Environment and Climate Change Canada
Environnement et Changement climatique Canada
Canada

CLEAN FUEL STANDARD

Cost-Benefit Analysis Framework

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1. Introduction

The cost-benefit analysis (CBA) is part of a regulatory impact analysis statement (RIAS) that is published in the *Canada Gazette* along with regulations (and proposed regulations) to estimate the incremental benefit and cost impacts to society attributable to those regulations (and proposed regulations). The Government has announced that it intends to publish proposed *Clean Fuel Standard* (CFS) Regulations for liquid fuels in spring/summer 2019 with final regulations planned for 2020 and a coming into force in 2022. Proposed CFS Regulations for gaseous and solid fuels are targeted for publication in the *Canada Gazette*, Part I in 2020 with final regulations planned for 2021 and coming into force in 2023.

This CBA framework deals with the liquid fuel stream design of the proposed CFS Regulations, and outlines the approach for the CBA as part of the RIAS that will accompany the 2019 publication of the proposed Regulations. It will compare a scenario in which there are no new CFS regulations (the baseline scenario), to a scenario in which the new regulations would set lifecycle carbon intensity standards on liquid fossil fuels produced and imported in Canada (the regulatory scenario). The impacts of the proposed CFS would be assessed in terms of incremental changes in compliance and administrative requirements, emissions and production, and the associated benefits and costs.

2. Regulatory design

As described in the Clean Fuel Standard Regulatory Design Paper,[1] liquid fossil fuel primary suppliers (i.e., producers and importers) would be subject to the proposed CFS and would be required to reduce the carbon intensity of liquid fossil fuels they produce and import in Canada by 10 grams of carbon dioxide equivalent per megajoule (g CO_2e/MJ) from 2016 intensity levels by 2030.

The CFS is intended to be a flexible policy tool to reduce the carbon intensity of liquid fossil fuels. Three main categories of compliance and credit-generating actions are anticipated: (1) actions that reduce the carbon intensity of the fossil fuel throughout its lifecycle; (2) supplying low-carbon fuels; and (3) specified end-use fuel switching. A fourth category may be permitted if the Department includes a market stability mechanism such as an emissions reduction fund. The CFS would also allow parties that are not fossil fuel primary suppliers to participate in the credit market as voluntary credit-generators.

[1] The Regulatory Design Paper can be obtained on Environment Climate Change Canada's Clean Fuel Standard Webpage.

3. Analytical outline

The impacts of the proposed CFS Regulations would be assessed in accordance with the Government of Canada's Cabinet Directive on Regulations and *Canadian Cost-Benefit Analysis Guide*.[2] Regulatory impacts would be identified and compared incrementally to the baseline scenario. This guidance indicates that the net present value and the present value of benefits and costs should be based on a minimum forecast of ten years. To the extent possible, the benefits and costs would be quantified and monetized. In accordance with guidance regarding environmental and health regulatory analyses, monetized impacts would be analyzed in present value terms, applying a 3% discount rate for future years. Impacts that cannot be quantified and monetized would be assessed qualitatively.

3.1. Baseline scenario

The baseline scenario would be based on the most recent greenhouse gas (GHG) inventory and projections.[3] It would include the federal carbon pollution pricing backstop system (the federal backstop system) and would include the future impact of relevant policies and measures taken, or announced in detail, by the federal, provincial and territorial governments as of the fall of 2018. Key macroeconomic variables such as gross domestic product (GDP), the exchange rate and inflation are aligned to Finance Canada's projections. Population growth projections are obtained from Statistics Canada and updated in consultation with provinces and territories. Forecasts of oil and natural gas prices and production are taken from the National Energy Board's most recent Canada's Energy Future publication.[4]

3.2. Regulatory scenario

In the regulatory scenario, compliance with the proposed CFS Regulations for the liquid stream would result in incremental domestic GHG emission reductions, capital and operating costs for industry to comply and generate credits, as well as administrative costs for both industry and government. Increased compliance costs would also be expected to have an impact on the demand for energy and therefore on economic output and emissions (see section 5.3).

