Evaluation of Ontario's Cap and Trade Regulation

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Disclaimer

This report does not represent the views of any organization and are solely the views of the author.

Foreword

The study on *Energy Policy and Sustainable Energy Transitions* has been a special area of research for me, as it involved studying past regimes, discourses and policies that developed Ontario's energy sector. The *Green Energy Green Economy Act, 2009* rapidly evolved Ontario's renewable energy and conservation policies. In less than a decade, Ontario's energy sector is undergoing a new reform in support of a low-carbon energy transition. In the context of studying Ontario's progress towards a sustainable low-carbon path, it will be important to understand the context of the *Climate Change Mitigation and Low-carbon Economy Act, 2016* on the developments in the energy sector. This understanding will be achieved through a policy evaluation of Ontario's cap and trade program to assess the progress towards a sustainable energy transition. This evaluation will examine the approach that Ontario plans to use to reduce emissions significantly with carbon pricing established in the cap and trade program. An evaluation of Ontario's cap and trade regulation coming into force in 2017 will be a centerpiece of my research and an important evaluation of Ontario's progress towards sustainability.

With this evaluation, it has strengthened my understanding on the interactions of climate policy on the energy sector. The needs of the future energy system, with consideration of climate change, will impact the development of energy policies, energy planning and infrastructure development. This paper relates to my plan of study in many respects: understanding the rationale of emerging provincial climate policy to uncover discourses in the development of the policy design (objective 1-1); assessing carbon reduction policy, their impact and the design of cap and trade systems (objective 2-2); exploring the potential changes to regulatory frameworks to enable achievement of climate policy goals (objective 2-3); understanding the changes to energy infrastructure that forms a central part of a sustainable energy transition (objective 3-2); and conducting a policy evaluation of the cap and trade program to inform progress on the sustainable energy transition (objective 3-3).

Abstract

Using an interdisciplinary framework, this paper evaluates the effectiveness of Ontario's cap and trade regulation to achieve sustained emission reductions. This framework is shaped by six evaluation criteria to assess the program's effectiveness: (1) comprehensiveness in scope and coverage of emissions; (2) distributional fairness in the allocation of allowances; (3) effectiveness of the market design; (4) transparency of accommodations and flexibility arrangements; (5) measurability of emission reductions; and (6) the program's integration potential with broader political, economic and environmental policy initiatives.

First, all greenhouse gas emissions (GHG) emissions consistent with the Kyoto Protocol are covered using upstream and downstream points of regulation. The allowance decline cap will be sufficient to meet provincial emission targets of 15% by 2020. Second, based on a mix of auctioned allowances and transitional assistance, the analysis indicates that the value of allowances distributed can potentially accrue to industries for at least the first compliance period. Third, the effectiveness of the program will depend on enforceability, monitoring and oversight of the market rules to facilitate price discovery. There will be transparency in the criteria for eligibility of free allowances, circumstances allowing for flexibility arrangements, and the reporting of the action plan evaluations every year. Forth, accommodations and flexibility arrangements will be provided to industries to mitigate the risk of carbon leakage and in maintaining competitiveness. Fifth, until the carbon price reaches levels that could prompt significant technological progression by industry, the measurability of emission reductions by 2020 will depend on the implementation of complementary policies set out in the climate change action plan to support sustainable reductions in all sectors of the economy. The measurability of emissions will depend on the enforceability of the submission requirement to confirm facility and provincial level emission reductions. Sixth, Ontario's design of the cap and trade program will be aligned with broader policy goals at the provincial and federal levels.

To inform future program development, key themes are outlined. Monitor the performance of the market rules in creating an efficient, transparent, enforceable and effective market for many years to come, as well as the provision for accommodations and flexibility arrangements. Enhance the measurability and sustainability of emission reductions by ensuring successful implementation of the climate change action plan and assessing the cost-effectiveness of the

initiatives funded by cap and trade proceeds. Continue reviewing the implementation of the cap and trade program, progress of the climate change action plan, long-term goals and alignment of the program with forthcoming federal climate policy.

Keywords: climate change; effectiveness; accommodations; flexibility; measurability; sustainability; integration

Acronyms and Definitions [1]

CO_2. Carbon dioxide emissions from fuel combustion that depend on fuel properties such as carbon content, density, heating value and combustion technology.

CH_4. Methane emissions from fuel combustion are technology-dependent.

HFC. Hydrofluorocarbons are used as alternatives for ozone-depleting substances in refrigeration, air conditioning, building insulation, fire extinguishing systems and aerosols.

GWP. Global Warming Potential allows for the comparison of greenhouse gases relative to their carbon dioxide equivalent. The GWP referenced in this report is based on a 100-year time horizon based on the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

NF_3. Nitrogen trifluoride is used in the electronics industry as replacements for PFC and SF_6 including the manufacture of semiconductors, liquid crystal display panels and photovoltaics.

N_2O. Nitrous oxide emissions are generally emitted from industry as a by-product of fossil fuel combustion.

PFC. Perfluorocarbons are used as alternatives for ozone-depleting substances in manufacturing semiconductors, refrigerants and solvents in the electronics industry.

SF_6. Sulphur hexafluoride is a synthetic gas that is used in the electricity sector for insulating high-voltage equipment.

[1] 2015 National Inventory Report, Environment and Climate Change Canada, and U.S. Environmental Protection Agency (2016)

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1. Introduction

Climate change is one of the most urgent issues we are facing today and in the coming decades due to the dangerous risks that global warming can cause on the environment and natural ecosystems. Due to this risk, it has justified collective action from the global community to mitigate climate change through participation in the United Nations Framework Convention on Climate Change (UNFCCC). Canada has made a major pivot to propose a national carbon price with the provinces and has been developing forthcoming climate policy with the U.S. and Mexico. Canada's international commitment to fight climate change has been strengthened by Ontario's leadership on climate change mitigation, including the closure of coal-fired generation and the development of renewable energy and conservation policies supported by the *Green Energy Green Economy Act, 2009*. Ontario's commitment to fighting climate change is further strengthened by the *Climate Change Mitigation and Low-carbon Economy Act, 2016* that enables deep decarbonisation.

2. Background of Climate Policy Context

2.1 Market-Based Carbon Pricing Options

Since the 1920s and 1960s, carbon taxes and cap and trade have been introduced as market driven policies to internalize the price of carbon in order to mitigate GHG emissions. Both approaches have different risks and implications. Carbon taxes fix the price of carbon, allowing the market to determine the optimal level of emission reductions. This contrasts with a cap and trade system that controls emissions, leaving the market to determine the price. As a result, while there is certainty with the cost of reducing greenhouse gases with carbon taxes, there is certainty on the quantity of emissions reduced with a cap and trade program. Due to the diversity of emissions in most economies and different abatements costs for emission sources, the conventional approaches of using a command and control system and performance standards have likely not been sufficient, which brought increasing attention to market-based carbon pricing options (Aldy and Stavins, 2012).

In Canada, both a carbon tax and a cap and trade system have been used for the past two decades. A $30 per tonne carbon tax was implemented in British Columbia in 2008. This was

followed by an emissions tax on coal and petroleum coke implemented in Manitoba in 2014. Since Alberta's 2007 Specified Gas Emitters Regulation that placed intensity-based limits on industrial emissions, a carbon tax on its large industrial emitters is planned to come into force in 2017. Quebec started its cap and trade program earlier in 2013 and joined California's cap and trade program in five joint auctions to date. Ontario will be administering a joint cap and trade program in 2017, with plans to join Quebec and California in a linked cap and trade system in the near future. Ontario, Quebec and British Columbia have aggressive targets in the near and long term, while Alberta and Saskatchewan with the most carbon intensive economies will need to reverse the emissions growth that came with their booming oil industries and fast-growing populations (McCarthy, 2016a). Ontario, Alberta, Quebec and British Columbia representing 80% of Canada's GHG emissions will use some form of broad carbon price to shift the economy away from its dependence on fossil fuels (Ibid).

In a carbon tax system, a levy is charged on each unit of carbon dioxide emitted. Carbon taxes can achieve emissions reductions efficiently as firms optimize carbon reductions such that the cost of an incremental emission is equal to the carbon tax (Hearing before the Committee on the Budget House of Representative, 2007). From a climate perspective, the same cumulative reductions can occur at a lower cost with a carbon tax that shifts reductions in the year that are cheapest to undertake (Hearing before the Committee on the Budget House of Representative, 2007). As a result, carbon taxes can encourage cost-effective, market-driven reductions in a year. Carbon taxes can be perceived to double tax the firms for both abatement and tax payments to the government (Stavins, 2008) but the fiscal revenues could be used for employment or other tax benefits that improve economic growth, thereby creating a double dividend (Baranzini et al., 2000; Jaccard, 2006). From a consumer's perspective, the carbon price for Ontario was estimated to be in the range of $70 per tonne to fund tax reductions, which could impose an additional cost of $50 per month on households (Sawyer et al., 2016). The political acceptance of a carbon tax introduces the consideration of alternatives to guide cost-effective emission reductions, technology choices and behavioural changes to achieve significant emission reductions.

In a cap and trade program, the government sets a cap on emissions to achieve provincial emissions targets and divides the cap into allowances. Program participants buy allowances

from the government to cover their expected emissions, while some may require transitional assistance. Through the trading of allowances on the carbon market, it allows the most cost-effective emission reductions to happen first and minimizes the total cost of attaining an emissions target (Pew Centre on Global Climate Change, 2008; 2011). Firms that reduce their emissions sooner will lower their cost of compliance and benefit from making fewer allowance purchases over time. With international trading, it also lowers the costs compared to a domestic unlinked system (Hearing before the Committee on Energy and Natural Resources US Senate, 1999). This is confirmed in Ontario as international linking can lower the carbon price from $157 to $18 per tonne in 2017 (Sawyer et al., 2016). A potential drawback with cap and trade systems is that government intervention is required in allocating the cap, which can result in distributional issues among program participants.

Although the carbon prices have ranged from $1 US to $130 per tonne [2], 85% of global emissions priced below $10 per tonne including the European Union Emission Trading Scheme (EU-ETS), Chinese pilot trading systems and U.S. Regional Greenhouse Gas Initiative (RGGI) are considered to be lower than the theoretical prices estimated in models to meet the 2°C climate stabilization goal recommended by scientists (EcoFys, 2015). These findings support the fact that cap and trade systems can lead to lower cost compliance to attain an emissions target. As well, participating in a cap and trade program has the benefit of enabling harmonization with other countries, as more than 35 countries are regulating two-thirds of global emissions with a cap and trade program (Stavins, 2008; EcoFys, 2015; Littell and Farnsworth, 2016). Regardless of the method used, revenues from carbon pricing lead to interesting debate on how best to use the proceeds. This may include investing in low-carbon technology and infrastructure projects, while reducing income taxes, government debt and providing transitional assistance to industry (Canada's EcoFiscal Commission, 2016).

2.2 Post-Kyoto and Emerging Context

Since 1992, the signing of the United Nations Framework Convention on Climate Change (UNFCCC) by 154 nations led to the agreement in stabilizing emissions to a level that would prevent dangerous anthropogenic interference with climate change (McCarthy Tétrault LLP,

[2] Carbon taxes have ranged from $1 US per tonne in Mexico and Poland to more than $60 per tonne in Switzerland and Finland, and $130 per tonne in Sweden (EcoFys, 2015). In a cap and trade system, prices have ranged from $5 US per tonne in New Zealand to $36 per tonne in Tokyo (Ibid).

2015). The UNFCCC came into effect in 1994 and subsequent negotiations led to the signing of the Kyoto Protocol in 1997. The Kyoto negotiations established market-based mechanisms such as an emissions trading program, the Clean Development Mechanism and Joint Implementation.[3, 4] Now, 20 years after Kyoto, the earlier prospect of a global emission trading market created national and sub-national trading schemes in the EU-ETS, New Zealand and Norway, regional level trading schemes in the RGGI, and joint cap and trade systems in Quebec and California in 2014.

Canada ratified but withdrew from the Kyoto Protocol in 2011. It has instead committed to the Copenhagen climate change target of 17% below 2005 levels by 2020 (Canada Emission Trends, 2014). Previously, there has been political risk for the federal government to push for carbon taxes, as was experienced by the defeat of former Liberal leader Stephen Dion's carbon tax plan in 2008. The prospect of carbon prices has been politically challenging, but the urgency with climate change has convinced Canadians to support mitigation actions (Coulson and Roberton, 2016). The 2009 Copenhagen Accord brought countries together to the 21st session of the Conference of the Parties to the UNFCCC (COP 21) in December 2015 urged by the need to agree to a plan to address climate change. This led to the adoption of the Paris Agreement by 195 countries to partake in initiatives in mitigation, adaptation, technology development and transfer, capacity building initiatives, global stocktaking, implementation and compliance.[5] With the emergence of a national carbon price in Canada and forthcoming agreement from the North American Climate Summit, it supports the alignment in climate change strategy between all levels of government to achieve significant, long-term emission reductions.

2.3 History of Climate Policy in Ontario

Since the *Green Energy Green Economy Act, 2009*, Ontario was the first jurisdiction in North America to commit to phasing out coal-fired generation and achieving a conservation first and aggressive renewable energy mandate. Ontario was a member of the Western Climate Initiative (WCI) and was interested in pursuing cap and trade with Quebec and California. Following the

[3] The Clean Development Mechanism (CDM) is a market consisting of certified emission reductions undertaken by developing countries that could be used as offsets elsewhere. A portion the proceeds in the CDM were used to finance adaptation projects vis-à-vis an Adaptation Fund for developing country parties to the Kyoto Protocol. The European Union trading scheme has been one of the largest purchasers of CDM offsets.

[4] Joint Implementation is similar to the CDM but was created for emission reduction projects in the former Soviet Union and Eastern Europe (Newell et al., 2013).

[5] See draft decision on the Adoption of the Paris Agreement.

2008 economic crisis, many U.S. states withdrew from the WCI due to the initial economic and political costs of unemployment that were experienced in California, but Ontario stayed and helped with the development of design principles of the WCI (Klinsky, 2013). Ontario's participation in the WCI remained politically sensitive in a time when the viability of a renewable feed-in-tariff program was debated during the provincial election (Ibid).

