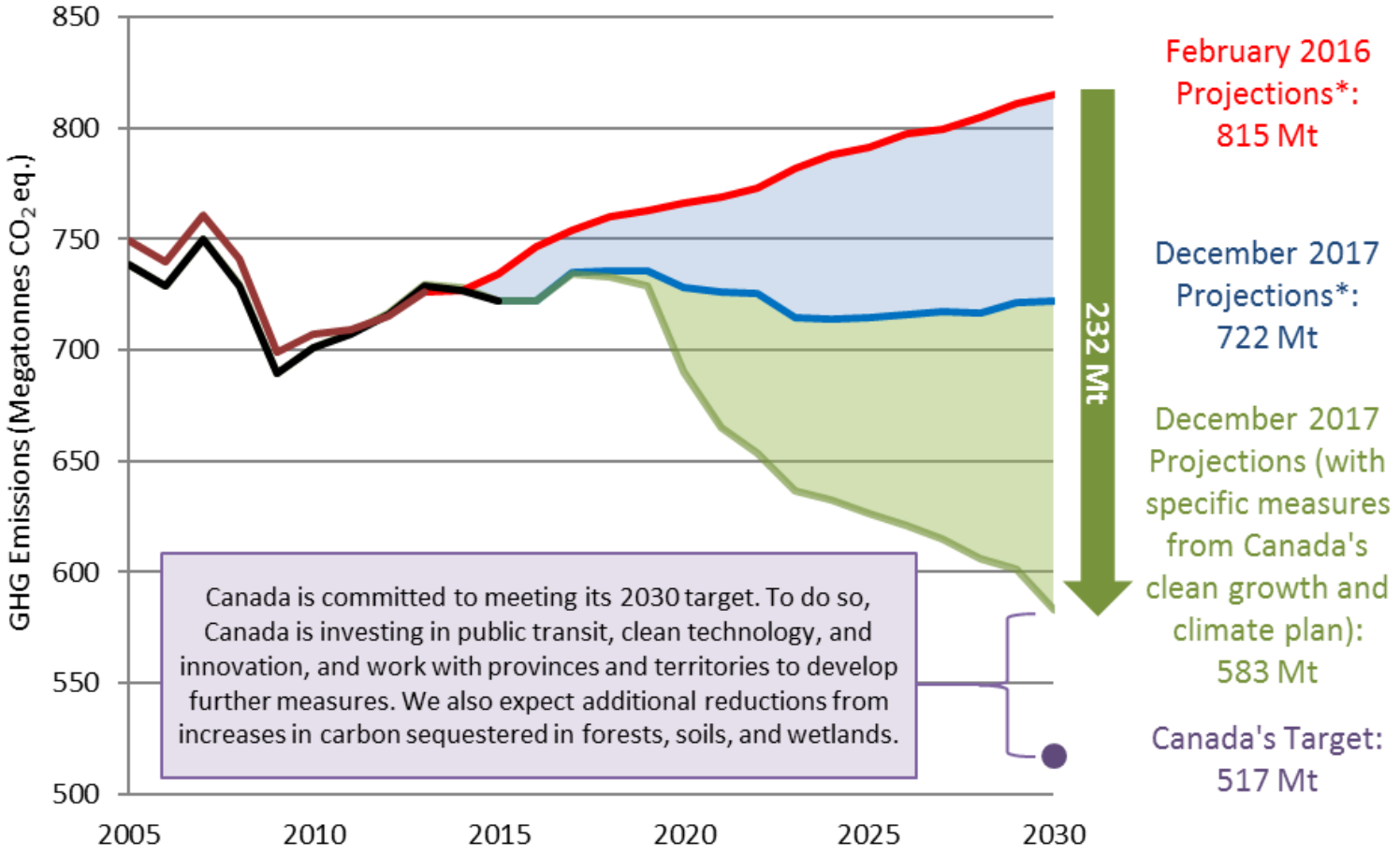
ECCC

- Environment and Climate Change Canada's (ECCC) mandate is the preservation and enhancement of the quality of the natural environment, including water, air and soil quality.
- Climate change is recognized as a global problem and Canada is working to meet its commitments under the Paris Accord by reducing its green house gas emissions.
- The Pan Canadian Framework (PCF) on Clean Growth and Climate Change is the coordinated effort between the federal and provincial governments of Canada to meet our emissions reduction targets, grow the economy, and build resilience to a changing climate.

Progress to Target



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EAD

- The Economic Analysis Directorate (EAD) of ECCC is responsible for analyzing proposed regulations, generating greenhouse gas emissions projections for submission to the United Nations, as well as studying competitiveness impacts of regulation on industry.
- Since the summer of 2016, EAD has been involved with the modelling and analysis of The Clean Fuel Standard (CFS), which has informed the development of the regulation.
- One of the tools used by EAD is the Energy, Emissions and Economy Model for Canada (E3MC).

E3MC Model Overview

- E3MC is used to:
  - develop GHG projections underlying Canada's Biennial Reports to the UNFCCC and Canada's Emissions Trends reports.
  - analyze sector-based policies as it simulates how factors such as energy prices and government measures affect the choices that businesses and consumers make.
- E3MC is composed of:
  - **ENERGY 2020** simulates supply, demand from various economic sectors (including agriculture) and price of all sources of energy and emissions.
  - **The Macroeconomic Model** examines consumption, investment, production and trade decisions, related to all economic sectors including agriculture.