The liquid fuel stream carbon intensity reduction requirement of 10 g CO_2e/MJ corresponds to an annual credit compliance obligation of approximately 26 megatonnes (Mt) and up to 23 Mt of incremental GHG emissions reductions in 2030. Some compliance actions taken under the CFS are expected to be attributable (or partially attributable) to other federal and provincial policies and/or industry action, that would have occurred in the absence of the CFS. Given this, it is expected that not all of these actions, and the costs and emission reductions associated with these actions, would be attributable to the CFS in the CBA.

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[2] Government of Canada's Cabinet Directive on Regulations: Policies, guidance and tools

[3] For more information, refer to Canada's GHG emissions projections.

[4] For more information refer to the National Energy Board's publication on "Canada's Energy Future".

3.3. Key benefits

It is expected that the CFS would result in significant incremental GHG emissions reductions. Emissions reductions would be estimated for various compliance scenarios. To monetize the benefits, the social cost of carbon (SCC) would be applied to the expected GHG emissions reductions. The SCC is a measure of the incremental additional damages that are expected from a small increase in carbon dioxide (CO_2) emissions (or conversely, the avoided damages from a decrease in CO_2 emissions). Estimates of the SCC provide a way to value CO_2 emission changes in CBA and compare them to the incremental costs of abatement.[5]

There could also be some potential co-benefits due to emissions reductions in air pollutant emissions for certain compliance pathways. Emissions of air pollutants (such as particulate matter) affect health and contribute to air pollution problems such as ground level ozone, haze, and acid rain.[6] Reductions in air pollutant emissions would improve air quality and could lead to some additional health and environmental benefits. Air quality impacts would be assessed qualitatively and the analysis would look at the degree to which these impacts could change the net result of the CBA. Preliminary information obtained to date suggests that changes in air quality would not have a substantive impact on the net result of the CBA.

3.4. Key costs (and savings)

The compliance cost impacts would be assessed by identifying the one-time costs, and ongoing costs and savings where possible, using available evidence. Where there is insufficient cost information, pathways could be assessed qualitatively, as low, medium or high cost with a range of costs to be determined. Voluntary credit-generating costs would be estimated in a similar manner as compliance costs for fossil fuel primary suppliers (regulated parties). Resource costs are directly incurred as a result of the generation of credits, not as a result of the purchase of credits. Therefore, the CBA would treat credit purchases as a transfer payment between parties and thus not a cost to society as a whole. In addition, if credit-generating actions are expected to occur in the absence of the CFS, they would not be attributed to the CFS, and would thus not result in incremental costs.

It is expected that government and industry would incur incremental administrative costs as a result of the CFS. In order to implement the CFS, the Department would incur additional costs related to typical administration, compliance promotion, monitoring and enforcement costs, as well as specific one-time administrative costs related to the design and development of a credit transaction system, the Fuel Lifecycle Assessment Modelling Tool, and the electronic reporting system. Resources would also be required in order to operate and enforce the credit transaction system, verify compliance pathways, as well as to update these tools and systems.

[5] Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates

[6] For more information refer to ECCC's website on the Air Pollutant Emission Inventory report

Enforcement costs would include estimates of the number of new inspections required, as well as the annual costs of inspections and enforcement measures, based on the number of new regulated parties.

Industry would incur administrative costs to comply with the CFS. For example, companies would have annual reporting and verification requirements, would be required to register to the credit transaction system and would be required to submit documentation to verify lower-emitting fuel pathways. Administrative impacts on industry would be evaluated using the Government's Regulatory Cost Calculator, a tool used to monetize increases or decreases in administrative costs on business.[7] The methodology used for the CBA would be similar to those that were used for recent regulations (such as the *Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds: Upstream Oil and Gas Sector*).[8]

3.5. Pathway modelling, data and analysis

The CFS is intended to be flexible on how fossil fuel primary suppliers can comply. Given this, it is not possible to forecast and monetize all possible pathways that may exist now and in the future. To assess CFS impacts, the CBA would identify a representative set of compliance pathways for each category (actions that reduce the carbon intensity of the fossil fuel throughout its lifecycle; supplying low-carbon fuels; and specified end-use fuel switching).