With the election of a new Liberal majority led by Premier Kathleen Wynne in 2013, cap and trade was re-introduced as good environmental policy that fuelled a good economy (Ontario, 2015). The climate change challenge presented an opportunity to transform the Ontario economy and lead to better public transit, more electric vehicles, greener building standards and net zero technologies to reduce energy costs (MOECC, 2015b). In April 2015, Ontario announced its intention to join the WCI cap and trade system. Ontario hosted the Climate Summit of the Americas in July 2015 and signed a Pan-American action statement with 23 signatories. This covered support for carbon pricing, public reporting, taking action in key sectors and committing to meet GHG reduction targets (Ontario, 2015b). In November 2015, Ontario and Quebec signed a Memorandum of Understanding to confirm their intent to link the cap and trade programs under the WCI (Town of Richmond Hill, 2016). By then, Ontario released the Cap and Trade Design Options and Climate Change Strategy. This was followed by the release of the draft regulation in February 2016 for public consultation. The *Climate Change Mitigation and Low-carbon Economy Act, 2016* received Royal Assent in May 2016.

2.4 Lessons Learned from Other Jurisdictions

Past experiences from the EU-ETS and RGGI highlighted the need to manage costs and volatility with cost containment measures (Klinsky, 2013). The price crash in the EU-ETS was caused by multiple factors including the 2008 economic recession, lowered electricity demand and reduced output. Due to the reduction in output in the economy, the under-estimation of abatement was found to have an equal effect on the fall in carbon prices as the over-allocation of allowances (Ellerman and Buchner, 2006). The EU's cumulative oversupply led to reduced auction volumes and established a stability reserve of surplus allowances to regulate the liquidity of allowances (European Commission, 2014). The combined effect of the economic recession and low natural gas prices relative to coal was also experienced in the RGGI, where emission targets are likely not binding unless further revised (Aldy and Stavins, 2012).

Initially, there was no price floor or banking system to mitigate surplus allowances in the EU-ETS system. These provisions were added to the EU-ETS after the price crash to mitigate the price fall and disallow the continued surplus of allowances (Newell et al., 2013). Carbon markets today in the EU-ETS, RGGI, Quebec and California include a price floor and ceiling to mitigate price variation. The flexibility of banking and borrowing promotes cost-effective reductions, which lowers the costs of compliance (Tatsutani and Pizer, 2008; MOECC, 2015a). With a price floor, it prevents prices from dropping below an expected range (Dinan and Spoor, 2001). With a price ceiling, it provides certainty on the incremental cost of abatement that can avoid larger losses to the firm, in case the reductions were achieved at a much higher cost with an increasingly stringent cap (Ibid). With a price floor and ceiling, this hybrid approach makes cap and trade systems a price-based approach to regulate potential price variability (Aldy and Stavins, 2012; Jaccard, 2006).

With allowance banking, it allows for cost flexibility as allowance levels can vary with price shocks through temporal flexibility (Newell et al., 2005). There could be benefits and risks associated with banking. Laboratory experiments found that banking allowances can smooth prices across time and increase efficiency (Muller and Mestelman, 1998). However, as seen in Europe, banking can create an incentive to hold onto allowances for hedging or speculation purposes based on their future expected values (Neuoff et al., 2012). As a result, this causes allowance prices to rise (Tatsutani and Pizer, 2008). Over time, as better information on the cost of abatement becomes available, banking and borrowing can help carbon prices reflect their future discounted value (Murray et al., 2009). Banking allowances can reduce price volatility and allowance surplus and has the benefit of increasing market efficiency.

After many years of experience with carbon markets post-Kyoto, new trends have emerged. First, significantly different carbon prices can cause inter-jurisdictional financial flows between countries and varying degrees to which the cap reflects actual emissions (Radu, 2014; Klinsky, 2013). Second, there should be greater transparency to allow equal access to information (Klinsky, 2013). Third, there should be comparability when linking to avoid concerns about competitiveness and leakage risk that can affect the sustainability of policy actions (Ibid). These could be important considerations for Ontario as it plans to link with Quebec and California in the near future.

3. Overview of Climate Policy in Ontario

After the *Climate Change Mitigation and Low-carbon Economy Act, 2016* was passed in May 2016, the MOECC published key policy documents, including the Cap and Trade Program Regulation, Allocation Methodology, Reporting Regulation and Guidelines that govern the quantification, reporting and verification of greenhouse gas emissions, and the 2016-2020 climate change action plan. The climate change legislation, regulation, supporting guidelines and action plan collectively shape the foundation of Ontario's climate policy.

3.1 Climate Change Mitigation and Low-carbon Act, 2016

The climate change legislation creates a regulatory and legal foundation for cap and trade in Ontario. The purpose of the Act is three-fold (*Climate Change Mitigation and Low-carbon Economy Act, 2016*, s. 2):

1. To reduce greenhouse gases in order to respond to climate change, protect the environment and assist Ontarians through the transition to a low-carbon economy;
2. To enable Ontario to collaborate and coordinate its actions with other jurisdictions to ensure efficacy of its regulatory scheme in the context of broader international efforts to respond to climate change; and
3. […] to encourage Ontarians to change their behaviour by influencing their economic decisions that directly, and indirectly, contribute to the emission of greenhouse gases.

The climate change legislation sets the components of Ontario's climate policy (MOECC, 2016a):

- The provincial long-term emission targets are -15% (2020), -37% (2030) and -80% (2050) relative to the 1990 baseline;
- The climate change action plan sets out the actions to modify behaviour and enable achievement of greenhouse gas reduction targets;
- There will be provision for the distribution of allowances, creation of early retirement credits, offsets registration, enforcement, and public notices in the cap and trade program;
- Investments and initiatives will be funded by the Greenhouse Gas Reduction Account (GGRA) to support emission reductions; and

- Reporting and review processes will ensure transparency and accountability in the actions taken.

The legislation sets out the timelines, disclosure of information in the climate change action plan and review processes for the initiatives funded by the GGRA. The climate change action plan will be reviewed at least every five years. To be transparent and accountable, the status of the actions funded by the GGRA will be reported at least once every year. The action plan will at a minimum include details on the greenhouse gas reductions by action, the cost per tonne reduced and the amount of funding received from the GGRA to initiate the action (supra, s. 7). Low-income consumers will be assisted to manage higher home heating costs.

The GGRA will be a new account established to receive proceeds from the distribution of Ontario emission allowances, administrative penalties and fees payable to the Crown under the Act (supra, 71). Authorized expenditures from the GGRA include the costs of administering and enforcing the Act and regulations, costs to fund the action plan initiatives and other initiatives that are reasonably likely to reduce greenhouse gases, and the costs incurred by the Crown to support emission reductions (Ibid). The Minister will review and evaluate the initiatives before they are undertaken (Ibid). To ensure transparency in the evaluation process, a report will be published at least once every year on the evaluations conducted and funded by the GGRA (Ibid).

In terms of eligible initiatives funded from the GGRA, these include activities in Schedule 1 of the Act that informed the climate change action plan (MOECC, 2016a):

Schedule 1 of the Act

Initiative 1: Energy sources and uses (production of renewable energy)

Initiative 2: Land use and buildings (retrofitting buildings)

Initiative 3: Transportation (alternative and low carbon forms of transportation compared to traditional gasoline and diesel vehicles such as electric vehicles)

Initiative 4: Industry (energy conservation programs)

Initiative 5: Agriculture, forestry and natural systems (afforestation initiatives)

Initiative 6: Waste management (organic waste composting systems)

Initiative 7: Initiatives that support organizations in developing and delivering financing tools, project aggregation and professional services to consumers to reduce greenhouse gas emissions

3.2 Cap and Trade Program Regulation (O. Reg. 144/16)

Ontario's cap and trade program runs from January 1, 2017 to December 31, 2020 for the first compliance period. The regulation establishes subsequent compliance periods for each three-year period thereafter. Facilities that emit greater than 25,000 tonnes of CO_2e are mandatory participants of the program, if emissions are attributable to activities related to natural gas distribution, petroleum product supply, electricity importation or any activity specified in Schedule 2 of the Reporting Regulation. Voluntary participants emitting 10,000 and 25,000 tonnes of CO_2e per year can opt into the program. Market participants are allowed to trade allowances in the carbon market, but do not have a compliance obligation.

Ontario will use a hybrid approach to regulate emissions upstream and downstream to cover combustion and process emissions from capped participants. To meet the 2020 provincial emission targets, the government will issue allowances each year that fall by an average rate of 4.1% from 2017 to 2020. [6] Some of the allowances will be auctioned while the remainder are distributed for free. The facilities that are required to purchase allowances to cover emissions include distributors and suppliers of fuels and electricity importers. Eligible facilities that apply for free allowances are those engaged in the production of specified GHG activities in the Reporting Regulation.

To support a well-functioning market, there will be rules on effecting trade transactions, timelines to provide notices on auctions and sales, and enforcement provisions. The cap and trade program allows for flexibility in achieving reductions over multiple periods and using allowances and credits to cover emissions. By the end of the compliance period, participants demonstrate compliance by submitting the allowances and/or credits purchased to cover the emissions produced.

The cap and trade regulation comes into force on July 1, 2016, but further regulations are expected. The Ontario cap and trade regulation is planned to allow participation of indirect

[6] One allowance is equal to one tonne of CO_2e.

steam emissions emitting less than 10,000 tonnes of CO_2e per year. The eligibility requirements and number of early reduction credits to be issued are yet to be finalized. Further requirements to create, verify and register offsets and the management of allowances for shut-downs, bankruptcies or ownership changes will be consulted on. Complementary regulations on administrative monetary penalties for specific contraventions and impact mitigation for First Nations will be made separately in 2016.

3.3 Methodology for Free Allowance Distribution

The total amount of free allowances distributed is the sum of allowances distributed using five approaches, including production adjustments for changes in output. The methodology for distributing free allowances identifies the facilities that are eligible for free allowances and the methodology for allocating allowances based on the facility's combustion and process emissions. Allowance distributions will be supported by verified production data to justify the free allowance allocations. The allocation methodology for free allowances will be discussed in Section 8.1 of this report.

3.4 Reporting Regulation and Guideline for Quantification, Reporting and Verification of Emissions (O. Reg. 143/16)

In 2009, Ontario established a reporting regulation (O. Reg. 452/09) and guideline for the quantification, reporting and verification of greenhouse gas emissions under the *Environmental Protection Act*. Amendments were made to lower the reporting threshold to 10,000 tonnes of CO_2e and require verification on emissions greater than 25,000 tonnes of CO_2e per year. In 2016, reporting was required for petroleum product producers, natural gas distributors, magnesium producers, and equipment used for both electricity and natural gas transmission and distribution.

Under the *Climate Change Mitigation and Low-carbon Economy Act, 2016*, the new Reporting Regulation (O. Reg. 143/16) superseded the prior reporting regulation to support the implementation of the cap and trade program. The Reporting Guideline outlines the methods to quantify emissions for an activity engaged in by 2017 and the rules for reporting emissions by mandatory and voluntary participants. It describes the contents of GHG reports for facilities engaged in specified GHG activities, the rules for verification and continuing duties for verification, and the general duties of the verification firms. The following changes to the

Reporting Regulation and Guidelines were made in support of the cap and trade program (MOECC, 2016a, 2016b):

1. Requirement to report production and process related information to support the calculations for free allowance allocations;
2. Reporting requirements for voluntary participants;
3. Alignment with Quebec on the measurement requirements for emissions to be accurate within 5% and for production data to be within 0.1%;
4. New default emission factors for calculating emissions from electricity imports; and
5. Greater detail on the reporting of biomass used in a facility.

These changes represent improvement to the process to ensure greater accuracy in the measurement and reporting of greenhouse gas emissions in support of the cap and trade program.

3.5 Climate Change Action Plan for 2016 to 2020

Following the release of the climate change legislation in May 2016, the MOECC released the climate change action plan in June 2016 to establish the Ontario government's five-year plan on how to invest the cap and trade proceeds. The purpose of the action plan is to create the conditions to provide greater consumer choice, both to consumers and businesses to reduce their carbon footprint and accelerate the adoption of low-carbon technologies. Key areas of the action plan include (MOECC, 2016c):

1. Establishing a green bank to increase access to financing for energy efficient technologies;
2. Electrifying the transportation system by increasing the availability of zero-emission vehicles, cleaner trucks and making transit more available;
3. Reducing emissions from buildings by providing better information to make more informed decisions on energy use and making new buildings more energy efficient over time;
4. Making Ontario one of the easiest and most affordable jurisdictions to install or retrofit clean energy systems including solar, battery storage, advanced insulation and heat pumps, while protecting low-income and vulnerable communities;

5. Supporting a carbon market that achieves reductions at the lowest cost, driven by businesses and industry making investments to reduce greenhouse gas emissions;
6. Working with First Nations and Metis communities to address climate change and build capacity with actions guided by Traditional Ecological Knowledge;
7. Building on progress by making government operations carbon neutral that include government facilities, operations and procurement; and
8. Ensuring natural, agricultural and forest lands are used efficiently and sustainably to enhance the removal and storage of carbon, and enhancing the capture to CO_2e from waste.

With anticipated annual cap and trade proceeds of $1.8-1.9 billion totalling a maximum of $8.3 billion by 2020, the funds are expected to fund 28 climate mitigation actions to achieve 9.8 million tonnes of GHG emission reductions by 2020.

4. Research Design and Methodology

4.1 Research Question

Will the Ontario cap and trade regulation achieve sustained emission reductions?

4.2 Research Design

The methodology to address this research question involved using a six evaluation criteria framework informed by the Pew Centre on Global Climate Change, Canadian Institute of Resources Law, U.S. Congressional Budget Office and Resources of the Future:

1. To what extent will the cap and trade program achieve emission reductions? On what scale? Will it capture the key emission sources?
2. To what extent will the allocation of allowances in the cap and trade program produce a fair distribution of costs and benefits?
3. To what extent will the carbon market be efficient, transparent and effective? Will the rules be enforceable?
4. To what extent will accommodations and flexibility arrangements be transparent?
5. To what extent will the emission reductions be measurable and sustainable?

6. To what extent will the cap and trade program align with political, economic and environmental policy considerations?

These questions will inform the progression of the report as follows.

Scope of Ontario's Cap and Trade Program (Section 5). In designing the scope of a cap and trade program, policymakers will choose which GHGs to regulate and how to regulate the emission sources. This policy choice determines the sectors that will comply with the program. While maximum coverage of emissions is possible, it is often more expensive to meet an environmental objective as smaller sources are harder to measure and more expensive to regulate. Section 5 of this report reviews the scope and scale of the emissions coverage in Ontario's cap and trade program.