The Clean Fuel Standard

- Using Reference Case 2017 (REF17) projections and the same set of modelling assumptions as developed for the PCF analysis, the reductions from the Clean Fuel Standard (CFS) in E3MC would be 26 MT in 2030.
- The CFS is an important component of Canada's effort to meet its obligations under the Paris Accord.
- As a small, open economy, Canada's imported price of biodiesel and ethanol are tied to the international price of oil.
- The Agriculture sector's demand for fuel in E3MC is an exogenous forecast developed by Agriculture Canada.
- As a result, economic activity in agriculture and GHG emissions are not greatly impacted by the CFS.

Key Modelling Assumptions

- Reductions in combustion intensity are assumed.
- 10% reduction in life cycle carbon intensity is modelled by requiring 10% renewable content by 2030 for diesel and gasoline (plus light and heavy fuel oil) in transportation, buildings and industrial sectors (including off-road transportation).
- Due to supply availability concerns, a 5% (instead of 10%) requirement is modelled for the renewable component of natural gas by 2030. Covered sectors include buildings, industry and electricity generation.
- Given the high emissions intensity of petroleum coke and heavy fuel oil, 90% of these fuels is assumed to switch to natural gas in Heavy Industry (with the exception of Newfoundland and Labrador where no substitution was assumed).

Modelled Reductions by Sector

- Applying these assumptions to the REF17 baseline gives **26 MT CO2e** of reductions in 2030.

Sector	2015	2030 (REF17)	2030 (CFS)	2030 CFS vs REF17
Oil and Gas	190	214	206	-8
Transportation	173	154	145	-10
Electricity	79	48	47	-1
Heavy Industry	74	97	95	-2
Buildings	86	83	80	-3
Agriculture	73	72	71	-1
Waste and Others	48	53	52	-1
Total	722	722	696	-26

- Total emissions by sector in 2015 and 2030 (MT CO2e) (Numbers may not add up due to rounding)

Modelled Results by Fuel

- Combustion emissions by energy source in 2015 and in 2030 (MT CO2e) (Numbers may not add up due to rounding)

Energy Source	2015	2030 (REF17)	2030 (CFS)	2030 CFS vs REF17
Renewable Sources*	5	5	7	2
Natural Gas	212	266	260	-6
Gasoline	98	80	69	-10
Diesel	86	91	88	-2
Other Oil based fuels	53	57	54	-2
Coal and Coke	77	38	31	-7
Total	531	535	509	-26

*Includes biofuels, biomass, hydro, nuclear, solar, wind and wave

Modelled Results for Agriculture by Fuel

- Combustion emissions by energy source in 2015 and in 2030 for On-Farm Fuel Use (KT CO2e) (Numbers may not add up due to rounding)

Energy Source	2015	2030 (REF17)	2030 (CFS)	2030 CFS vs REF17
Renewable Sources*	< 100	< 100	300	300
Natural Gas	1900	1800	1700	-100
Gasoline	< 100	< 100	< 100	0
Diesel	10200	10400	9400	-1000
Other Oil based fuels	1700	1700	1600	0
Coal and Coke	0	0	0	0
Total	13900	13900	13100	-800

*Includes biofuels, biomass, hydro, nuclear, solar, wind and wave

Considerations

- Analysis conducted by EAD so far has **focused on GHG reduction potential**, overall economic impacts will be assessed as regulatory options are better defined. Current estimates do not account for potential output losses due to the new regulation.
- The biofuel production module and the associated economic sector have been added into E3MC.
- Work has been completed to demonstrate the viability of using E3MC to analyze GHG emissions on a life cycle basis.
- The Land Use, Land-Use Change and Forestry sector (LULUCF) is not modelled in E3MC and the CFS impacts have not yet been analyzed in the context of LULUCF.

Next Steps

- Modelling priorities:
  - Understanding the capacity for biofuel and biofuel feedstock production in Canada as well as imports
  - Developing robust domestic cost curves for the production of renewable natural gas, biodiesel and ethanol
  - Incorporating the biofuel cost curves into modelling of the CFS in E3MC in order to better inform policy design
  - Researching and adding novel biofuels into E3MC as necessary
- ECCC modelling team will continue to be involved in the analysis of CFS regulatory options as they are being defined.
- Given the complexity and the breadth of the issue, we can expect a wide range of questions to be considered as the policy is being developed.

Next Steps

- The CFS regulatory framework was released in December 2017 to facilitate the development of the regulation through consultations with provinces, territories, indigenous people and other stakeholders.
- An update was released in July that outlined the timeline for the CFS regulation.
- A proposed regulation will be released in the spring of 2019 for liquid fuels with requirements coming into force in 2022.
- For gaseous and solid fuels, a proposed regulation will be released in fall 2020 with requirements coming into force in 2023.
- Consultations are continuing this fall and ECCC is working to refine the CFS and to incorporate feedback.

- Thank you.