Output-based Allocations Discussion Document

Contents

Overview and Context

In November 2015, the Government of Alberta (GOA) announced its Climate Leadership Plan, outlining areas where the province will take action to reduce greenhouse gas emissions. The plan ensures that Alberta and our industries thrive in a carbon competitive global market and supports diversification of our economy.

The plan includes a transition from the current Specified Gas Emitters Regulation to a carbon competitiveness system that will give output-based emissions allocations to emissions intensive, trade-exposed industries. Output-based allocations will reduce the average cost of compliance for some industries while ensuring that top performing facilities are rewarded. The purpose of this system is to drive best-in-class performance, support comparability with international jurisdictions, and maintain competiveness of industries in Alberta.

Purpose of the Discussion Paper

The purpose of this Discussion Paper is to start to frame an informed, solutions-oriented discussion around options for the development, transition and implementation of output-based allocation system.

This Discussion Paper proposes:

- Principles to guide the development and implementation of the output-based allocation system;
- Principles to guide the engagement;
- Engagement approach; and
- Engagement scope.

Principles of the output-based allocation system

Encourage Meaningful Emissions Reductions
The transition away from facility-specific regulations to a carbon competitiveness approach will ensure that incentives exist for continuous improvement. This includes consideration of the current system rigour and anticipated future impacts to ensure further reductions are achieved.

Flexible
Emission allocations will work for all facility configurations in Alberta. The allocations will be designed to enable continuous learning and adaptation to new information, new types of industries and facility configuration, and the changing policy landscape outside of Alberta.

Efficient
To the extent possible, compliance costs will be contained by providing compliance flexibility aligned with the Specified Gas Emitters Regulation.

Minimize Carbon Leakage and Competitiveness Risks
Emissions allocations are granted to take into account sector trade-exposure and emission intensive industries to minimize competitiveness impacts that could shift activity to other locations with no real global emissions reductions (emissions leakage).

Predictable

Allocations will be set and reviewed based on a structured process that provides predictable outcomes for all regulated parties and stakeholders. Decisions on final emissions allocations will be made as soon as possible. This will allow responsible parties to maximize emissions reductions, minimize costs, and ensure compliance with all requirements when they come into effect in 2018.

Consistent
Principles and decision-making processes will apply consistently within and across sectors and products. Any consideration for exceptional circumstances will be made consistently for all facilities in a similar situation.

Similar industrial processes will receive similar treatment regardless of facility or sector. Information will be shared equally to all parties to avoid creating commercial advantage. Treatment of comparable facilities in other jurisdictions with greenhouse gas policies will be taken into consideration when setting and reviewing emissions allocations.

Allocations will be developed and implemented consistent with policy direction set out in Alberta's Climate Leadership Plan including the carbon levy on combustion emissions for transport and heating fuels, the reduction of emissions from coal transition, and the oil sands limit, as examples.

Administratively Simple
The system will be designed to ensure administrative ease in safeguarding compliance and facilitating ongoing improvements.

Verifiable
Data used to establish output-based allocations and data used to report annually against output-based allocations should be verifiable. Data will be subject to annual third party verification as a part of implementation of the emissions allocation approach.

Transparent
All greenhouse gas quantification methodologies to support the development, verification and review of the output-based allocations will be transparent, including emissions and product data. Where necessary, confidentiality will be protected. Summary data, assumptions, information and records of decisions will be shared as appropriate. The final allocations, and any associated regulations, standards, and other policies will be publicly available.

Principles of Engagement

Alberta's Climate Change Office seeks to engage stakeholders to garner feedback on key technical issues to inform the development of the output-based allocation system.

The following principles will guide the engagement process:

Transparent
Stakeholders are advised of the engagement and associated scope of engagement sessions. Input to the process will be summarized and made publicly available (the GOA will protect stakeholder identities, where necessary).

Solutions-focused
Stakeholders are empowered to bring forward solutions and recommendations that align with principles for output-based allocation establishment.

Consistent
The scope of the discussion will remain the same across all stakeholder groups to ensure "fairness" in application. Engagement materials provided to all stakeholders will be consistent.

Meaningful
Stakeholders' opinions are heard and considered in the development of options.