Distribution of Benefits and Costs from Allowance Allocations (Section 6). In designing a cap and trade program, policymakers face the challenge of determining how the allowances will be allocated, primarily who receives free allowances and who pays for the allowances (Dinan and Spoor, 2001). To assess the extent to which the allowance allocation produces a fair distribution of cost and benefits to consumers and industry, Section 6 of this report assesses the distributional impacts from the allowance allocations.

Effectiveness of Market Design (Section 7). A well-functioning market is a key feature to manage price stability while achieving emissions certainty (Murray et al., 2009; Newell et al., 2005). To incent behavioural change, it relies on the effectiveness of the market to facilitate price discovery that drives appropriate investments to signal the long-run cost of carbon abatement (supra, ibid). Section 7 of this report assesses the effectiveness of market design by reviewing whether the market is efficient, transparent, enforceable and effective to support the discovery of the carbon price.

Transparency of Accommodations and Flexibility Arrangements (Section 8). Being transparent with accommodations and flexibility arrangements are critical as it indicates the effectiveness of program rules, given the leeway provided to participants that allow them to remain in compliance with the program. For Ontario, it will be important to assess the transparency of accommodations and flexibility arrangements permitted in the cap and trade program, which will be explored in Section 8 of this report.

Measurability of Emissions and Sustainable Impact (Section 9). The measurement of emissions supports the assessment of emission reductions, the cost of abatement and the industry's overall cost of compliance to reduce emissions. To assess the extent to which the emission reductions from the cap and trade program are measurable, Section 9 of this report assesses the measurability of emission reductions through a review of the measurement, verification and reporting processes.

Integration with Other Measures (Section 10). In addition to the design foundations of the cap and trade program explored in earlier sections, Section 10 of this report will focus on assessing how the Ontario's climate change action plan forming the vision of the province's climate change strategy will integrate with political, economic and environmental policy considerations.

4.3 Study Methodology

Analysis of Ontario's cap and trade regulation will involve a review of government publications and policy documents related to the climate change policy, including: *Climate Change Mitigation and Low-carbon Economy Act, 2016*; Cap and Trade Program Regulation; Methodology for Free Allowances Distribution; Reporting Regulation and Guideline for the Quantification, Reporting and Verification of Greenhouse Gas Emissions; climate change action plan; draft regulation and design options; stakeholder submissions; climate change discussion paper; and Quebec and California cap and trade regulations and updates.

This paper presents an evaluation and independent estimates of the distribution of allowance allocations, leakage risk for Ontario's manufacturing industries, and potential distribution of free allowances by NAICS industries. Data was used from Statistics Canada, Trade Data Online, facility data reported under O. Reg. 452/09 (Greenhouse Gas Emissions Reporting), and MOECC and ICF reports. The impacts of similar policies from the EU-ETS and U.S. in literature reviews were used to infer the potential impacts of Ontario's approach to cap and trade. Recommendations will be made to inform future program development.

5. Scope of Ontario's Cap and Trade Program

5.1 Scope of Emissions Coverage

The cap and trade program will support an economy-wide coverage that regulates 82% of 2020 emissions (see Table 1). Mandatory participants include emission sources from natural gas distribution, petroleum product supply, electricity importation or any GHG activity in Schedule 2 of the Reporting Guideline. The coverage affects 75% of the people in Ontario (Ministry of Finance, 2016; MOECC, 2015e).

Table 1. Emission Reduction Targets in Ontario

Anticipated Impacts for Ontario	2020	2030	2050
Ontario's Cap on GHG Emissions (MT)	150	112	35
Coverage of Ontario's Emissions	82% (2017-2020)		
Emissions Reduction from 1990 levels	-15%	-37%	-80%
Expected Emission Reductions (MT)	~19	>60	>160
Projected Carbon Price ($CAD/tonne)	~$22	~$95	>$100

Source: Data collected from MOECC's 2014 Climate Change Update Report; carbon price projections from Point Carbon at <http://energyinsider.ca/index.php/ontarios-cap-and-trade-some-early-impact-estimates/>

The cap and trade program will cover the seven greenhouse gases included in the Kyoto Protocol. These are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, sulphur hexafluoride, perfluorocarbons and nitrogen trifluoride. Carbon dioxide, methane and nitrous oxide, making up the majority of GHG emissions in the economy, will be covered. Sectors include transportation emissions from passenger, freight and rail (33% of forecast 2020 emissions), industrial processes and emissions from product use (34% of 2020 emissions), emissions from residential, commercial and institutional buildings (18% of 2020 emissions) and from electricity generation (3% of 2020 emissions). [7] Ontario's exclusion of emissions is consistent with the emissions coverage in Quebec and California. Ontario's emissions profile by sector and expected emissions growth is displayed below (see Table 2).

[7] This is the forecast of emissions without emission reductions by sector to reconcile the figures to the 82% emissions coverage under the cap and trade program.

Table 2. Ontario's Emissions Profile by Sector from 1990 to 2030

Sector	Actual Emissions (Mt CO_2e)		Forecast Emissions (Mt CO_2e)				
	1990	2013	2017	2020	2030	% change (2013-2020)	% change (1990-2030)
Transportation	46	61	60	60	57	-2%	24%
Industry	64	47	57	58	60	23%	-6%
Buildings	26	32	29	30	34	-6%	29%
Electricity	26	11	4	5	8	-55%	-69%
Agriculture	10	10	10	10	9.9	-4%	-1%
Waste	6	9	7	7	7	-22%	17%
Total Emissions (MT)	**177**	**171**	**167**	**169**	**176**		
2020 Emissions Goal (-15% of 1990 emissions)				150			
2030 Emissions Goal (-37% of 1990 emissions)					112		
Expected GHG Reductions				**19**	**64**		

Sources: Data collected from emission forecasts in MOECC's 2014 Climate Change Update Report; 2013 data from National Inventory Report

5.2 Scale of Coverage Through Points of Regulation

There will be a compliance obligation on mandatory and voluntary sources at the point of distribution (upstream approach) and at the point of emission (downstream approach). In Ontario, a hybrid approach will be used: upstream for natural gas distributors, petroleum product supply and electricity importation; and downstream for large final emitters including industry and institutions. Through these points of regulation, both process and combustion emissions are covered. Process emissions come from chemical reactions as part of production processes, where the primary purpose of the process is not energy production (MOECC, 2015b; 2015c). Combustion emissions come from the burning of fuel for heating and can be reduced through energy efficiency or fuel switching (Ibid).

Natural Gas Distribution

For natural gas distribution, emissions from Ontario's natural gas utilities will be regulated through the distribution of natural gas to retail customers. This includes the upstream coverage in the distribution process and downstream coverage of the emissions reported between 10,000 and 25,000 tonnes of CO_2e per year from the gas utilities' residential, commercial and small industrial customers. The cost of purchasing allowances to cover emissions from the distribution of natural gas will be recovered from customers as a cost pass-through in rates.

Large final emitters that are customers of natural gas distributors and natural gas fired electricity generators emitting more than 25,000 tonnes of CO_2e will instead be responsible for their own allowance purchases. The downstream regulation of emissions associated with the use of fuel at industries and institutions, including natural gas use for general stationary purposes, will be regulated at the point of consumption at the facility (MOECC, 2015c).

Petroleum Product Supply

The regulation of petroleum product supply includes persons that supply 200 litres of more of petroleum products, such as fuel oil and propane, from a petroleum refinery or is imported into Ontario. Upstream regulation applies when the petroleum product is first placed onto the Ontario market, after the petroleum product was moved from petroleum refineries or fractionation facilities (O. Reg. 143/16, s. 12). This ensures that domestic sales or transfers of petroleum products from wholesale or retail points in Ontario will capture for GHG emissions from fuel distribution in Ontario (MOECC, 2015c). The cost of carbon upstream in the distribution process will result in a fixed charge per litre of gas consumed by all Ontarians.

Electricity Generation and Importation

Electricity Generators. Emissions from domestic electricity generation that use fossil fuels, primarily relating to natural gas fired electricity generation in Ontario, will be covered by the natural gas distributor. There is an exception to electricity generating facilities that connect directly to an international or inter-provincial natural gas pipeline, which will have the emissions regulated at the point of generation.

Electricity Imports. An electricity importer is a person authorized by the IESO market rules to cause or permit electricity to be conveyed into, through or out of the IESO-controlled grid (*Electricity Act, 1998*, s. 2). Importers are required to buy allowances at the border (a "first jurisdictional deliverer" approach) in an amount that is equal to the estimated emissions from the sources of imported power. Default emission factors were considered from marginal power plants within Ontario's interconnections to estimate the carbon content of electricity imports. It is expected that emission factors will be updated annually from select jurisdictions in Canada and the U.S. (IESO, 2016; Ontario Ministry of Energy, 2016).

Ontario's five interconnections include the ISO New England (ISO-NE), New York Independent System Operator (NYISO), Pennsylvania, New Jersey and Maryland (PJM), Midcontinent Independent System Operator (MISO) and Manitoba. The electricity emission factors will depend on the marginal resource used by these jurisdictions during the on-peak and off-peak periods.[8] Higher emissions from fossil-fuel based electricity generation would be produced at the margin. When linkage is considered, how Ontario's emission factors may align with the emission factors applied to electricity imports in Quebec and California will ensure consistent treatment of electricity imports in the WCI. The measurability of emissions from electricity imports is discussed in Section 9.2 of this report.

Electricity Exports. The default emissions factor does not apply to electricity exports. Exports will pay the market clearing price for electricity without the embedded carbon cost when natural gas is on the margin. This approach is consistent with the approach taken by California, Quebec and RGGI (Ontario Ministry of Energy, 2016). Ontario exports could be less competitive over time if the emissions exported outside the province are not regulated (IESO, 2016).

Cogeneration, including Behind the Meter Generation. Cogeneration facilities produce electricity and by-product heat or steam to run an industrial process. The emissions from cogeneration facilities are proposed to be treated consistently with electricity generators whose emission allowances would be covered by the fuel distributor. The exception is when the cogeneration facility is connected to an inter-provincial pipeline. In this case, allowances are purchased at the point of generation. Cogeneration facilities will also be provided free allowances to cover its emissions from the combustion of natural gas to generate electricity and/or thermal energy (heat or steam).

Non-Emitting Generators. Renewable energy generators including solar, wind, hydroelectricity and nuclear facilities are not regulated under the cap and trade program.

Similar to downstream industrial emitters, the emissions from energy-from-waste facilities will be covered at the facility. Energy-from-waste facilities are regulated, but receive free allowances to cover emissions in the first compliance period (see Section 8 of this report). Energy-from-

[8] A marginal resource is defined as the next available unit of production required to meet the next unit of demand. In the context of an electricity system it is managed in a least cost dispatch approach (Ontario Ministry of Energy, 2016).

waste facilities that use biomass as a source of fuel to produce electricity, heat or other useful energy will be regulated under the cap. Biomass is defined as an organic matter that is renewable and derived from a plant, animal or micro-organism or product made out of organic matter (O. Reg. 143/16). Biomass must be agricultural waste, organic waste material, waste from food processing, distribution and preparation operations, landfill gas, biodiesel, biofuel or biogas (Ibid). The measurability of biomass production in support of carbon neutrality benefits is discussed in Section 9.4.2 of this report.

Industries and Institutions

Large final emitters that engage in any of the specified GHG activities[9] in Schedule 2 of the Reporting Regulation will be regulated at the facility. Both combustion and process emissions will be regulated from large final emitters in support of meeting provincial emission reductions. Industries and institutions will be provided free allowances to cover their emissions over the first compliance period (see Sections 6 and 8 of this report). The effectiveness of transitional assistance provided will depend on the ability of large facilities to engage in significant low-carbon activities to achieve long-term emission reductions. It is expected that incremental reduction opportunities for large final emitters will be timely as industrial emissions could be higher than the emissions from the transportation sector by 2030 (see Table 2 above).

5.3 Treatment of Emissions from Existing and New Facilities

Absent restriction on the treatment of new facilities in the cap and trade program, it is assumed that new entrants that begin operations in January 1, 2016 with annual emissions greater than 25,000 tonnes of CO_2e are mandatory participants of the program. Starting in 2017, this will ensure stringent regulation of carbon emissions from new and existing facilities. These sources will be assessed on the ability to reduce combustion and process emissions significantly based on the stringency of the cap decline from 2017 to 2020. Depending on the eligibility of the GHG activities from the industrial activity of the existing or new facility, the emissions from existing and new facilities can be covered with free allowances for the first compliance period.

[9] Schedule 2 activities (O. Reg. 143/16) that preclude electricity generation, operation of electricity or natural gas equipment, coal storage and general stationary combustion include the following production activities: adipic acid, ammonia, carbonate use, cement, copper and nickel, ferroalloy, glass, HCFC-22 and HFC-23 destruction, hydrogen, iron and steel, lead, lime, magnesium, nitric acid, petrochemical, petroleum refining, phosphoric acid, aluminum, pulp and paper, refinery fuel, soda ash and zinc.

5.4 Stringency of the Cap Decline

To ensure that reductions are sustained, the cap should be made more stringent through deeper emission cuts in order to send a strong price signal to incent technological innovation (Tatsutani and Pizer, 2008). Based on Ontario's emissions forecast in 2020, an 11% reduction is needed to fall from the forecast to achieve 150 Mt in emissions, which is equivalent to a 15% reduction from 1990 levels. According to the Ontario allowance budget, the emission allowances decline by an average rate of 4.1% per year by 2020. The decline factor is sufficient to meet the 2020 provincial target, as it is limited by the program cap of 124.7 million allowances in 2020 to cover 82% of the economy's emissions. Ontario's cap includes emissions from the fuel and electricity distributors similar to Quebec and California. In addition, Ontario will cover emissions from energy-from-waste facilities that are not included in Quebec's and California's cap and trade programs (Purdon et al., 2014).

To support the provincial emissions targets, it is expected the transportation and natural gas sectors will be impacted by annual cap declines, while the sector-specific cap for electricity generation remains unchanged (Ministry of Finance, 2016). This recognizes the significant reduction of emissions from the closure of coal-fired generation that will contribute a 32.5 MT reduction in emissions by 2020 (Ministry of Finance, 2016; MOECC, 2015d).