To the extent possible, the representative compliance pathways used for the CBA would consider what has occurred in other jurisdictions with similar policies (such as California's *Low Carbon Fuel Standard*), as well as pathways that are technologically ready and/or commercially available today. The analysis would attempt to identify the technical and/or economic limits to achieving reductions under each compliance pathway, in order to establish an upper bound on the amount of credits that could possibly be generated for each pathway.

Data sources used to determine the benefit and cost impacts for each representative compliance pathway would be obtained from a literature review of available online sources, papers, studies and data (such as, the IHS report on the *Greenhouse Gas Intensity of Oil Sands Production: Today and in the future* or from reports by the Kent Group like *Canada's Downstream Logistical Infrastructure: Refining, Biofuel Plants, Pipelines, Terminals, Bulk Plants & Cardlocks*).[9,10] Data would also come from internal studies and sources of information (such as the Natural Resources Canada study on the *Deployment of Mid-level Ethanol Blends* or data

[7] For more information on cabinet policies and how they would be assessed refer to the Cabinet Directive on Regulations: Policies, guidance and tools

[8] For more information refer to the: Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds: Upstream Oil and Gas Sector

[9] For more information, refer to the IHS Markit website found here.

[10] For more information, refer to the Kent Group LTD website found here.

from the Department's Energy, Emissions and Economy Model for Canada).[11] Information obtained through consultations with the technical working group would also be considered to support the analysis.

Currently, there are no models within the Department designed to model emission reductions, credit supply or economic impacts of a CFS policy in detail. The Department is currently developing a Fuel Lifecycle Assessment Modelling Tool and is updating existing economic models to assess the CFS. The CBA may use new and updated models for publication in the *Canada Gazette*, Part II, should they become available in time, and as appropriate. For publication in the *Canada Gazette,* Part I, the CBA would assess each potential pathway in terms of emission reductions and compliance costs through a partial equilibrium analysis. This analysis would assume that the demand for energy remains constant and would not include energy price impacts on GDP and GHG emissions, and can also be referred to as a static analysis.

4. Impacts from categories of credit-generating actions

The CFS would have three main categories of compliance and credit-generating actions: (1) actions that reduce the carbon intensity of the fossil fuel throughout its lifecycle; (2) supplying low-carbon fuels; and (3) specified end-use fuel switching. The CFS would also have other mechanisms in place to allow for some compliance flexibility. Impacts from these categories of compliance and credit-generating actions as well as compliance flexibilities are described below.

4.1. Actions that reduce the carbon intensity of the fossil fuel throughout its lifecycle

It is expected that parties may be able to take actions along the lifecycle of fossil fuels that reduce the carbon intensity of the finished fuel. Credit-generating actions may include, but are not limited to, process improvements, electrification, switching to lower carbon fuels in the production process and carbon capture and storage. These actions could be taken by liquid fossil fuel primary suppliers (e.g., refinery) and by voluntary credit-generators upstream or downstream of a refinery (e.g., oil sands producer).

The CFS is intended to be flexible by providing fossil fuel primary suppliers and voluntary parties with a range of pathways that they could choose to meet their compliance obligations and generate credits. There is uncertainty about the type of process improvements that would be chosen, their costs, credit generation and GHG reduction potential, as well as the extent to which uptake of process improvements would occur in the absence of the CFS. Therefore, it is

[11] A summary of, and access to the full Natural Resources Canada report on the "Deployment of Mid-Level Ethanol Blends" can be obtained on the Government of Canada's website found here.

unclear how many credits would be incremental reductions that could be attributable to the CFS. The Department welcomes feedback and suggestions on costs and the degree to which each compliance pathway could be attributed to the CFS as well as methods for determining incrementality.