Engagement Approach

A series of invite-only technical workshops were held throughout fall 2016 and into 2017 with stakeholders from various industries, environmental organizations, academia, and think tanks. Workshops were divided into four groups:

- Group 1: Electricity and Heat
- Group 2: Oil and Gas
- Group 3: Chemicals, Fertilizers, Minerals and Metals, and
- Group 4: Coal Mines, Pulp and Paper, Landfills, and Food Processing.

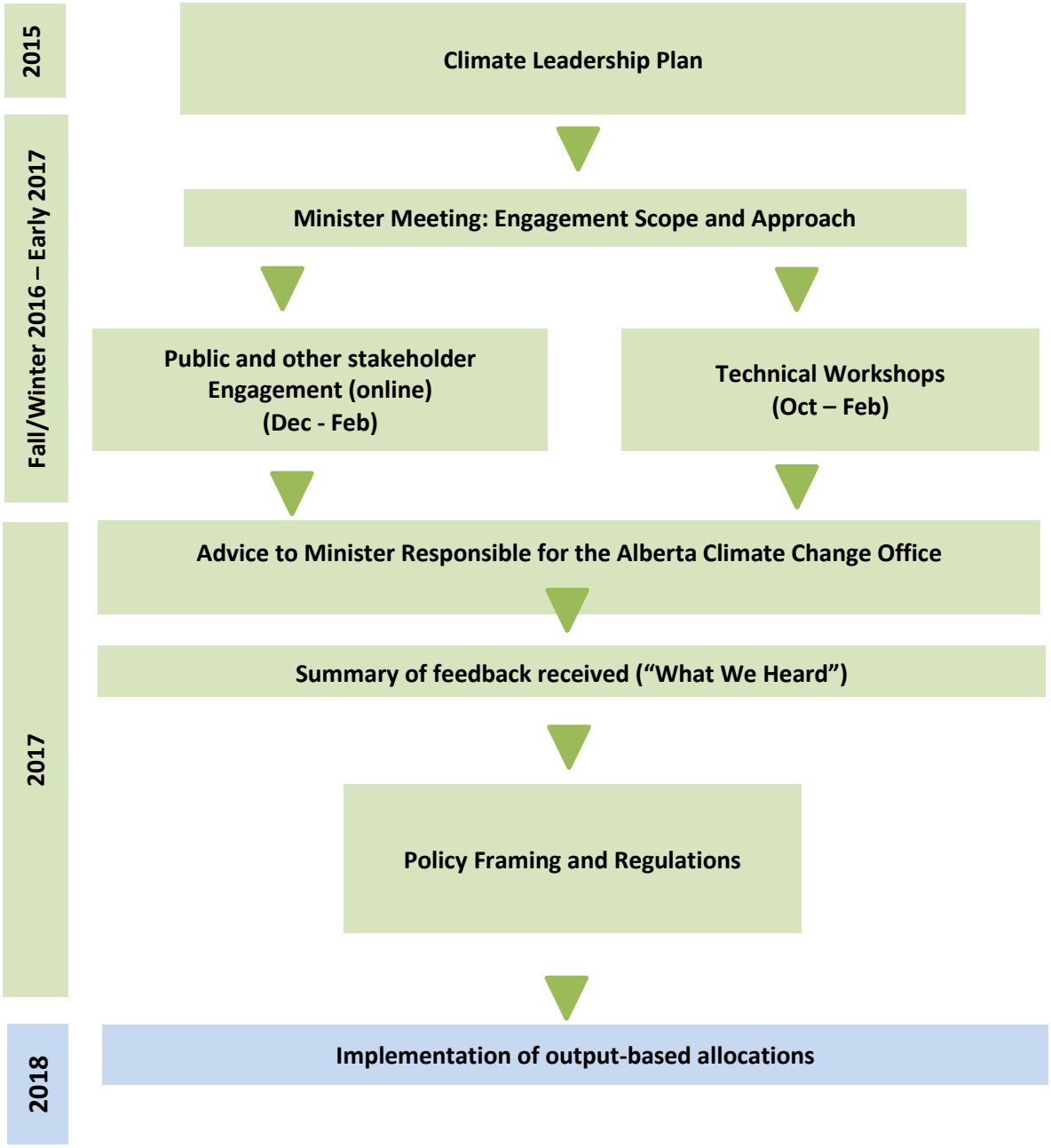
Engagement to inform the new output-based allocations system was undertaken concurrently for all industrial sectors and other stakeholders to enable consistent application of outcomes and principles as well as comprehensive assessment of the impact of this carbon pricing approach. Information sharing and data collection will support the development of the output-based allocations approach.