5.5 Assessment

Ontario's cap and trade program has an economy-wide coverage of emissions in the key sectors to ensure cost-effective reductions in the next four years. From 2017 to 2020, the emissions of all the seven GHGs will be regulated, covering 82% of Ontario's emissions by 2020 that is consistent with the emissions coverage with Quebec and California. The cap decline rate falls at an average rate of 4.1% to achieve a 15% emissions reduction by 2020. Through the upstream regulation of fuel distributors for petroleum products, natural gas and electricity, 54% of Ontario's forecast emissions are covered by 2020. Upstream regulation of fuel distribution is expected to enhance the program's administrative feasibility and implementation. It has been argued that the upstream regulation of emissions has the most leverage on total emissions (Bushnell et al., 2014). Through the downstream approach, 34% of the forecast emissions are covered from industrial activity by 2020. Ontario's exclusion of smaller sources includes agricultural, waste emissions, and aviation and marine fuels.

The exclusion of agricultural and waste sectors could be administratively simpler and reduce program costs, as emissions from smaller sources could be harder and more expensive to measure if regulated under the cap. Given the broad coverage of emission sources, the overall monitoring costs for emissions could potentially be high. The exclusion of emissions from aviation and marine shipping fuels from the provincial cap is consistent with Quebec and California. The Environmental Commissioner of Ontario (ECO) has noted that Ontario's concessions to aviation fuel and its tax exemptions to coloured fuel undermine the intended purpose and operation of the cap and trade program (Environmental Commissioner of Ontario, 2016). In response to the ECO's comments, Ontario has initiated a review of the initiatives supporting fossil fuel use in its Climate Change Strategy (Ibid). Further reductions to supply subsidies could also increase the cost-effectiveness of conservation when carbon pricing takes effect (Love, 2014).

To meet the emissions cap each year, upstream regulated sources will pay for the cost of their emissions whereas downstream regulated sources are eligible for transitional assistance to cover their process and combustion emissions until at least 2020. For sources that are not regulated under the cap, there are future developments in using agriculture, forestry and lands as offsets for Ontario's cap and trade program (MOECC, 2016c). Although these emission sources are not directly capped, these sectors will be funded by cap and trade proceeds to build greater productivity for the environment as carbon sinks that provide Ontario specific compliance options (Ibid).

Based on the coverage of emissions, there is a level playing field established for domestic electricity generation and imports based on a first jurisdictional delivery approach. The carbon content of imported electricity will be regulated at the border with application of a default emissions factor. The amount of carbon from electricity imports would depend on where the imported electricity originates. The emissions of electricity exports are not subject to the cap and trade program, which could affect Ontario's competitiveness of electricity exports. On the one hand, nuclear refurbishments increase the strategic importance of natural gas as a peaking resource, which could increase the carbon intensity of Ontario's exports. On the other, the generation fleet is becoming cleaner with increasing capacity fueled by renewable energy that makes up 50% of the supply mix by 2025. As a result, there could be potential developments

supporting the increased deployment of low-carbon technologies in the energy system, but natural gas fired generation is expected to play an important role in Ontario's supply mix.

The emissions from combined heat and power facilities (generating electricity and heat) are covered under the cap and trade program, as are facilities generating thermal energy directly (at the facility) and indirectly (via steam imports). Cogeneration facilities that primarily produce electricity output, with heat as a by-product, will be eligible to cover emissions using free allowances. The free allowances will allow cogeneration facilities to be competitive with other facilities producing heat or steam for production purposes.

The program's allowance cap will be sufficient to meet provincial emission targets. A direct implication of participating in the program is the cost to achieve significant emission reductions by 2030 and 2050. In assessing Ontario's energy use, 76% of homes are heated with natural gas (as opposed to 3% in Quebec), 29% of Ontario's installed electricity capacity relies on natural gas (as opposed to 59% in California) and 15% of Ontario electricity generation is fuelled by natural gas (as opposed to 59% in California) (ICF International, 2016). As Ontario has made few investments in low-carbon technologies in Ontario to date (The Conference Board of Canada, 2016) and started cap and trade at a later time than Quebec and California, Ontario's marginal cost to abate could be higher. This challenge supports the economic gains to be made for Ontario by linking with the WCI to leverage a larger pool of allowances and/or offset credits to lower the overall cost of compliance. For Ontario to develop resilience to climate change, it is a good start for the province to be committed to an upstream regulation of fuels to attain the most leverage on emission reductions.

Based on this assessment, there is comprehensive coverage of emissions that supports low-cost compliance, fair treatment of emissions in the cap and trade program, and sufficient annual declines in the program allowance cap to meet the 2020 emission targets. In order to enable cost-effective emission reductions, this endeavour could be achieved through linkage with Quebec and California and the use of complementary policies to support broad emission reductions in all sectors of the economy.

6. Distribution of Benefits and Costs from Allowance Allocations

6.1 Allocation Approaches: Risks and Benefits

Based on WCI design recommendations, the distribution of allowances is at the discretion of the jurisdiction (Western Climate Initiative, 2010). This introduces the consideration of benefits and risks associated with auctioning allowances, as opposed to allocating the allowances for free. The allocation of allowances made by policymakers can affect the social cost of the policy and create distributional impacts from the allocation of allowances.

There are reasons to support free allowance distribution. Free allowances will compensate firms with a production subsidy and implicitly lower the marginal cost to abate (Haites, 2003). It provides transitional assistance to Emissions Intensive Trade Exposed (EITE) industries to mitigate against the risk of carbon leakage, as has been done in other emissions trading programs. However, the allocation of free allowances will forego revenues that can be recycled into additional relief programs or emission reduction initiatives. Environmental groups have raised the concern that the motivation to reduce emissions is delayed with free allowances (Wilson and Grochalova, 2016). Allocating fewer allowances can send a stronger price signal and create more demand for low-carbon innovation (Clean Economy Alliance, 2015).

Auctioning incents the use of low-carbon technologies and rewards firms that can reduce emissions (Pew Centre on Global Climate Change, 2007). The spirit of auctioning aligns with the cost causality principle as emitters internalise the externality. The government also eliminates the risks created by distributing free allowances to the EITE industries as there are often information asymmetries on how much cost can be passed onto different sectors (Ibid).

6.2 Distributional Outcome of Allowance Allocations

Ontario's cap and trade program will auction 25% of outstanding emission allowances for sale and distribute a portion of the allowances for free to reduce the risk of carbon leakage (O. Reg. 144/16, s. 57). With a mixed use of auction and free allowances, $1.8-1.9 billion from annual allowances is expected to be earned each year, with 60% of the proceeds paid by petroleum product suppliers and 40% of the proceeds paid by natural gas distributors (Sawyer, 2015). A maximum of $8.3 billion could be earned at auction (Appendix 6 of this report) consistent with the findings in Table 3, whose proceeds are planned to be used in various areas of the economy.

Allowances will be distributed for free to large emitters that could potentially cost $0.7-0.9 billion each year. The amount of free allowances provided would be distributed to about 100 industrial emitters.

Table 3. Aggregate Distribution of Allowances (Estimated for 2017 to 2020)

Year	Ontario Allowances	Total Revenues: if 100% auctioned	Auction Revenues (estimate)	Percent of Revenues Earned at Auction	Cost of Free Allowances (estimate)	Cost of Allowances as Percent of Total
2017	142,332,000	$ 2,569,883,333	$ 1,849,466,667	72%	$ 720,416,667	28%
2018	136,440,000	$ 2,665,633,333	$ 1,881,546,914	71%	$ 784,086,420	29%
2019	130,556,000	$ 2,744,093,704	$ 1,895,646,173	69%	$ 848,447,531	31%
2020	124,668,000	$ 2,805,030,000	$ 1,891,530,000	67%	$ 913,500,000	33%
Total	**533,996,000**	**$ 10,784,640,370**	**$ 7,518,189,753**	**70%**	**$ 3,266,450,617**	**30%**

Source: O. Reg. 144/16 for allowance caps and expected carbon prices. *Notes:* Auctioned revenues are estimated based on a carbon price of $18/tonne that increases at a rate of $1.48/tonne each year to $22.50/tonne by 2020. These estimates are based on projected emissions that increase linearly between 2017 and 2020.

The distribution of free allowances representing roughly 30% of the total revenues will benefit large final emitters. The extent of the benefits received will depend on many factors including the industry's marginal cost to abate, market structure, or degree of cost pass-through of the carbon cost. The value of allowances accruing to consumers or the industry will be based on the implementation of climate change action plan initiatives funded by cap and trade proceeds.

6.3 Distributional Effects of Free Allowances to Industry

6.3.1 Benefits to Ontario's Large Emitters

Based on the distribution of free allowances, the allocation is assumed to be proportional to the emissions intensity of the product, process or activity (Appendix 2 of this report). Higher shares of free allowances will benefit firms under the product-output approach. Using 2013 facility emissions data, preliminary estimates of the portion of distributed allowances show that 90% of the large industrial emitters will benefit from allocations made under the product-output benchmark and historical allocation approaches (Appendix 3).

Free allowances will be awarded to individual companies, rather than to the sector that is practiced in Quebec's allocation approach. For analysis purposes, the following results are summarized by sector. If the benchmark allowances for process and fixed emissions are

combined to approximate total allowances received per tonne of output, assuming an average of 600,000 tonnes of output was produced[10], the following results emerge:

- Hydrogen production receives the most allowances at 9.65 allowances per tonne of hydrogen per year (~5.79 million allowances; ~15% of the cost of 2017 free allowances);
- Iron and steel manufacturing receives 3.1 tonnes for various types of iron[11] produced per year (~1.85 million allowances; ~5% of the cost of free allowances);
- Grey cement production receives 0.803 allowances per tonne of cement per year (~0.48 million allowances; ~1% of the cost of free allowances);
- It is expected that petroleum refineries that produce oil in Sarnia, Ontario will be eligible to receive 0.0047 allowances per Complexity-Weighted Barrel, and beer manufacturers will be eligible for 0.007 allowances per hundreds of litres of beer produced.

Under the historical absolute allocation approach, pulp and paper manufacturing industries will receive in total ~0.99 million allowances a year before applying the cap adjustment factor (~3% of the cost of free allowances). General stationary combustion eligible for historical absolute allowances receive ~0.09 million allowances a year (~0.22% of the cost). Additional industries eligible for historical emissions include glass production, petrochemical manufacturers, smelting and synthetics manufacturing among others.[12] Due to the declining cap adjustment factor between 2017 and 2020, the government has noted that the issuance of free allowances does not indicate that these facilities will receive 100% assistance (MOECC, 2016b). This rationale is further explored in the declining allowance cap for certain industries (see Section 8.1.3.3 for details). The analysis above further demonstrates that the distribution of benefits from free allowances amongst industries is not all equal. The intra-distributional inequities between the manufacturing industries that receive free allowances are discussed.

[10] This is the average output of 25 facilities categorized in the product output allocation category using 2013 data from the facility data reported under O. Reg. 452/09.

[11] This includes fixed process and combustion emissions for iron products, BOF steel, EAF steel, limestone used, coke and dolomite.

[12] For energy-use allocations applicable to direct/indirect thermal energy production and historical emissions intensity allocations, more specific information on the emissions intensity of products or the amount of energy used in a process would be needed to generate an accurate estimate.

6.3.2 Cost of Mitigating Leakage

In the event a domestic economic activity relocates to another jurisdiction and produces emissions that are identical to what existed at home, there could be lost production that lowers the nation's competitiveness with no net change in GHG emissions (Beale et al., 2015). If emissions can be shifted outside domestic boundaries due to the imposition of carbon pricing policies, the notion of carbon leakage undermines the policy's effectiveness, integrity and political attractiveness.

An estimate of leakage risk for Ontario was assessed to enable comparability of leakage results found in other studies. Table 4 shows the impact of a 1% increase in the electricity price on exports (proxy for total "production") and GDP (proxy for total "consumption" in Ontario). The percentage difference (e.g. production minus consumption) is an indicator of production leakage from Ontario. If electricity prices were increased by 10% over the last ten years, it could imply a -1.2% of lost production based on the six industries tested. This is attributed to industries in pulp and paper (-0.6%), chemical (-0.2%), aluminum (-0.15%), cement (-0.1%), glass (-0.07%) and iron (-0.06%). The leakage rate is small, but the analysis reveals relatively higher leakage risk in chemicals, basic metals and pulp and paper industries. The results in this study are consistent with EnviroEconomics' analysis stating that about -1.5% of emissions could be leaked, resulting in a fall in GDP by -0.03% in 2020 (Sawyer et al., 2016). The potential losses to Ontario's manufacturing production could be small in terms of overall lost economic output. It is reasonable to expect a mix of transitional assistance and auction proceeds, as this policy option maximizes net GHG reductions after leakage is considered.[13]

[13] See "Summary of Impacts Across Policy Alternatives in 2020" in Ontario's 2016-2020 Climate Change Action Plan.

Table 4: Estimated Net Production Impacts as Proxy for Leakage

Industry	Ontario's Competitiveness Effects with 10% increase in cost of energy (estimated)			U.S. Competitiveness Effects with $15/tonne (Aldy-Pizer, 2015)
	Production a.	Consumption b.	Net production (a) - (b)	
Iron	-0.12%	-0.06%	-0.06%	0% to -0.7%
Chemical	-0.3%	-0.1%	-0.2%	-0.2% to -1.2%
Paper	-0.4%	0.2%	-0.6%	-0.1% to -0.6%
Aluminum	-0.2%	-0.05%	-0.15%	-0.5% to -1.3%
Cement	-0.1%	0.0%	-0.1%	-0.3% to -1.3%
Glass	-0.13%	-0.06%	-0.07%	-0.3% to -0.5%

Sources: Data from Ontario's exports (proxy for production) in iron, chemical, paper, aluminum, cement and glass industries from 2006-2015 were collected from Trade Data Online; and Ontario's GDP (proxy for domestic consumption) in the above sectors were collected from Table 379-0030, Statistics Canada. *Notes:* See Appendix 4 of this report for estimation methodology based on the approach used by Aldy and Pizer of Resources of the Future. Net production is a proxy for production leakage (Aldy and Pizer, 2009; Aldy, 2016). Results are illustrative for Ontario due to the extremely small sample size used to illustrate the impacts.

In comparison to the U.S. study by Aldy and Pizer, a $15 per tonne carbon price on U.S. energy-intensive industries estimated that the cement, glass, aluminum and chemicals industries had stronger leakage effects of greater than 1%. The paper and iron/steel industries had lower leakage risks of less than 1%. The net effect on leakage was modest, as there was only a 0.2% decline in net imports (Aldy and Pizer, 2009). The study also found a 0.4-2.2% decline on employment levels (Ibid).