4.2. Supplying low-carbon fuels

Credits could be generated by supplying low-carbon fuels for use in Canada. Based on similar policies in other jurisdictions (e.g., British Columbia, California), the most-likely representative compliance pathway under this credit-generating category would be to increase the amount of low-carbon fuel (e.g., ethanol, biodiesel, etc.) blended with fossil fuels (e.g., gasoline, diesel, etc.). Low-carbon fuel producers and importers (the voluntary credit-generators) would earn credits for providing low-carbon fuels. The most-likely compliance pathways for blending are expected to be as follows: ethanol in gasoline, biodiesel in diesel and hydrogenation-derived renewable diesel (HDRD) in diesel.[12,13]

In the baseline scenario, the federal *Renewable Fuels Regulations* require petroleum producers and importers to have an annual average of 5% renewable fuel content in gasoline (met with ethanol) and 2% renewable fuel content in diesel fuel and heating distillate oil (met with biodiesel and HDRD) based on volume.[14] However, some provinces blend at higher rates due to their own renewable fuel mandates and low carbon fuel standards, which have increased the national average blend rate up beyond the federal mandate in recent years. The same volume of renewable fuel used to meet the volumetric mandate of the *Renewable Fuels Regulations* may be used to generate a credit under the CFS. However, given that these actions would have occurred in the absence of the CFS, they would not result in incremental costs or GHG emissions reductions in the CBA.

In the absence of the CFS, the likelihood of increased blending above existing blend mandates and policies is low, since it is generally more expensive to blend low-carbon fuel with fossil fuel. Given this, the increased use of low-carbon fuels above baseline levels is expected to be attributable to the CFS. Therefore, these costs and the associated emission reduction benefits that are expected to occur above baseline levels would be attributable to the CFS.

In the regulatory scenario, it is expected that low-carbon fuel blending would increase above baseline levels. The CBA would assume that low-carbon fuels are blended up to their expected technical and/or economic limits (e.g., vehicle compatibility or feedstock supply limits leading up to 2030) to determine the maximum amount of credits that could be generated for each

[12] A diesel substitute produced from vegetable oils or waste residues made by an esterification process, also called "fatty acid methyl esters" (FAME).
[13] A diesel substitute produced from vegetable oils or waste residues made by a hydrotreating process, also called "hydrotreated vegetable oil" (HVO) or "renewable diesel."
[14] For more information, refer to the Government of Canada's website on the *Renewable Fuel Regulations*.

blend pathway. To determine how many of these credits would result in incremental GHG reductions, the technical and/or economic limits would be compared to the baseline level of blending.

It is expected that regulated and non-regulated parties affected by the CFS would incur the following cost impacts in order to increase the amount of blending with low-carbon fuels. Producers and importers (the voluntary credit-generators) would supply low-carbon fuels for use in Canada. If low-carbon fuels are supplied domestically, domestic low-carbon fuel suppliers would incur production costs (capital and operating) to build additional capacity. Refiners and terminals (a non-regulated party) would incur net incremental ongoing costs of purchasing low-carbon fuel over fossil fuel, as well as transportation costs to obtain low-carbon fuel. Differences in energy content between low-carbon fuels and fossil fuels would be taken into account.

Terminals would also have to store fossil fuels with higher volumes of low-carbon fuel to meet increased demand due to the CFS. It is expected that they would incur capital and operating costs to install or upgrade infrastructure (such as the installation of additional storage or shipping capacity). Retailers and card-locks (a non-regulated party) would have to provide blended fuel to end-users and are expected to incur capital costs to install tanks and dispensers with higher blending capabilities. The average upfront one-time and ongoing costs for each affected party would then be applied to the estimated number of affected parties to obtain total costs for each blending pathway.