The workshops focused on gathering the information required to inform the development of output-based allocations, including understanding the implications of output-based allocation options on emissions reductions and competitiveness. The engagement process ensured that a comprehensive and credible assessment of potential implications is brought forward.

External conveners supported engagement by guiding technical workshops and helping to ensure diverse perspectives are represented and considered.

Dave Sawyer, a recognized national expert in climate change economics, is assisting the Climate Change Office in assessing the environmental, social and economic considerations to inform options and recommendations regarding the carbon competitiveness approach and the output-based emissions allocations.

Output-based Allocations Engagement Summary



Engagement Scope

The following are proposed considerations that will guide scope of engagement in developing output-based allocations. Please also note “out-of-scope items” in the next section for additional clarification.

Output-based Allocation Product Categorization

The transition to the output-based allocation system requires refinement of categories for various products produced by facilities that emit above the 100,000 tonne per year threshold. Today these facilities include and produce the following:

Electricity Production
Electricity generation occurs at industrial and grid scale electricity generation in Alberta as well as behind the fence generation used within a facility in the calculation of their overall compliance obligation.

Heat Production and Usage
The most common emissions source across all industrial facilities is fuel combustion for process heating. Heat integration between neighbouring facilities is an important opportunity to improve efficiency.

Hydrogen
Hydrogen is an integral component to industrial facilities across multiple sectors in Alberta, and is an integral part of many emerging technologies, especially in value added sectors. It is frequently transferred between facilities, an innovation that helps improve efficiency and reduce waste. Hydrogen is manufactured in multiple types of processes in Alberta (steam methane reforming, shift reactions, gasification, etc.).

In-situ Bitumen Extraction
In-situ steam injection is an enhanced oil recovery method and is the main type of thermal stimulation of heavy oil (bitumen) reservoirs in Alberta. The two main types of in-situ steam injection practiced in Alberta are Cyclic Steam Stimulation and Steam Assisted Gravity Drainage.

Oil Sands Mining and Extraction
Oil sands mining involves the use of open-pit mines to recover bitumen deposits located within 75 metres of the surface. Bitumen extraction refers to the initial gravity separation of bitumen, sand, and water in a primary separation cell.

Upgrading
Bitumen upgrading refers to the breakdown or conversion of large “heavy” hydrocarbon molecules into lighter molecules by coking using thermal energy, or hydrogenation (adding hydrogen in the presence of a catalyst). The final product can be shipped by pipeline to refineries for processing into various petroleum products.

Refining
Petroleum refining involves processing crude oil feedstock into various useful products such as gasoline, diesel fuel, kerosene, naphtha, heating oil and liquefied petroleum gas.

Natural Gas Transmission Pipelines
Pipeline systems typically consist of a mainline fed by several lateral lines. Gas or liquids enter the system from various local lines with lateral compressors used to boost the pressure of the collected gas/liquids to mainline pressure.

Natural Gas Processing
The gas production process includes the removal of water, sulphur and other impurities from raw natural gas and the separation of natural gas into methane, ethane and other natural gas liquid components. Gas plants are designed according to the volume and composition of the gas received and the desired products.

Chemicals
In Alberta, the chemical manufacturing sector is unique in that no two facilities are alike. Large chemical facilities produce a wide variety of products that have varying greenhouse gas emissions intensity.

Products produced in Alberta's chemical sector include the following:

Carbon black	Fine particles of carbon which are used in rubber compounding, pigments, printing inks and additives.
Styrene	Hydrocarbon liquid used in the production of rubber, plastic, insulation, fiberglass, pipes, automobile and boat parts, food containers and carpet backing. Styrene is made using a two stage process where benzene and ethylene react to form ethylbenzene, which is then dehydrogenated to form a styrene monomer.
Linear Alpha Olefins (LAOs)	Hydrocarbons used as chemical intermediates for a variety of surfactants, lubricant additives and drilling fluids. These LAOs are manufactured using a process of chain growth of ethylene on a triethylaluminium base to produce a mixture of longer-chain aluminum alkyls.
Ethylene	Produced by thermally cracking ethane, propane or other saturated hydrocarbon feedstocks at high temperature to crack the carbon-hydrogen bonds.
Ethylene oxide	Made by catalytic partial oxidation of ethylene with air or pure oxygen. About 80 per cent of ethylene feed is converted to ethylene oxide and 20 per cent to carbon dioxide and water in the reaction.
Ethylene glycols	Produced by reacting ethylene oxide with water and separating the pure substances from the aqueous solution.
Polyethylene	Produced by the catalytic polymerization of ethylene and co monomers to produce solid granules or pellets, which are shipped to plastics processors.
Isooctane	Formed in an alkylation process and is used as a fuel additive in gasoline.
Methanol	Methanol is used as a feedstock to produce chemicals such as acetic acid and formaldehyde.
Hydrogen	Produced from steam methane reforming, hydrogen is largely used by refineries and upgraders.