Canada's EcoFiscal Commission found that 2-5% of Ontario's GDP would be exposed to competitiveness pressures under a range of carbon prices from $10-100 per tonne (Beale et al., 2015). Only a few specific manufacturing sectors representing less than 1% of Ontario's GDP including steel, chemicals, petrochemicals, fertilizer and refining demonstrated notable exposure to competitiveness pressures (Ibid). These results are consistent with the fact that significant competitiveness and leakage risks have not yet emerged (Newell et al., 2013).

In a multi-industry cap and trade program, the market power of the industry affects the pass-through costs to consumers (Haites, 2003; Laing et al., 2013). As Appendix 5 of this report indicates, Ontario's chemical products have relatively low market power (index of 0.19) followed by basic metals and fabricated metal products (index of 0.21). This contrasts with the pulp and paper industry that has higher market power (index of 0.4). As hydrogen, iron and steel products are price takers, they pass on a smaller portion of their marginal costs to

consumers, despite high degrees of exposure to carbon prices. This shows that some industries in Ontario can benefit less from the free allowances received. Some reasons for the differences in the distribution of benefits among manufacturing industries could be due to differences in market power, emission intensities, cost structures and demand elasticities (Haites, 2003).

As the Ecofiscal Commission notes, the interconnectedness between the structural economy and impacts on competitiveness with carbon prices supports evidence-based analysis to assess the sector-by-sector competitiveness pressures from carbon pricing (Beale et al., 2015). This could be a useful area of analysis, as providing free allowances are a major cost to the policy. It would be important for policymakers to assess how sensitive different sectors are to carbon pricing over time and the extent to which transitional assistance would be most helpful to the industries.

6.4 Distribution Effects of Allowances to Consumers

6.4.1 Benefits to Consumers

Depending on how cap and trade proceeds are used, it affects the value of the allowances distributed to consumers and private entities (Stavins, n.d.). In the past, Stavins' analysis of the American Clean Energy and Security Act (Waxman-Markey Bill, 2009) concluded that 20% benefits accruing to industry can fully compensate for the equity losses due to the policy's implementation (Ibid). Based on the division of initiatives undertaken in the Kerry-Lieberman Bill, Stavins found that 82% of the benefits from the value of allowances had accrued to consumers while the remaining 18% accrued to industry.

The distribution of the value of allowances can be assessed from projected allocations of GGRA funding in the climate change action plan (Appendix 6 of this report). Based on the projected allocation of cap and trade proceeds, it was found that about 80% of Ontario's cap and trade proceeds may benefit consumers. [14] This amounts to over $6 billion in the value of the proceeds that may accrue to consumers. These benefits could be realized if the majority of greenhouse

[14] Initiatives benefitting consumers include six of the seven categories mentioned in Schedule 1: investments to deploy renewable technology (initiative 1); support for increasing consumer demand in using zero emission fuels that enhance land use and reduce building emissions (initiative 2); investments to support increasing consumer demand for zero emission vehicles and public transit infrastructure (initiative 3); investments in reducing greenhouse gas emissions in agricultural and waste industries (initiatives 5 and 6); and initiatives that will support organizations in developing and delivering financing tools, project aggregation and professional services to consumers to reduce greenhouse gas emissions (initiative 7). The benefits distributed to industry include allocations to new technologies (carbon capture, sequestration and storage) and changes to processes or inputs into the processes to reduce emissions (initiative 4).

emission reductions are achieved by 2020, but it may not if the expected cap and trade proceeds are not collected in full.[15] From a revenue perspective, there is risk that the maximum revenues from cap and trade may not be earned to realize the benefits from additional greenhouse gas reduction activities. From a distributional fairness perspective, the benefits received by consumers who effectively pay for the distributor's allowances could be lessoned.

6.4.2 Costs to Consumers

The direct cost to consumers, owing to the distribution of allowances, is the cost of free allowances paid to the industry, amounting to about $3.27 billion for 2017-2020 period (see Table 3). The indirect cost to consumers, as described below, is the immediate cost that consumers pay for the cost of allowances used by fuel distributors, amounting to about $7.52 billion for approximately 4.5 million Ontario households[16] from 2017 to 2020 that will pay an additional $158 per year for the cost of compliance by 2020. Table 5 below provides estimates of the income distribution effects of home heating and gas transportation costs to consumers.

In 2017, it is estimated that gasoline prices will rise by 4.3 cents/litre and natural gas heating costs by 3.3 cents/m^3 for residential customers based on a carbon price of $18/tonne.[17] Assuming 1,400 litres of gasoline and 2,400 m^3 of natural gas are used by the average household in Ontario every year, the cost of carbon that ranges from $18 to $100 per tonne could incrementally increase the bill for low-income consumers from 0.5% and 2.5% of after-tax income. For low-income consumers, the total bill impact including incremental carbon costs could range between 8% and 10% of after-tax income. Due to the substantial impacts on low-income consumers, it supports the need for targeted assistance to low-income families. This can be particularly challenging as residential tenants have been identified to be unable to make energy efficiency upgrades, but will pay the price of carbon (Ibid). This also includes exemptions on fuels used on First Nation reserves to mitigate the cost impacts, which will be specified through complementary regulation.

[15] A discussion of the risk of market illiquidity described in Section 7 of this report, demonstrated that the oversupply of allowances contributed to a loss of revenues earned at auction May 2016 joint auction between Quebec and California.
[16] This is 75% of 6 million households in Ontario affected by cap and trade.
[17] The cost estimates for gasoline and home heating costs were published by the Ministry of Finance in the 2016 Ontario Budget in March.

Table 5. Cost Impacts to Consumers by Income Bracket (Estimated from 2017 to 2030)

Income Bracket	Total Consumption (after income taxes)	Carbon Price: $18/tonne		Carbon Price: $100/tonne	
		Incremental (+$158/year)	Total (+$2,760/year)	Incremental (+$880/year)	Total (+$3,480/year)
Lowest Quintile	$ 34,895	0.5%	7.9%	2.5%	10.0%
Second Quintile	$ 44,155	0.4%	6.2%	2.0%	7.9%
Third Quintile	$ 63,569	0.2%	4.3%	1.4%	5.5%
Fourth Quintile	$ 82,821	0.2%	3.3%	1.1%	4.2%
Highest Quintile	$ 118,729	0.1%	2.3%	0.7%	2.9%

Sources: Table 203-0022 Survey of Household Spending, by income quintile; Table 405-0002 for sales of fuel used for road motor vehicles; Table 405-0004 for motor vehicle registrations; EB-2015-0114 for 2016 natural gas rates approved in Toronto.

6.5 Assessment

Based on the distribution of allowances, this analysis attempts to estimate potential gains and losses experienced in the program's first compliance period. This analysis was based on the quantifiable benefits known at the time related to the distribution of allowances.[18] Industries are expected to benefit significantly in terms of the value of allowances received from the allocations. Based on the policy options assessed by the Ontario government, however, a combination of auction and free allowance distribution is expected to mitigate carbon leakage and achieve the highest GHG reductions at the lowest cost. The distributional impacts between producers and consumers are summarized as follows.

For producers, there could be a potential gain of about $4.7 billion received from the distribution of allowances. These benefits could be comprised of the cost of free allowances received and portion of cap and trade proceeds accruing to industry. About 90% of free allowances are expected to come from allowances distributed from the production-output benchmark and historical allocation approaches. The EITE industries benefit from free allowances being a production subsidy on their operations. The economy benefits by keeping jobs and investments in Ontario. When carbon leakage is mitigated, it is expected to last for the period in which transitional assistance is provided. In the near term, the costs of the benefits are socialized among all consumers.

[18] This analysis does not account for capital investments or mitigation strategies incurred by large emitters, potential cost savings from energy retrofit programs funded by action plan initiatives, and the potential employment impacts associated with the implementation of the cap and trade program.

Despite the potential benefits received, this analysis has shown that manufacturing industries receiving free allowances can experience varying levels of risk exposure to carbon pricing. This justifies higher proportions of allowances to some industries over others. The basis of free allowance allocations will benefit those who are more carbon intensive and have less ability to pass on carbon costs to their customers. In the long term, even after the free allowances are phased out, price-taking industries may suffer from the lower level of cost pass-through of product costs to customers. This could support the need to evaluate the sector impacts from carbon prices to assess how carbon leakage can be addressed, without the provision of free allowances. Although it remains uncertain when the free allowances will be phased out, price taking firms with less pricing power will need to prepare for major changes soon. This will be beneficial for firms to reduce their future costs of compliance without free allowances availed. It could therefore be reasonable to expect that carbon pricing will incentivize competitive behaviour in the industry due to varying degrees of cost pass through of the carbon cost to its customers.

For consumers, it is projected that the potential benefits in GHG reductions distributed to consumers from the action plan initiatives may be countered by the costs paid to fund free allowances to the EITE industries and the cost of allowances purchased by fuel distributors. However, as transitional assistance will be phased out over time, the distribution of benefits to consumers through the re-investment of cap and trade proceeds is expected to increase, as targeted action plan activities will reduce the energy costs for households and businesses.

Recent events in the May 2016 auction in Quebec and California raise concern on the viability of the market to indicate the marginal costs to abate. This introduces risk to the funding model for the action plan to implement initiatives and complementary policies and create benefits to consumers. Further, as many complementary policies have not been implemented, it weakens the expectation of meeting provincial targets, unless the emission reductions will be enforced through more stringent means (Winfield, 2016). This places importance on the enforcement of the cap and trade program to achieve meaningful and significant reductions. As more information becomes available on the results of the auction and action plan initiatives, it will be useful to continue monitoring the costs and benefits associated with the distribution of allowances beyond 2020.

7. Effectiveness of Market Design

The effectiveness of the cap and trade system will be influenced by the performance and enforcement of the market rules to facilitate discovery of the carbon price. The carbon price should signal the marginal cost of abatement and incent real behavioural change to achieve significant emission reductions. This is a critical outcome as a low carbon price in the EU-ETS could not incent long term technological investments (Laing et al., 2013). Ontario's market design will be assessed for its ability to be efficient, transparent, enforceable and effective.

7.1 Market Design and Administration

Due to the potential harmonization of Ontario's cap and trade program with Quebec and California, Ontario's market design framework is consistent with the WCI. Once linking occurs, amendments to the Ontario cap and trade program will pertain to enforcing congruency in the market design with Quebec and California. By using the Compliance Instrument Tracking System Service (CITSS) to support the implementation of Ontario's cap and trade program, the following market rules have been established for Ontario:

- Quarterly auctions with sealed bids of 1,000 lot purchases
- A minimum (floor) price that is pegged to the Quebec and California auctions, increasing with the rate of inflation each year; and maximum (reserve) prices at fixed, tiered, prices representing 5% of total allowances auctioned
- Purchase limits of up to 25% of total allowances sold for capped participants, or 4% of total allowances sold for non-capped participants
- Holding (or banking) limits of no more than 4% of the participant's allowances for current and future vintage allowances
- Offset credit limited to 8% of a participant's total compliance obligation each year
- Same disposition of allowances as WCI that are unsold or exhausted at auction
- Similar enforcement provisions as WCI at the time of submission to enforce rigidity in the compliance process

In Ontario's cap and trade program, the Minister administers the program by establishing the compliance and holding accounts for capped participants. Participants will use the compliance account to track their purchases in meeting compliance obligations and use the holding account

to bank current vintage allowances and/or credits for the future. At the end of the first compliance period, the Minister removes the allowances and credits from the participant's accounts. Capped participants will demonstrate compliance by submitting allowances and/or credits that reflect total emissions produced from 2017 to 2020.

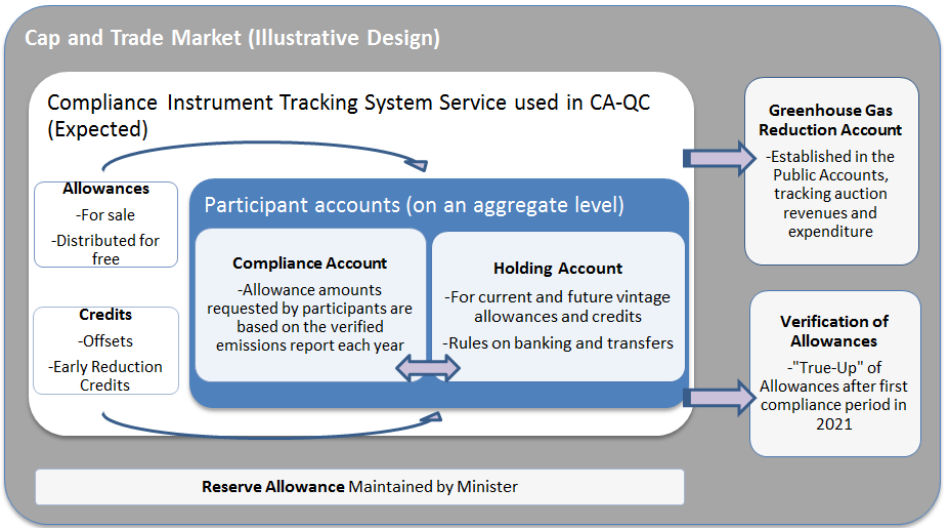

Figure 2. Illustration of Ontario's Cap and Trade Market

7.2 Efficiency

There could be various measures used to make the carbon market efficient. Such measures include imposing purchase restrictions, cost containment measures that smooth out price variability, a strategic reserve to add liquidity in the market, and intervention measures during the bidding process to enforce the purchase and holding limits. These are measures used in Ontario's cap and trade program.

Purchase limit. Efficiency in the market is controlled by how much each bidder can purchase in the market. To ensure that the carbon market is efficient, restrictions on the purchase limit will prevent market dominance by one participant. Once bidding into the market is permitted for a participant, the rules on purchase limits will apply to the compliance and holding accounts.

In joint auctions in Quebec and California, the measure of the concentration of allowances purchased by participants is measured by the Herfindahl-Hirschman Index (HHI). In a past auction (November 2014 to August 2015), 100% of allowances auctioned were sold (Appendix 7 of this report). The HHI ranged between 478 and 627, indicating that each participant held about

5-6% of the allowances in the market.[19] As the market becomes more efficient, the share of each participant's bid in the market is reduced. This indicates that a competitive market creates efficiency as market outcomes are not controlled by one participant.

Banking limit. The banking provision enables temporal flexibility and adds efficiency to the market, as it can mitigate potential price shocks if there are expected shortages in the following period. The market rules allow for 4% of the participant's annual current and future vintages allowances and/or credits to be held for future use (Appendix 8 of this report). To ensure that the banking limit is followed, allowances and/or credits that exceed the holding limit can be removed and reserved for sale at auction (O. Reg. 144/16, s. 43).