4.2.1. Domestic low-carbon fuel production

The low-carbon fuel supply required for the CFS could be met through imports or domestic production. The CFS would require the use of the Fuel Life Cycle Assessment Tool to calculate facility-specific carbon intensity values, and the same requirements would apply to imported low-carbon fuels. The CFS would allow producers and importers of low-carbon fuels to generate credits based on the amount they supply annually to the Canadian market.

A consistent CFS regulation could provide a reliable and predictable market signal to investors that could encourage increased domestic low-carbon fuel production. The CFS would have the same lifecycle analysis conducted on imports. With no differentiation in the way lifecycle carbon intensity analysis is conducted between domestic and imported low-carbon fuels, firms may elect to import low-carbon fuels, should the option be cheaper than domestic production. Given this, the CBA would consider how much of the demand increase is expected to be captured through domestic capacity expansion versus imports.

The CFS could also incent low-carbon fuel producers and importers to use lower-carbon feedstocks and processes. Consideration is also being given to include some criteria that could provide incentives for low-carbon fuels to be produced in a way that protects against adverse

indirect land use changes. The advanced low-carbon fuel sector is still an emerging industry and as such, there is more uncertainty on the variability of business models, technical abilities, and market demand, in comparison to traditional low-carbon fuels and fossil fuels.

As the CFS is intended to be a credit-based system, it is expected that new low-carbon fuel producers would only benefit from the CFS once production is underway. Upfront capital cost barriers could act as a limiting factor towards quick development and adoption of new low-carbon fuel facilities or expansions of existing facilities. As a result, the CBA would consider the degree to which the CFS could incentivize the expansion of a low-carbon fuel industry in Canada.

4.3. Specified end-use fuel switching

End-use fuel switching occurs when an end-user of fuel changes or retrofits its combustion devices to be powered by another fuel or energy source (such as electricity, natural gas, propane and hydrogen in transportation). A representative compliance pathway would be electricity used by electric vehicles (EVs). Home charging of EVs would generate credits for distribution utilities, public charging would generate credits for network operators, and private/commercial charging would generate credits for site hosts.

Distribution utilities, site hosts and network operators (voluntary credit-generators) would generate credits proportional to the avoided emissions when factoring lifecycle emissions of the gasoline or diesel being displaced, and of the electricity used to charge the EVs. A baseline of existing electricity used in EVs for a reference year (e.g., 2016) would be considered in the methodology for the calculations for credits.

It is expected that the EV market would continue to expand in the baseline scenario in the absence of the CFS, with corresponding increases in electricity consumption as a substitute to gasoline and diesel. Other policies (such as provincial subsidies) would also create incentives for EV uptake and infrastructure to be built.[15] Fossil fuel primary suppliers would have the option to purchase credits from electricity distributors, network operators and site hosts, therefore acting as a subsidy for electrification. This subsidy on its own and without other policies factored in would not likely be sufficient to incentivize investment that supports measurable EV uptake. Investments made solely on the basis of generating EV credits in the future, and the associated revenue, would be unlikely since voluntary credit-generators would have little guarantee that their initial investment would drive EV uptake. However, it would provide another incentive that could work in conjunction with other federal and provincial EV policies to increase EV deployment.

[15] Springel, K., (2017). "Network Externality and Subsidy Structure in Two-Sided Markets: Evidence from Electric Vehicle Incentives".

4.4. Compliance flexibilities

In addition to generating or acquiring credits from other participants in the credit trading system, the CFS would provide additional compliance flexibilities. These flexibilities would be treated as follows in the CBA.

4.4.1. Market stability mechanisms

The Department is considering using an emissions reduction fund as a market stability mechanism to establish a specified price level. Consideration is also being given to a market clearing mechanism, which would be activated if a fossil fuel primary supplier has insufficient credits for compliance. Parties with credits would be able to pledge credits for sale in this market with a specified price limit.