Fertilizers
Currently, Alberta has four ammonia-producing fertilizer facilities that are subject to the Specified Gas Emitters Regulation. The facilities produce ammonia as the main product and a variety of coproducts. Ammonia production involves the reaction of nitrogen with hydrogen. Hydrogen is generated by the catalytic steam-methane reforming process where light hydrocarbons react with steam over a catalyst to produce hydrogen and carbon dioxide.

Alberta has one facility that produces nitric acid as an intermediate product in the production of ammonia nitrate.

Coal Mines
Coal mining is characterized by surface mining operations involving the use of drilling equipment, explosives, and heavy-duty diesel equipment to mine and transfer coal to storage piles. Some coal operations clean and process coal, which may include coal or natural gas emissions from coal dryers. There are not currently any underground mining operations in Alberta.

Minerals
Mineral production facilities currently subject to the Specified Gas Emitters Regulation in Alberta include magnesia, cement and lime producers.

Cement and lime are made by controlled high-temperature burning of calcium carbonate rocks in horizontally-mounted rotary kilns. Magnesia, calcined magnesium oxide, is made from the calcination of magnesium carbonate.

Metals
There is currently one metal manufacturer subject to the Specified Gas Emitters Regulation. This facility is unique in that it produces nickel and cobalt along with other emissions intensive co-products such as ammonia.

In this process, the nickel/cobalt ore is leached with ammonia in a hydrometallurgical process to dissolve the nickel and cobalt metals into metal-rich solutions. Nickel metal is recovered by precipitating by-products. Cobalt metal powder is recovered using hydrogen and sulphuric acid.

Calcined Petroleum Coke
Calcined petroleum coke can be used to make carbon anodes for aluminium, steel and titanium smelting processes. Calcined petroleum coke is produced by heating petroleum coke feedstock to high temperatures.

Pulp and Paper
Alberta has four chemical pulp mills, which use the kraft process, currently subject to the Specified Gas Emitters Regulation.

Landfills
Landfills represent an accumulated stock of waste material received for permanent disposal. The only materials that flow out of landfills are liquid leachate and landfill gas, which are generated from anaerobic decomposition of organic matter found in municipal solid waste. There is currently one landfill that is subject to the Specified Gas Emitters Regulation.

Food Processing
One large food processing facility is currently subject to the Specified Gas Emitters Regulation. The majority of emissions are from waste and wastewater on-site, specifically anaerobic lagoons.

Considerations for Implementing Output-based Allocations

As a starting point, we reference the Climate Change Advisory Panel Report recommendations for engagement on the output-based allocation system.

The engagement will serve to inform the methodology and principles that will be used to generate draft allocation options. Consideration will be given to the following elements as part of the output-based allocation engagement process.

Output-based Allocations
The Climate Change Advisory Panel (the Panel) recommended that output-based allocations reflect top quartile performance or better. For electricity generation, the Panel proposed that output-based allocations would be based on a "good-as-best-gas" generation standard, which specifies the product benchmark as the least emissions-intensive natural gas-fired generation system in Alberta. For refining and upgrading, the panel recommended consideration of a top decile global standard.

Reduction Schedules
The Climate Change Advisory Panel proposed that output-based allocations be reduced at a pre-determined annual rate, called the tightening or ramping rate, at (1-2 percent) to drive reductions in emissions. Consideration could also be given to emissions from industrial process (carbon dioxide emissions from chemical reaction other than combustion where the product of the industrial process is integral to production and not combusted, vented, or otherwise wasted) which are considered difficult to reduce without decreasing production.

Existing Facility Treatment
Existing facilities already in operation prior to 2017 are expected to be subject to the output-based allocation approach starting in 2018.