Strategic reserve. Starting in 2017, 5% of the total allowances in each compliance year will be put into a strategic reserve that are priced at $51.23, $57.63 and $64.04 per tonne, increasing by 5% each year with the rate of inflation (supra, ss. 55 and 80).

The strategic reserve adds liquidity to the market by limiting price shocks that could occur in the event of an allowance shortage in the market. Prior to bidding for reserve allowances held for sale, the applicant is required to meet certain conditions before bidding into the reserve allowances. This includes not exceeding the holding and purchase limits and the amount of the financial assurance. Only capped entities can make purchases from the strategic reserve.

Based on past results, the amount reserved for sale should be adequate, as less than 5% of strategic reserve allowances have been accessed by Quebec and California. This was estimated from the Quebec and California joint auction report from January 2016, as a total of 141.8 million reserve allowances were recorded out of 2.9 billion allowances and/or credits in all the accounts combined.

Interventions in bidding to increase efficiencies. There are various points in time where additional oversight is exercised during the bidding process to enforce compliance of the purchase and holding limits for each participant. These are important measures to maintain efficiency in the market.

[19] If the HHI is controlled by a single participant holding 100% of the allowances in the market, the HHI would be 10,000.

At time of the auction, the minimum price to be bid by each participant will be the higher of the allowance prices in Quebec or California on the day of the auction (supra, s. 71). Prior to accepting the bids, there is a screening process to prevent bids that exceed the holding and purchase limits, and whose bid value may exceed the value of the financial assurance (supra, ss. 72 and 74). There is oversight at the time of bidding to enforce program compliance and monitoring of purchases and holding limits to prevent the accumulation of market power by a participant. Further, to prevent the risk of default, the bid value is to be less than the value of the financial assurance.

The acceptance of bids starts at the highest bid price and continues in decreasing order by bid price until no more bids remain (supra, s. 75). This order appears to ensure that the lowest bid price will prevail. Before reserve allowances are available for sale to participants, the auctioned allowances in the market must be used up. In times of an allowance shortage, the remaining allowances will be distributed proportionately to the participant's share of allowances in the market. However, the market rules do not indicate explicit mechanisms to deal with allowance surpluses.

With market oversight to enforce purchase and holding rules, it makes the program administratively feasible when there are smoother allowance prices over time. Due to the monitoring and oversight activities enforced in the bidding process, it is likely that higher program costs will be needed to create efficiencies in the market.

7.3 Transparency

Transparency in the market rules will be discussed in terms of the submission requirements, participant disclosure requirements, availability of notices and opportunities to appeal. These rules ensure responsible conduct from participants and accountability from the government to report on the progress of the auctions.

Submission requirement. At the end of the first compliance period, only the following allowances can be submitted for compliance: Ontario allowances reserved for sale, emission allowances with a current or earlier year vintage, and emission allowances distributed free of charge (supra, s. 13). Until linking with Quebec and California is established, only Ontario allowances and credits are submitted by capped participants by the end of the first compliance

period. To prevent theft, the submission of allowances and credits will be confirmed by two of the participant's account representatives (supra, s. 15).

Disclosure of information. At the time of registration, all registered program participants will disclose the identity, corporate structure and ownership of the applicant. Specifically, ownership details include business associations with greater than 20% control. Related persons are defined as having greater than 50% control of the business. Market participants do not have a compliance obligation, but can register by disclosing information in Schedule 1. Participants who are related persons will allot the purchase and holding limits between the persons.

There will be one primary account representative or designated representative who can perform actions on behalf of the participant. The registrant's designation of account representatives will be declared at the time of registration. Altogether, the requirement to disclose the relationships of the participant will enhance the participant screening process, disclose the potential allotment of allowances between related parties, and indicate relationships between the participant and account representative(s) who administers the accounts on the participant's behalf.

Availability of notices. Over the course of the year, information on the auction or summary of auction sales will be made available to the public (supra, ss. 60 and 64). Similar to the notices on auction results issued for the Quebec and California, the availability of auction results will ensure that the bidding process was transparent on market activities.

Opportunities to appeal. For decisions or orders related to the conditions of registration, cancellation of registration, closing of cap and trade accounts, administrative penalties and review of compliance order, the participant can request a hearing by the Environmental Review Tribunal (*Climate Change Mitigation and Low-carbon Economy Act, 2016*, ss. 2 and 60). Although the scope of appeal is defined, this process can simplify the adjudicative process and create process efficiencies.

7.4 Market Enforcement

Ontario's cap and trade regulation has enforcement provisions to incentivize compliance. This is necessary to ensure that the allowances submitted represent the emissions produced by 2020.

Similar to Quebec and California, Ontario participants can be penalized with additional allowances to be submitted in an amount equal to three times the shortfall, known (3 to 1 rule). If the participant continues to fail to surrender all the allowances used to meet its compliance obligation, the obligation is converted to debt (O. Reg. 144/16, s. 20). The holding account will be restricted to transferring allowances or credits to the compliance account. The account representative's authority to deal with the accounts is further restricted to the compliance account (supra, s. 17). These enforcements ensure that the participant does not submit fewer allowances than the amounts reported. The 3 to 1 rule, account restrictions and compliance penalty are expected to incentive compliance and ensure accuracy of the emissions produced.

Further to these rules, Ontario intends to develop and publish rules on the application of administrative monetary penalties in 2016 to deal with non-compliance of the program and reporting regulations (MOECC, 2015c; 2016b). It will be difficult to comment on the enforceability of the submission requirement, as the administrative penalties have not been finalized. With the provision of timelines in the program regulation, it can ensure payment of the debt to help enforce the submission requirement.

7.5 Effectiveness

An important market outcome is the discovery of the carbon price that reflects the marginal cost to abate and incents behavioural changes to achieve a low-carbon transition. Considering the socio-economic impacts and damage costs to the environment, potential damages were estimated to cost $5 billion a year (Canada, 2011). For Canada, there are estimates of $100 per tonne by 2020 and $300 per tonne by 2050 to achieve deep decarbonisation (Canada, 2013). As environmentalists have cautioned, it can be problematic if carbon prices are not high enough to incent the immediate deployment of low-carbon technologies (Winfield, 2016). At the same time, the price of $18 per tonne in Ontario is relatively higher than many global economies and will continue to rise to indicate higher marginal costs to abate over time.

This will be a challenge for policymakers to balance the pace of change by instituting higher carbon prices today to signal immediate behavioural and technological change from society or allowing carbon reductions to be driven cost-effectively. The extent of a higher carbon price at signalling technological change could be tempered by the implementation of complementary policies, which may lower carbon prices when fewer allowances are demanded (Canada, 2013;

Newell et al., 2013; Peeters et al., 2013). The prospect of linking will also attain the emissions target at a lowest cost by leveraging a greater pool of allowances and/or credits to be used for compliance purposes.

7.6 Assessment

Based on the assessment of the efficiency, transparency, enforceable and effectiveness of Ontario's cap and trade program, there is administrative capacity built in the system to support an efficient and transparent market. Ontario's market design will be guided by a set of harmonized rules to enable linking in the WCI. The use of WCI infrastructure is expected to save implementation and transactional costs. There will be limited flexibility for Ontario to change the market design, as any potential changes will need to be reflected in Quebec's and California's market design. However, use of shared infrastructure for market operations is a necessary path for Ontario to achieve low-cost compliance and linking of its cap and trade systems within the WCI.

Market oversight has been built into the design to enforce the conditions to participate in the market. The market rules will enforce the purchase and holding limits to increase efficiencies and compliance with the program. These are cost containment measures including a price floor, price ceiling and strategic reserve to ensure that the market does not fail. The monitoring and oversight of the program to enforce the market rules are expected to result in higher program costs. Through market oversight and transactional efficiencies, it is expected to facilitate price discovery that enables low-cost emission reductions.

Transparency in the market design has been achieved with the disclosure of participant information that clarifies business relationships, potential allotment of holding limits and access to the accounts. The market rules will be enforced throughout the bidding process. Prior to the submission of allowances, the risk of fraudulent activity will be mitigated by having the bids confirmed by two account representatives. By the end of the compliance period, participants must demonstrate compliance by submitting allowances equal to emissions produced. The consequences could be serious as the EU-ETS's provincial emission caps were met, but not all firms were compliant and surrendered allowances on time (Laing et al., 2013). In case of a shortfall of emission allowances in Ontario, the 3:1 rule, account restrictions and compliance penalty will carry through. Penalties will otherwise apply, if this condition is not met. For

Ontario, instituting specific timelines with the requirement to pay the financial penalties could strengthen the enforceability of the submission requirement. It will be important to review the administrative penalties when subsequent regulations become available in 2016.

With the harmonization of the market with the WCI, Ontario's allowance price will be aligned with the carbon price in Quebec and California. The price increases by the rate of inflation to create consistent a floor price with Quebec and California. Despite the gradual price increases, the interaction of complementary policies can have negating effects of lowering the cost of carbon regulation (Canada, 2013). If lower carbon prices are accelerated with aggressive policies towards renewables, it may reduce the reliance on fossil fuels and free up allowances, but also dampen the price signal (Newell et al., 2013; Peeters et al., 2013). Due to potential interactions from renewable and other complementary policies that can reduce natural gas usage and the demand for allowances, it questions whether the carbon price path needs to rise to very high levels to achieve sustained behavioural changes. Policymakers therefore face the challenge of balancing the pace of change by allowing carbon reductions to be driven cost-effectively in the marketplace as compared to instituting higher carbon prices to signal immediate behavioural changes in the society.

Evidence from marginal abatement cost curves have shown that a carbon cost of over $100 per tonne would be needed for Canada to achieve a 50% emissions reduction (Rose and Wei, 2008). The risk of keeping carbon prices lower is the potential that it may dampen the adoption rate of new technologies (Scott et al., 2004). Policy experiences show that the impact of a low carbon price in prompting technological change was experienced by the U.S. SO_2 trading program, as more than half of the sources did not switch to low-sulphur coal when economical (Hahn and Stavins, 2011). The EU-ETS also experienced low carbon prices which stimulated short-term investments rather than longer term, high abatement technologies (Laing et al., 2013). In the near term, monitoring the market will be important to ensure that market liquidity facilitates price discovery. With a market-driven carbon price, it is expected that an efficient market leads to a carbon price that reflects the marginal cost to abate and the gradual progression of meaningful technological changes when it becomes viable to do so.

In Ontario, the CITSS supports market oversight, compliance verification, the recording of transfers and account information in the WCI. Although there will be limited flexibility on

market rules, the use of CITSS can be seen to raise efficiencies for trading activities and lower infrastructure costs to support the implementation of the cap and trade program. The CITSS is similar to the U.S. EPA's Allowance Tracking System used for the Acid Rain Program. The Allowance Tracking System was adopted by the EU-ETS to record allowance transfers used for compliance purposes and to ensure that the submission of allowances at the end of the term will correspond to the emissions produced. Decisions about the CITSS are made by the WCI Board of Directors with representation from Ontario.

8. Transparency of Accommodations and Flexibility Arrangements

8.1 Accommodations

Accommodations were first introduced in the U.S. cap and trade program under the Clean Air Act in 1990 that distributed free allowances to regulate SO_2 emissions. Following the U.S. SO_2 cap and trade model, the EU-ETS distributed free allocations based on production-based emissions (Peeters et al., 2013). Based on the production-based approach, the estimation of emissions without a good measurement of baseline emissions made the EU market prone to an over-allocation of allowances (Laing et al., 2013). Following the 2008 economic recession, the oversupply of EU allowances persisted with 77% of the EU firms holding surplus allowances in 2011 (Ibid). This led to the price crash and profits for many firms that passed on the costs to consumers (Pew, 2011). The inability of the carbon price to signal investments in low-carbon technologies was criticized. Today, the EU-ETS has evolved its emissions trading program to using industry benchmarks (Radu, 2014). The result of using performance benchmarks has reduced free allocations to the EU countries (Lecourt et al., 2013). As described in Section 2.4 earlier, there are automatic stability mechanisms in the EU-ETS to ensure an appropriate level of supply based on cumulative allowances injected and banked.

Studies that have examined the impact of different allocation approaches provide insight on the implications of the allocation method that Ontario proposes to use. Output-based allocations provide incentives to firms to maintain their current production levels as compared to historical allocations (Haites, 2003). Results show that output-based allocation can reduce leakage substantially, which is a benefit to the industries receiving allocations using the production-output method (Bushnell and Chen, 2012). While historical allocations are cheaper to maintain,

the cost of maintaining production in an output-based allocation approach will be reflected in higher allowance prices (Haites, 2003).

Due to the potential for carbon leakage in EITE industries, Ontario has made provision for the distribution of free allowances in the first compliance period. The determination of transitional assistance was based on the emissions intensity and trade exposure of Ontario's EITE industries (Appendix 8 of this report). The first part of this section assesses the transparency of free allowances provided to the EITE sectors. The second part of this section then assesses the flexibility arrangements included in Ontario cap and trade program to meet their compliance obligations. The discussion on early reduction credits and offsets will be limited, as these areas were not finalized in the program regulation.

8.1.1 Eligibility for Free Allowances

A facility that is a capped participant involved in the GHG activities listed in Schedule 2 of the Reporting Regulation is eligible to apply for free allowances. The established allocation methods in the Methodology for Free Allowances Distribution will apply to all eligible participants. The basis of free allowance distributions will be informed by a standard measurement and verification process to validate the reported emissions consistent with the Reporting Regulation. Similar to capped participants, voluntary participants can apply for free allowances based on verified data.

8.1.2 Review Process for Distribution of Free Allowances

The cap and trade regulation outlines a process for applicants to apply for free allowances and how these applications will be considered. By September 1 every year, eligible participants submit an application for free allowances, which is certified by a third party, based on the specified GHG activities engaged in at the facility (O. Reg. 144/16, s. 86). The Minister will determine the amount of free allowances based on the proposed methodologies (supra, s. 88). The Minister may also decline the application, if the information submitted was incorrect or the GHG activity has ceased (Ibid).

8.1.3 Transparency of Allocation Methodology for Free Allowances

The distribution of free allowances in Ontario follows the approach used in California's cap and trade program. A facility's allocation is determined by a formulaic approach which is the

product of (a) an industry assistance factor, (b) the base amount of emissions and (c) the cap adjustment factor (Methodology for Free Allowances Distribution, Tables 5 and 6). The total amount of free allowances distributed is the total of allocations by method and of the production adjustment. Each component of the allocation methodology is discussed.