Both mechanisms would function as a price cap on regulatory compliance for industry. The CBA would treat this price level as an upper bound estimate of compliance costs (without consideration of GDP impacts). For actions where there is a lack of information, the CBA could also assume that the costs are equivalent to the specified price level.

An emissions reduction fund contribution could be considered as a transfer payment in the CBA. Transfer payments are financial payments made in which no goods or services are being paid for, and are typically netted out of the CBA since the cost of the payment is offset by an equal but opposite benefit. The CBA may describe the benefits qualitatively given uncertainties about the magnitude and incrementality of eventual benefits. It may also estimate the societal costs at the specified price level and would therefore explicitly show the transfer, understanding that it would cancel out in the final calculation of costs and benefits.

4.4.2. Additional compliance flexibilities

Obligation carry-forward: The CFS would allow 10% of a company's annual carbon intensity compliance obligation (CO_2e exceedances) to be carried-forward into the next compliance period, with a maximum carry-over of 2 years and a 20% annual interest penalty. The CBA would assume that the market clears at the end of each compliance period.

Early credit-generation: The CFS would also allow credits to be generated from each fuel stream (liquid, gaseous and solid) beginning on the date of publication of the final regulations for the liquid fuel stream, which is expected in 2020. All solid or gaseous fuel credits generated before the solid or gaseous fuel stream regulations come into effect could be banked for future compliance. It is expected that there would be limited incentive for firms to generate credits early unless they are relatively low cost and therefore relatively likely to occur in the absence of

the CFS. Given this, it is unlikely that the CBA would attribute the costs and the benefits of early credit-generating actions to the CFS.

Trading between streams: When requirements for the liquid fuel stream come into effect, a fossil fuel primary supplier would be able to meet up to 10% of its liquid fuel stream obligation with credits from the gaseous, or solid fuel streams. The incremental cost and benefit impacts of pathways occurring under the other two streams would be assessed similarly to the liquid stream pathways as described in section 3, the Analytical Outline.

5. Cumulative impacts

5.1. Interaction between pathway categories

Offering a broader range of credit-generating pathways versus limiting pathways to those most likely to yield incremental GHG reductions would provide compliance flexibility, but it may result in compliance credits being allocated for certain activities that would have occurred in the baseline scenario. Given this, some compliance pathways may lead to non-incremental actions receiving credits that would substitute for incremental actions. If GHG emission reductions are not attributable to the CFS, the associated costs of achieving those reductions would also not be attributable to the CFS.

The CBA would aim to provide some form of relative ranking of pathways by the expected cost per tonne. Assuming that firms are profit-maximizing, it is likely they would choose the lowest cost compliance pathways first until their compliance obligation is met. The CBA would attempt to establish a distinction between attributable and non-attributable impacts.

5.2. Interaction between CFS and carbon pollution pricing

Fossil fuel primary suppliers may not use credits that have been generated under another federal, provincial or territorial program or regulations, such as credits from the federal backstop system, for compliance under the CFS. However, as mentioned in the Regulatory Design Paper, the CFS would allow the generation of credits for actions that also generate credits or comply with federal, provincial or territorial carbon pricing systems as long as these actions are otherwise compliant with the CFS.

For example, a refinery that undertakes a process improvement that reduces the carbon intensity of its facility may be entitled to surplus credits under the federal Output Based Pricing System. That same process improvement might also reduce the carbon intensity of the fuel it supplies. Credits would be allowed under the CFS for that process improvement. Similarly, actions taken in response to provincial or territorial carbon pricing systems could also generate credits under the CFS. In this sense, the CFS may complement carbon pricing systems by

sending a stronger price signal for change in the production and use of fossil fuels by creating a double-incentive.