New Facility Treatment
The Specified Gas Emitters Regulation allows three years of operation prior to establishing a baseline. Compliance obligations are ramped in starting in year four, over a period of six years. The gradual target ramp up was intended to recognize that newer facilities should be better performing than existing facilities and thus, would need more time to find intensity reduction opportunities.

With the shift to an output-based allocations approach, it may no longer necessary to wait for a representative period of facility operation to establish a baseline because output-based allocations will already be in place. Also, if a new facility is outperforming sector peers, the output-based allocation system is intended to give recognition of this, so a long ramp up period is not needed.

A brief transitory period could be established to recognize the abnormal emissions profile during start-up of some new facilities, where the compliance obligation in this start up period may be reduced, but compliance will still be required. This transitory period compliance obligation could be achieved through mechanisms such as a buffer factor being applied to those facilities in any sector that have significant process / emission variability in first stages of operations.

Unique Facility Treatment
For facilities or products that are unique (only one or very few facilities produce the specific product), the output-based allocations could be based on their existing net emissions intensity limit under the Specified Gas Emitters Regulation (production weighted baseline emissions intensity*0.80) or adjusted to reflect top performing comparable facilities/processes in other jurisdictions.

Multi-product Facility Treatment
There are several facilities in Alberta that produce more than one product, and each product could receive an allocation based on that specific product. This would enable consistency across facilities that produce one product versus facilities that produce multiple products. This would also allow production differences that occur year to year at a multi-product facility to be addressed consistently.

Industrial Process Emissions
Industrial process emissions are defined by the Specified Gas Emitters Regulation as “direct emissions from an industrial process involving chemical or physical reactions other than combustion, and where the primary purpose of the industrial process is not energy production”. These emissions are reported under the current regulation but are not subject to a reduction target, under the assumption that the only way to reduce the emissions would be to reduce production. It is noted that some reduction opportunities within the industrial process exist including activities such as catalyst improvement and emissions capture.

Industrial process emissions could continue to be defined as in the Specified Gas Emitters Regulation. Standardized emissions performance for industrial processes applicable to specific sectors/sub-sectors could be established and incorporated into the output-based allocations. Their inclusion could be in a manner that does not penalize facilities for not reducing the emissions from the standard intensity for a given process, but provides an incentive to decrease emissions where possible or applies a cost if emissions are increased. Industrial process emissions could be excluded from any tightening of the output-based allocations over time recognizing the difficulty in reducing these emissions without reducing production.

Treatment of Indirect Emissions
The Specified Gas Emitters Regulation does not account for indirect emissions, other than in monitoring for material changes in imported energy or intermediate products (e.g. hydrogen) that affect baseline applicability. Indirect emissions could be included under the output-based allocation approach to more accurately reflect the emissions intensity of the production process.

In cases where facilities can switch between on-site combustion and electricity use, the risk of emissions leakage exists. Given the common output-based allocations for electricity generation, this standard could also be applied to total electricity use to calculate indirect emissions and prevent leakage. This would accurately capture the benefit of electrification if one exists, but avoid a perverse incentive. This treatment of indirect emissions from electricity could also be applied in the setting of output-based allocations. A similar treatment should be considered for other indirect emissions sources including hydrogen and heat.

Other Considerations

Quantification Standards / Guidance
Alberta's Climate Change Office will establish required standardized quantification methods for all facilities to ensure alignment between facilities and with broader provincial and national emissions reporting.

Some facilities may be required to update their measurement, monitoring and quantification procedures to meet the requirements of the standardized methodology. This may include increasing sampling or installing additional measurement equipment for highly uncertain sources.

The standardized quantification methodology will include:

- Standardized composition analysis and measurement frequency for produced gas, solid fuels, and other variable fuel types;
- Common approach to assumed carbon dioxide emissions per carbon content of fuel, methane destruction efficiency, etc.; and
- Standardized treatment of production across industries (e.g. sold carbon dioxide, hydrogen, heat, etc.).

Reporting
Reporting and compliance submissions under the output-based allocation approach also need to be defined, where currently the Specified Gas Emitters Regulation requires submission of a verified compliance report with true-up on an annual basis by March 31 in the following calendar year.

Review
Output-based allocations should be reviewed periodically to ensure they are meeting the objectives:

- drive best-in-class performance
- improve transparency and benchmarking
- maintain competiveness
- encourages meaningful greenhouse gas reductions

Review periods could be established (such as a set review every five years), or where a material discrepancy is found in the information used in setting the output-based allocations. Such a review would serve to ensure that output-based allocations are set based on best available quantification methodologies and continue to be appropriate for the specific product. Review would also ensure that favourable on-site activities that result in greenhouse gas emission reductions and are beyond best practices will continue to receive recognition under the output-based allocations approach.