8.1.3.1 Industry Assistance Factor

All industries receiving free allowances are subject to the same industry assistance factor of 100% that treats all industries equally in terms of the leakage rate assumed for all sectors. However, Ontario's approach of using a 100% industry assistance factor is consistent with California's approach of providing transitory support to all industries in the initial years of the program (Appendix 10 of this report).

If transitional assistance continues after the first compliance period, the decline in the industry assistance factor will be a key indicator to assess the industry's risk of leakage. The approach to provide transitional assistance should be targeted and evidence-based using data from the firm's experiences in the program. Once Ontario links with Quebec and California, there should be consideration in aligning industry-specific assistance factors based on consistent methods to define EITE sectors. This would create greater comparability in the amount of transitional assistance provided and inform the cost of the emission reductions achieved with free allowances.

8.1.3.2 Determination of Base Emissions

Product-output benchmark allocation (Method A)

Under the product-output benchmark approach, free allowances are distributed to five industries: cement manufacturing, beer production, hydrogen production, iron and steel, and petroleum refining. Base allowances are determined by multiplying the industry's benchmark emissions for the product by that facility's output. As a result, the more energy-efficient the facility is, the more allowances the facility receives against the benchmark. The product-output approach constitutes the majority of free allowances provided in the program. The products receiving allowances under this approach have also been identified with higher leakage risk (Appendix 9 of this report). They include grey cement manufacturing, beer production, hydrogen

manufacturing, iron and steel production (liquid iron, BOF steel, EAF steel, coke, limestone and dolomite) and petroleum refining.

There are a significant amount of free allowances distributed with this approach, which totals about 60% of the free allowances provided (Appendix 3 of this report). This also equates to 20% of the cost of 2017 allowances or 5% of the 2017 provincial allowance cap. It continues to be important to ensure that the distribution of free allocations is accurate based on appropriate benchmarks used for eligible products under this approach.

Energy-use allocation (Method B)

Under the energy-use allocation approach, emission allowances are allocated based on the amount of fuel used at the facility. This allocation approach can be generalized for facilities that generate useful thermal energy for an industrial process. Energy use allocations could amount to 30% of the free allowances provided (Appendix 3 of this report). By allowing cogeneration facilities on-site to receive allowances attributable to both electricity generation and steam generation, it removes the disincentive for cogeneration development if electricity generation were ineligible (MOECC, 2016b). It therefore treats combined heat and power facilities that produce heat and electricity in the same way as thermal energy generated from a boiler, a third party or thermal energy from a cogeneration unit (IESO, 2016). This change will simplify program implementation and compensate those cogeneration facilities that cannot pass on the carbon cost to customers. The allowances for thermal energy imports are determined in Method E.

The allocation of allowances based on fuel input will generate more allowances for facilities that are more carbon intensive. This approach could be perceived to postpone investments in facilities that are more fuel intensive, as fuel-based allowances will increase in proportion to the amount of fuel used. [20] Given these risks, it appears to be reasonable that there was a re-allocation of industries including pulp and paper products, petrochemical production and steam

[20] Eligible energy inputs are defined as other fuels that are excluded from the fuel inputs qualifying under the product-output benchmark approach, historical absolute, direct allocations and historical emission intensity, other than a few exceptions permitted for two facilities that produce nitrogen and steel (Methodology for Free Allowances Distribution, s. 2.2.2). Base allocations can be determined estimating the total amount of energy used in a facility that had access to natural gas or another fuel, less the amount of electricity transferred to the IESO or to a distributor, plus the amount of electricity purchased or generated from the combustion of fuel (supra, s. 2.2.1).

supply from the energy use approach to the historical allocation or product-output benchmark approaches to encourage energy efficiency.

Historical allocation (Method C)

Under the historical allocation approach, emission allowances can be based on historical average emissions intensity or absolute emissions. For historical emissions intensity, the base allowances allocated are determined by multiplying the product's emission intensity by the facility's output. For historical absolute emissions, the amount of free allowances does not change based on output produced or energy inputs used.

Historical allocations are estimated to benefit at least 10 industries or 20 products. These products include base metal smelting, brick-making, carbon black, ethylene, magnesium production, mineral wool insulation, lubricants and styrene (Methodology for Free Allowances Distribution, Tables 2a, 2b and 3). Based on estimates of historical absolute emissions, this approach could represent about 30% of the free allowances provided, 3% of the cost of 2017 allowances, and 1% of the provincial allowance cap (Appendix 3 of this report).

Despite the benefits of the historical allocation, fixating allowances to a certain quota can penalize industries that are growing (MOECC, 2015c). The historical allocation approach can be seen to limit emission reduction targets for the next three years based on the emissions produced in the past. The historical approach rewards carbon-intensive industries by matching the allowances with higher historical emissions, but penalizes growing industries or industries that have taken early actions. This contrasts with the product-output benchmark approach that measures the energy efficiency of firms relative to the emissions standard of the industry benchmark. Historical allocations can ease administrative burdens as there are no annual adjustments to the free allocations provided.

Direct allocation (Method D)

Under the direct allocation approach, the allocations appear to be made based on the emissions reported and verified two years prior to 2015. Direct allocations are applied to six different facilities: combustion emissions at institutions/universities, waste treatment and energy-from-waste facilities; process emissions at a nitrogen production facility; and fixed process emissions

for a facility producing lime (Methodology for Free Allowances Distribution, Tables 4a to 4c). Similar to the historical absolute allocations, direct allocations could reward facilities if the allocation levels are high, while penalizing cleaner plants. Preliminary estimates in this report indicate that the direct allocations approach can represent about 2% of the amount of free allowances provided.

Indirect useful thermal energy (Method E)

The base allowance allocations for imported thermal energy is determined by multiplying the imported heat reported by the non-biomass portion of the energy input used to generate thermal energy, and the emissions factor of a boiler operating at 80% thermal efficiency. The eligibility requirement for the indirect useful thermal energy approach is that a facility must not have received allowances from another allocation method for the same energy source (supra, s. 2.5.3).

The MOECC proposed that smaller emissions from indirect steam purchases (less than 10,000 tonnes of CO_2e per year) could be eligible to opt-in to maintain a level playing field between regulated facilities (MOECC, 2016b). This appears to be reasonable as broadened emissions coverage with indirect steam sources can lower the cost of compliance in the cap and trade program.

8.1.3.3 Applicability of Cap Adjustment Factor

The inclusion of process emissions provides broader coverage to achieve economy-wide reductions, but the cap adjustment factor for process emissions does not decline until at least 2020. This approach recognizes the difficulty that facilities face in implementing process changes in the next four years. It buys additional time for firms to prepare for significant production changes thereafter. Generally speaking, however, it could potentially forego the opportunity of achieving cheaper emissions reductions in the long run, if technological changes could occur earlier in the process.

Without accounting for biomass use at a facility, the cap adjustment factor for combustion emissions will decline by an average rate of 4.57% per year from 2017 to 2020. This target is as stringent as the average cap decline rate to achieve province-wide reductions. However, if biomass is used at a facility, it can reduce the rate of decline for combustion emissions in

recognition of the carbon neutrality of biomass.[21] The cap adjustment decline rate for combustion emissions is allowed to vary by facility in proportion to the amount of biomass used. In addition, the cap adjustment factor for biomass fuels does not decline under the energy-use allocation approach (supra, s. 2.2.3). This allows for the continued levels of energy usage at cogeneration facilities. Further, the combustion emissions from an institution and energy-from-waste facility are exempt from a declining cap adjustment factor for at least the first compliance period (supra, s. 2.4.2).

A consequence of this policy change is that it could be harder to compare the reductions in combustion emissions between industries, as industries may or may not use biomass. The cap adjustment factor for combustion emissions will vary on a case by case basis. To assess the effectiveness of the cap adjustment factor, it could be beneficial to correlate the emission decline rates by industry to the cap adjustment decline rate, and monitor the cost of actions undertaken by facilities to achieve emission reductions.

8.1.4 Reporting of Free Allowances

To be transparent with the allocation of free allowances, the participants who received free allowances and the amount of allowances distributed to each participant will be made public, subject to confidentiality constraints (*Climate Change Mitigation and Low-carbon Economy Act, 2016*, s. 31).

8.2 Flexibility Arrangements

There are provisions in the climate change legislation and program regulation that allow participants to have some flexibility in meeting their compliance obligations. The flexibility arrangements include the following:

- Facilities can be eligible for free allowances under different approaches
- Provision for allowances due to increases in production
- Emissions from direct and indirect links
- Exemptions from holding limit

[21] In the biofuels industry, carbon neutrality (or zero net emissions) is claimed on the basis that the carbon removed from biofuel source approximates the amount of carbon released when it is burned.

8.2.1 Facilities can be eligible for free allowances under different approaches

Some facilities with more than one eligible GHG activity may apply for free allowances. This provision is allowed for certain circumstances as defined by regulation. Two examples are described. First, Terra International's Courtright Nitrogen Complex is eligible for allowances under different approaches for different products produced: (1) the historical emissions intensity approach to cover combustion emissions for ammonia and nitric acid produced; (2) the energy-use approach, if different fuels other than natural gas are used for ammonia and nitric acid production; and (3) direct allocations for process emissions in nitric acid manufacturing. Second, Imperial Oil and Carmeuse Lime are both eligible for allowances attributable to different processes. Despite the flexibility arrangements provided, it is not expected to be overused, as these exceptions are allowed under prescribed circumstances. Given that facilities can be eligible for free allowances under different approaches, facilities should maintain a good record on the attribution of emissions from different products and processes that receive free allowances for the activities.

8.2.2 Provision for allowances due to increases in production

Through the production adjustment mechanism, it allows for the updating of allowances based on actual emissions produced. The production adjustment is applicable to allowances distributed under the product-output benchmark, energy-use allocation and historical emissions intensity approach. It does not apply to the historical absolute emissions approach.

The production adjustment will match the current year's allocation to production that happened in the same year.[22] On the one hand, if the adjustment results in a reduction in emissions, it reduces the risk of over-allocation. On the other, additional allowances granted through the production adjustment process will be a future vintage that can be submitted for compliance purposes (O. Reg. 144/16, s. 13). Although future allowances can be accepted in the current year, the additional allowances from the projection adjustment simply reflect the emissions increase that occurred in the prior year.

[22] Free allowances for 2017 will be allocated based on the past two years of production or energy use data from 2015. This was expected as 2016 data will not be available by September 1 every year, which would be the application deadline for free allowances (O. Reg. 144/16, s. 86). Once the 2017 data becomes available in 2018, the production adjustment will be calculated by subtracting the allocations using 2015 data from the allocations to be made using 2017 data.

8.2.3 Emissions from direct and indirect links

The GHG emissions associated with a person's prescribed activity can be emitted by the facility and include the emissions of a related party, only if two conditions are satisfied: (1) there is a direct or indirect link between the person and third party; and (2) there is a direct link between the prescribed activity and GHG emissions of the third party (*Climate Change Mitigation and Low-carbon Economy Act, 2016*, s. 9). This provision accommodates affiliates that are directly or indirectly associated with the corporate entity, so that all emission reductions can be attributed to the corporate entity for the purposes of estimating total emissions and free allowances.

8.2.4 Exemptions from holding limit

A registered participant is allowed to hold (or bank) up to 4% of total emission allowances and/or credits in a year. This can include a combination of current vintage allowances, strategic reserve allowances and early reduction credits banked for a future period (Appendix 8 of this report). The same rule applies to the holding limit for future vintage allowances.

There are two exemptions to the holding limit for current vintages. First, the holding limit can increase if the participant's activities produced emissions that were at least 250,000 tonnes of CO_2e more than the previous year (O. Reg. 144/16, s. 41). Second, the holding limit does not apply to the free allowances received. These exemptions are unique to Ontario's cap and trade program and reflect the needs of large industrial facilities that may require flexibility to increase production output.

8.3 Other Accommodations and Flexibility Arrangements

The *Climate Change Mitigation and Low-carbon Economy Act, 2016* created provision for credits and can impose monitoring, reporting and verification on the person who applies for the creation of offsets (ss. 34(4) and 35(4) of the Act). In California, the criteria for using offsets in the AB 32 Regulation created by the *California Global Warming Solutions Act of 2006* include the requirement that actual emissions are credited from activities that would not have otherwise occurred (CARB, 2014).[23] When establishing the criteria in Ontario, it will be important that the

[23] "Real" refers to crediting only actual reductions using conservative quantification methods; "Quantifiable" represents accurate and measurable calculation; "Additional" emissions are those that would not have otherwise occurred; "Enforceability" of an offset is demonstrated by submitting attestations to the California Air Resources Board; "Verifiable" emissions should be documented and transparent; "Permanent" are irreversible reductions or mechanisms for 100-year sequestration.

credits represent real, quantifiable, additional, enforceable, verifiable and permanent emission reductions.

Early reduction credits. According to Ontario's draft regulation, it was proposed that two million early reduction credits would be available between 2017 and 2020 (Draft Regulation, 2016, A.4.1). Ontario's approach is similar to Quebec's rules in providing a one-time allowance for these credits. Ontario's early reduction credits would be provided for permanent and irreversible reductions between 2012 and 2015 compared to a 2009-2011 base year, but would not be provided to industries that received free allowances under the product-output benchmark approach (supra, A.4.4). The average eligible emissions and emissions intensity of the facility each year must be lower than the reference period (supra, A.4.5). Based on these rules, there will not be over-compensation to firms receiving free allowances that increase with production. Early reduction credits will truly be useful for facilities that have a stringent target based on earlier action.

Offsets. The WCI rules allow offsets to cover no more than 49% of a facility's total emissions. Both Quebec and California use ozone depleting substances as common offset projects. In addition, Quebec's offsets include methane capture projects from manure storage facilities and waste disposal sites. California's offsets include projects in urban forests, livestock substances, rice cultivation and mine methane capture. Among the offset programs, there are different buyer liability rules whereby California's purchasing entities are responsible for the credibility of the offset. Quebec's offset registry system includes an Environmental Integrity Account that includes a buffer of additional offsets in case some offsets are less credible (Purdon et al., 2014).

California is considering additional principles on environmental and social safeguards from the Cancun Agreement (UNFCCC COP 16) to strengthen its existing offset protocols. Environmental safeguards are standards, principles or criteria included in the design and implementation of a sector-based crediting program to protect the environment and the rights of individuals and communities (California Air Resources Board, 2016). Including environmental safeguards in the development of offset protocols and mitigation against environmental degradation can prevent conversion of biodiversity and ecosystem (Ibid). Social safeguards can ensure the sharing of program benefits from the use of the offset (such as forests) by developers, government and communities to the local peoples who have traditionally used the lands.