For publication in the *Canada Gazette*, Part I, the baseline scenario for the CFS would include the federal backstop system as well as provincial and territorial carbon pricing policies that are in place or announced in detail as of fall 2018. For example, the CBA would assume that actions are not attributable to the CFS if they overlap with the federal backstop system and are expected to cost below $50 per tonne (given that the Greenhouse Gas Pollution Pricing Act sets a carbon price of $50 per tonne of CO_2e by 2022, with reviews in 2022).[16]

5.3. Energy price impacts on GDP and GHG emissions

The potential scale of the CFS is large enough that there could be meaningful price effects on energy that could lead to changes in GDP and GHG emissions. Incremental compliance costs to regulated parties as a result of the CFS would likely be passed onto fuel end-users (i.e., households and industrial users) to some extent through increased liquid fossil fuel prices. This would make lower carbon energy sources (e.g., electricity or hydrogen) relatively less expensive in comparison. This price effect would lead to decreased end-use demand for fossil fuels and increased end-use demand for lower carbon energy sources, which could result in additional emissions reductions. These impacts could only be assessed once compliance costs have been estimated, and a CFS-specific macroeconomic model has been developed. It may not be possible to develop such a model for publication in the *Canada Gazette*, Part I. However, energy price impacts on GDP and GHG emissions would be considered as part of a distributional analysis.

5.4. Distributional analysis of impacts

The CBA presents the benefits and costs to Canadian society as whole. However, these impacts may not be uniformly distributed across society so the analysis would consider a range of distributional impacts. The compliance costs associated with the CFS would likely vary by region and by sector, and the CBA would present a breakdown of impacts by total compliance costs and cost per tonne. The analysis would compare the total costs of compliance as a proportion of the total costs of business by sector and put costs into context via other relevant metrics. The analysis would also consider the likelihood that compliance costs are passed onto consumers of fuels and the impact this may have on households and on the competitiveness of other sectors of the economy. In addition, the distributional analysis would also consider the degree to which the CFS could provide incentives for investment in lower carbon energy sources that could benefit clean technology sectors.

[16] For more information on the federal backstop system refer to the Technical paper: federal carbon pricing backstop and the Pan-Canadian Approach to Pricing Carbon Pollution.

6. Uncertainty of impact estimates

Where possible, sensitivity analyses would be included in the CBA to assess the impact of changes to key parameters, which may be higher or lower than indicated by available evidence, on the expected results of the CFS. To address these issues, the analysis may consider alternate scenarios (e.g., high, low) to assess the impacts under alternate conditions. Key parameters and uncertainties include, but are not limited to the following:

Price and production forecasts: The analysis would be sensitive to the assumptions and forecasts for energy prices over the relevant time period, which would impact production forecasts. To address this, the analysis may consider presenting high and low scenarios for fuel and energy price forecasts.

Future policies: The analysis would assume that no other new policies come into force before 2030.

Pathway choice: There is a range of compliance pathways that regulated parties could choose to meet their compliance obligations, and the pathways that would be proposed by industry are uncertain. The CBA may consider demonstrating alternative compliance scenarios or upper bound cost and benefit estimates to show a range of possible impacts.

Low-carbon fuel assumptions: The analysis would be sensitive to assumptions around the low-carbon fuel content composition, the expected amount of imports versus domestic production of low-carbon fuels, as well as the assumed feedstock contribution to low-carbon fuel volumes. To address this, the CBA may consider presenting high and low scenarios for these parameters.

Emissions reduction fund benefits: Given the absence of a rigorous means to forecast the benefits of future projects, a sensitivity analysis may be required to test different assumptions regarding the potential returns from emissions reduction fund investments.

Benefits valuation: The values used to determine the benefits of the CFS are also subject to uncertainty. To address this, the CBA could present scenarios where the SCC estimate is lower or higher than the central case.

7. Next steps

This CBA framework outlines the Department's approach for analysis for the 2019 publication of the RIAS in the *Canada Gazette*, Part I in spring/summer. All feedback will be under careful consideration in the development of the analysis.