Transition from Specified Gas Emitters Regulation

The following requirements currently embedded within the Specified Gas Emitters Regulation must also be considered in transition and implementation of the output-based allocation system:

- Annual audit/verification to reasonable level assurance.

- Facility level quarterly reporting and payment with final verified reporting and true up by March 31 of the following compliance year.
- Use of emission performance credits as a compliance flexibility mechanism.
- Use of carbon offsets as a compliance flexibility mechanism.
- Ability to make payment to the Climate Change and Emissions Management Fund as a compliance flexibility mechanism.
- Exemption of biomass carbon dioxide emissions from compliance obligation.

Emissions Trading System Transition

The transition to the output-based allocation approach also requires a transition of elements of the emission trading system. Notably, the eligibility to generate carbon offsets is transitioning under both the application of the carbon levy to transport and heating fuels and the transition to the output-based allocation system. For example, the establishment of electricity output-based allocations could modify the ability to generate carbon offsets for compliance use in Alberta; however, emission performance credits (or similar credit) may be generated under this approach in their place.

Alberta must also consider the treatment of existing carbon offsets and emission performance credits that were generated under the Specified Gas Emitters Regulation. As some activities will no longer be eligible to receive such credit, Alberta must establish requirements regarding the eligibility of such credits and their retirement. The transition needs to balance the recognition of early action and the need to reflect new requirements and incent new activities.

The following elements must also be considered in the transition to inform the emissions trading system associated with output-based allocations:

Compliance Flexibility
Compliance flexibility currently enables unlimited opportunity to make on-site reductions, retire emission performance credits, retire Alberta-based carbon offsets, or make payment to the Climate Change and Emissions Management Fund. Discussion of compliance flexibility mechanisms under the new output-based allocation system, such as carbon offsets, emissions performance credits, and fund units, will be considered.

Credit Holding Duration and Use
Currently carbon offsets and emissions performance credits have no expiry under the Specified Gas Emitters Regulation. The introduction of a credit expiry or holding limits (e.g. five to seven years) could mitigate the risk associated with data management and records not being available or associated with older credits that may have been generated under outdated program rules.

Out of Scope Items

The following items will be considered out of scope for the purposes of the output-based allocation system engagement.

- Implementation details related to:
    - the oil sands emissions limit;
    - phasing out of emissions from coal electricity production;
    - the Renewable Energy Program;
    - engagement on micro and community generation;

    - methane reduction target implementation; and
    - potential programming for Energy Efficiency Alberta.
- Output-based allocation system emissions threshold (i.e., 100,000 tonnes)
- Carbon price and schedule
- Revenue investment decisions

Not all elements of the emissions trading system will be considered in this engagement process. This engagement process may include elements related to compliance flexibility, crediting opportunities, credit periods, and trade requirements. This engagement process will not include broader design elements related to emission trading system regulations to ensure market stability (e.g., the European Union review of market system to ensure price stability).

Carbon Pricing
Alberta's two pricing approaches – the carbon levy on fuels and the output-based allocation system – are complementary in nature, where no double pricing of emissions is intended and where together they result in an economy-wide price on carbon.

Emission Limits for Oil Sands and Coal-fired Generation
A separate engagement process on the implementation of the oil sands emission limit is ongoing as is a separate analysis for electricity transition. Depending on the outcomes of these works, additional limits on use of credits generated in other sectors or banked from previous years could be established.

Glossary

Biomass - comprises the organic materials made from living organisms, such as crops, crop residue, trees, wood and animal residue that have stored sunlight in the form of chemical energy. Biomass can be used directly to produce biofuels or other products or it can be burned to create heat or electricity.

Carbon leakage - occurs when there is an increase in emissions in one jurisdiction as a result of an emissions reduction in a jurisdiction with a strict climate policy. Carbon leakage may occur if an emissions policy raises local costs thereby giving another jurisdiction with a more relaxed policy a trading advantage.

Carbon offsets - voluntary reductions in greenhouse gas emissions, which can then be purchased by another party to offset their emissions levels.

Carbon pricing - price on carbon emissions that provides a financial incentive for emitters to reduce their emissions. This can spur the adoption of technology, efficiency and conservation, and provides emitters with flexibility to reduce emissions in a way that best suits their individual processes, abilities and circumstances.

Carbon levy - Alberta's carbon levy is applied to heating and transportation fuels such as diesel, gasoline, natural gas and propane. Companies and consumers have the choice to pay the levy or to change behaviour to reduce emissions.

CO2e (carbon dioxide equivalent) - metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential.

Combustion emissions - direct emissions resulting from the combustion of fuel for the purpose of energy production.

Emissions-intensive and trade-exposed - refers to industrial emitters with a substantial exposure to emissions costs and that compete at a provincial, national and/or global level and are therefore exposed and vulnerable to competitive market conditions. Exact definitions vary across carbon policy implementation.

Emissions performance credits - credits issued for reductions in GHG emissions beyond the regulatory requirement as reflected in the output-based allocations. One tonne of CO2e reduced beyond the requirement is equal to one emission performance credit.

Emissions trading system - a system whereby regulated facilities can come into compliance by purchasing emissions performance credits, carbon offset credits and/or fund credits. This system provides a great level of flexibility to regulated entities to comply at the lowest cost.

Good-as-best-gas standard – recommended requirement by the Panel that an emitter produce no more greenhouse gas emissions per unit of production than the cleanest natural gas-fired generation system.

Greenhouse gas (GHG) - an atmospheric gas that absorbs and emits heat into the atmosphere. The primary greenhouse gases in the atmosphere are carbon dioxide, methane, nitrous oxide, ozone and water vapour.

In situ production - used for bitumen deposits buried too deep for surface mining. Steam, sometimes with additives like solvents, is injected through a well into the bitumen deposit to make the bitumen flow to the point it can be pumped to the surface.

Indirect emissions - emissions from imported inputs such as electricity or heat that are emitted off site and, therefore, not directly accounted for in the facility emissions inventory.

Industrial processes - direct emissions from an industrial process involving chemical or physical reactions other than combustion, and where the primary purpose of the industrial process is not energy production

Large industrial facilities or large final emitters - facilities that produce a large amount of direct greenhouse gas emissions. In Alberta, the Specified Gas Emitters Regulation sets this as 100,000 tonnes or more of carbon dioxide equivalent per year since 2003.

Methane - the main component of natural gas. Methane is an abundant fuel that can be found below ground and under the sea floor. While methane is a useful fuel source, when released directly into the atmosphere it becomes a greenhouse gas.

Natural gas - mixture of hydrocarbons. While mainly methane, other hydrocarbons include ethane, propane and butane. Water, oil, sulphur, carbon dioxide, nitrogen and other impurities may be contained in the gas when it is produced.

Oil sands or bituminous sands (bitumen) - naturally occurring mixtures of sand, clay or other minerals, water and bitumen. Bitumen is heavy and extremely viscous oil that is too thick to flow in its natural state and requires special methods to bring it to the surface.

Output-based allocations - free emission allocations distributed to greenhouse gas emitters for allowable emissions per unit of production of a specific good or product.

Perverse incentives - incentives that have an unintended and undesirable result which is contrary to the intended interests of the policy.

Quartile - statistical term describing a division of observations into four defined intervals based upon the values of the data and how they compare to the entire set of observations.

Refining - process of converting conventional and synthetic crude oil into oil-based products and petrochemical feedstock.

Renewable energy - comes from resources which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat. Alberta has a significant potential for increased renewable energy development across the province.

Specified Gas Emitters Regulation (SGER) - came into effect in 2007. It requires facilities that emit 100,000 tonnes or more of greenhouse gases a year to reduce their emissions intensity. In Alberta, the marginal price of carbon is set by the province under the SGER, being $30/tonne today.

Steam Assisted Gravity Drainage - production method used for bitumen deposits buried too deep for surface mining. Steam, sometimes with additives like solvents, is injected through a

well into the bitumen deposit to make the bitumen flow to the point it can be pumped to the surface.

Tightening or ramping rate - rate by which the output-based allocation could tighten (becomes more stringent) per year.

Upgrading - process of converting heavy oil or bitumen into synthetic crude oil so it can be handled by conventional light oil refineries. Upgrading often includes reducing viscosity so that it can be pumped through pipelines, separating out the heaviest hydrocarbons and reducing sulfur, nitrogen and metals as well as sediments and water.