Through safeguards, equitable benefits-sharing could be achieved by providing tenure rights to the local peoples, improving stakeholder participation and apportioning benefits to the local peoples (Ibid). Given the potential linkage with Quebec and California, Ontario could consider harmonized protocols and stakeholder engagement in the development of its offsets protocols. This can ensure standardization in the baseline of offsets, comparability of offsets and acceptability of projects in all jurisdictions. This further supports greater integration of a common offset protocol and an offset registry system within the WCI.

8.4 Assessment

Based on this assessment, large industrial facilities will be receiving accommodations and have flexibility within the market rules to maintain its production needs while complying with the cap and trade program. Although Ontario's approach to allocate free allowances is transitory, it is not known with certainty by when the free allowances will be phased out. Given this context, it creates the need to understand the benefits and trade-offs with accommodations and flexibility arrangements provided to participants of the cap and trade program. A key goal for policymakers is to ensure that industries are accountable for the cost of their emissions provided through free allowances.

The allocation methods for free allowances cover a broad range of eligible products and processes in the manufacturing industries. The distribution of free allowances will be based on verified data from existing and new facilities. For the first compliance period, there is a 100% industry assistance factor, treating all industries equally to mitigate carbon leakage. This approach is consistent with the practice used in California for the initial years of its cap and trade program. In the future, it may be beneficial to consider alignment of industry assistance factors within the WCI using consistent methods to define the EITE sectors. This could ensure greater comparability in the amount of transitional assistance provided and the amount of emissions reduced in the jurisdictions.

In Ontario, process emissions are not required to be reduced by all facilities over the first compliance period. This recognizes the significant challenges that large industrial firms face in reducing process emissions. This benefits capital-intensive firms by mitigating the risk of leakage and avoiding uneconomic investments by 2017. There could be potential risk of delaying low-carbon investments until 2020, but the use of multi-compliance periods in a cap

and trade program enables flexibility to reduce emissions in the year it is most cost-effective to do so. For the facilities that have reduced emissions in the past, they could be eligible for early reduction credits in recognition of the investments undertaken in the past five years to reduce emissions permanently. The use of early reduction credits would not double penalize the facilities with more stringent targets caused by earlier action.

The cap adjustment factor for combustion emissions declines at an average rate of 4.57% per year, with exception to institutions and energy-from-waste facilities. With the consideration of biomass, the cap adjustment factor affecting the rate of decline for combustion emissions is relaxed.[24] This recognizes the carbon-neutrality of biomass by rewarding industries with more allowances that use biomass at the facility. If transitional assistance continues after 2020, the industry decline rates for process and combustion should align with the provincial allowance cap decline to achieve sustained emission reductions.

The cap adjustment factors, with the consideration of biomass, will make it harder to compare the decline rates for combustion emissions in different sectors. Consequently, it may be beneficial to monitor the rates of emission decline by industry and GHG activity to identify where the reductions are occurring and the cost of emission reductions by facility.

As the EcoFiscal Commission stated, there could be a small degree of leakage due to carbon pricing in Ontario. This is consistent with the findings in Section 6.3.2 of this report. Nevertheless, the extent of accommodations provided to Ontario's industries can mitigate the potential risk of leakage, which enhances the effectiveness of the policy during this transitional period. As noted, the consideration of targeted approaches to address leakage could be useful to inform the extent of transitional assistance provided.

Based on the allocation approaches for free allowances, it is likely that energy-use allocations will allow for continued levels of energy use. Industries that engage in energy efficiency are penalized by receiving fewer free allowances under the energy-use allocation. This resulted in a policy change requiring certain industries to increase energy efficiency by having free allowances allocated based on historical emissions or product-output benchmark approaches.

[24] A potential concern with the carbon balances of biomass may raise debates on its carbon neutrality. This is discussed in Section 9.4.2 of this report.

The basis of allocations will be determined on past emissions or industry standard. Going forward, industries are anticipated to be capable of reducing emissions much more significantly relative to the baseline, without transitional assistance.

Based on the flexibility arrangements made under the program's first compliance period, a broad range of options are available to accommodate exceptional situations. A few were explored earlier, but the provision related to exemptions to the holding (or banking) limit is discussed below. Under the circumstance where there are significant increases in production of more than 250,000 tonnes of CO_2e a year, the participant's holding limit on allowances and/or offsets of up to 4% a year is withheld. Additional free allowances will be provided for the increase in emissions and the production adjustment will also apply. With the production adjustment provided to participants in the following year, it creates the possibility that future vintage allowances, related to the past year's emissions increase, can be submitted for compliance purposes in the current year. To ensure accuracy in the measurement of reductions in the current period, any future vintage allowance related to the production adjustment should not be used for other purposes. The accommodations to industry participants create the need to evaluate the performance of the flexibility arrangements to inform future program development.

In the context of meeting provincial emissions targets, it is clear that significant reductions will need to occur in the industry to meet long-term goals, even with some degree of transitional assistance to achieve more cost-effective reductions. As forecast emissions in the industry will be 20% higher in 2020 from 2013 levels (Section 5 of this report), it suggests the need for some flexibility in the program rules to create more time for more significant changes to occur after 2020. For businesses, a challenge will be securing financing to engage in more expensive mitigation options, while finding incremental savings opportunities with energy efficiency programs to reduce combustion related emissions cost-effectively in the short-term. This emphasizes the significance of re-investing cap and trade proceeds to help fund these opportunities. Given the cost of transitional assistance provided to large industrial facilities, accommodations should be transitory, as planned, and be provided to facilities in the interim to mitigate leakage and other risks. It will continue to be a challenge for policymakers to balance the costs and extent of accommodations and flexibility arrangements provided, while encouraging significant behavioural change through the industry's participation in the program.

In the future, it may be useful to explore the impact of flexibility arrangements on the pace of change and stringency of the emissions cap.

9. Measurability of Emissions and Impact

Measurable emissions are critical to informing program coverage, the rate of cap decline and distribution of free allowances. The measurability of emissions should be quantifiable, reportable and verifiable. This enables accurate measurement of the baseline to benchmark progress and assesses the potential to meet targets. This section will assess the measurability of emissions by reviewing the measurement, reporting and verification processes. The impact of emission reductions from a societal level is further assessed based on the potential emission reduction impacts achieved through the climate change action plan activities.

9.1 Measurement of Emissions

To support the implementation of the program, Ontario's reporting regulation aligns with the reporting requirements in Quebec and California. This includes measurement of emissions to be within a 5% error range and production data to be within a 0.1% error range in 2017 (O. Reg. 143/ 16, s. 26). To support the collection of data and measurement of emissions to inform the allocation of free allowances, both process and combustion emissions are collected and verified in GHG reports. Also, greater detail on the measurement requirements and reporting of biomass types will be required (MOECC, 2016a). Relative to the last reporting regulation, the reporting refinements support the implementation of the cap and trade program and ensure a higher margin of accuracy in the quantification and verification of emissions.

Quantification methods. Based on the Reporting Regulation, there is a requirement to use standard quantification methods to quantify the amount of greenhouse gases from the specified GHG activity (O. Reg. 143/16, s. 4). Alternative quantification approaches including the use of U.S. Environmental Protection Agency, Intergovernmental Panel on Climate Change and Environment Canada quantification methods in measuring GHG emissions are permitted, if the emissions are the lesser of 20,000 tonnes and 3% of total emissions in the facility in a year (Ibid).

To facilitate the measurement of emissions, most GHG activities will be measured from the Continuous Emission Monitoring System (CEMS) which obtains a continuous measurement of gas concentrations or emission rate from the combustion or industrial process with the use of

continuous monitors (Guideline for Greenhouse Gas Emissions Reporting, 2016). For measurement-based quantification, there is assurance that data is monitored at all emission points. The quantification of emissions will be reported in accordance with standard quantification methods for specified GHG activities to enable standardization in the quantification of emissions across Ontario industries and jurisdictions.

9.2 Reporting Requirement

In 2008, Ontario joined The Climate Registry to work on a common GHG emissions reporting system with other states and provinces (MOECC, 2009). To be consistent in threshold and emissions coverage in Quebec and California, Ontario lowered its reporting threshold from 25,000 tonnes to 10,000 tonnes (MOECC, 2015b). The reporting requirement may cease after 2020 if facilities emit 40% of a facility that produces 25,000 tonnes of CO_2e for the last three years of the compliance period (O. Reg. 143/16, s. 8).

There are different reporting thresholds for mandatory participants. A person who imports electricity will report and have verified all the emissions imported into Ontario. The same applies to a person who supplies petroleum products for consumption in Ontario, whereby 200 litres or more of petroleum product supplied during the year is reported and verified. For natural gas distributors, the reporting threshold applies to emissions of at least 10,000 tonnes of CO_2e or more. The verification requirement applies to emissions greater than 25,000 tonnes of CO_2e.

Petroleum product supply.[25] For petroleum product suppliers, the supplier reports the annual quantity of emissions that is first placed into the Ontario market, and the volume of biomass-based fuel that may be blended with each petroleum product. An attestation form is required to confirm the quantity of petroleum products received at the facility.

Industrial activity. Generally, the process and combustion emissions from CO_2, CH_4 and N_2O, and relevant inputs are collected to support the calculation of greenhouse gas emissions. The quantification of emissions supports the preparation of annual GHG reports that undergo third party verification. Other product emissions that are reported include adipic acid, ammonia, carbonate use, cement, copper and nickel, ferroalloy, glass, hydrogen, iron and steel, lead, lime,

[25] See ON.390 of the Guideline for Greenhouse Gas Emissions Reporting

magnesium, nitric acid, petrochemical, petroleum refining, phosphoric acid, aluminum, pulp and paper, refinery fuel, soda ash and zinc products.

Electricity imports.[26] The reporting of electricity imports includes the annual amounts of specified imports and any imported amounts from unspecified imports. Based on California's cap and trade program, the effectiveness of the reporting rules to regulate the carbon content of electricity imports have not been that effective at mitigating leakage. Despite the use of emissions factors, leakage is not always mitigated if reshuffling and laundering takes place.

Reshuffling, in the context of electricity imports, could occur if low-emitting or non-emitting resources that used to serve out-of-state energy were instead reassigned to serve Ontario; and higher-emitting, out-of-state resources that used to serve Ontario were instead reassigned to serve out-of-state power needs (Bushnell and Chen, 2012). Since electricity exports are not subject to the default emissions factor, reshuffling may incentivize the flow of carbon-intensive exports to jurisdictions that do not have carbon prices.

Laundering can take place if high-emitting, out-of-state power sources do not report the emissions content of their resources, and label the imported power as unspecified to take advantage of a lower emissions rate (Ibid). To address reshuffling and laundering, the California Air Resources Board required each compliance entity to sign an attestation form claiming that the importer did not claim GHG reductions that were not real (Ibid). No attestation form is required for Ontario electricity imports in Ontario.

Electricity generation.[27] Electricity generators report carbon emissions by fuel type, and methane and nitrous oxide emissions for all fuels combined. The carbon content and heating value of each fuel are reported to calculate the carbon emissions. To support the energy-use allocations for cogeneration facilities, the amount of thermal output including (and excluding) energy used for electricity generation, and the steam or heat imported from another facility, if applicable, are reported. Process and fugitive emissions are reported, which include HFCs from cooling units that support power generation. An attestation form is required to confirm the quantity of petroleum products received at the facility for natural gas fired generation.

[26] See ON.60 of the Guideline for Greenhouse Gas Emissions Reporting
[27] See ON.40 of the Guideline for Greenhouse Gas Emissions Reporting

9.3 Verification of Emissions

Facilities emitting greater than 25,000 tonnes of CO_2e a year will be verified. Emissions from biomass do not require verification (O. Reg. 143/16, s. 30). The purpose of third party verification is to ensure there is a reasonable level of assurance that the GHG report does not contain any material discrepancy with the amount of emissions reported (supra, s. 32). This involves reviewing whether the errors are less than 5% of the emissions reported or 0.1% of the production data. This also includes a site visit for new facilities that are preparing their GHG reports for the first time. The verification process supports collecting more accurate baseline data in 2017 and facilitates allowance purchase decisions to pace out future investments.

Prior to submitting the GHG reports, the report must be accredited by a third party that is a member of the International Accreditation Forum (ISO 14065) and meets international standards (ISO 14064-3).[28] This is to ensure that the accredited verification bodies providing the verification statement did not verify the GHG report (supra, s. 31). The duty to verify only ceases for voluntary participants, whose facilities that emit less than 25,000 tonnes of CO_2e in the last three years between 2018 and 2020 (supra, s. 11).

9.4 Climate Change Action Plan Supporting GHG Reductions

9.4.1 Measurability of Emissions Reductions

To achieve significant greenhouse gas reductions in the coming decades, it relies on the conditions to support the reductions. The re-investment of cap and trade proceeds in GHG reduction activities creates enabling conditions to reduce emissions significantly. Although emission reductions of 9.8 million tonnes are planned to be achieved by 2020, not all emission reduction opportunities have been quantified. Some of the benefits could be realized after 2020, support reductions in other sectors, or sequester carbon in the future. Further, the cost of achieving reductions in non-capped sectors of the economy is unknown. To ensure that emission reductions persist, the climate change action plan emphasizes the need for monitoring and evaluation of the action plan activities. These objectives support greater transparency in emissions reporting to understand how the GHG reductions are driven and the costs to achieve them.

[28] Eligible accredited verification firms may be associated with the Standards Council of Canada and the American National Standards Institute and must demonstrate duties of impartiality by complying with ISO 14065.

9.4.2 Use of Complementary Sustainability Metrics

Monitoring and evaluation of the initiatives can help inform the province's long-term energy plan and climate policy direction to achieve sustainability. Complementary metrics could be used to supplement the evaluation of activities in the climate change action plan in the future. Some proposed approaches are discussed.

Mitigate adverse impact with adaptive management plan. In California, it uses adaptive management plan to assess whether environmental changes including localized air quality impacts, forest impacts, or other direct and indirect changes are caused by its cap and trade program or U.S. Forest Protocol. California's adaptive management plan provides oversight on the program, ensuring the realization of emission reductions and keeping the public and the regulatory board informed of the impacts attributable to the cap and trade regulation (Air Ressources Board, 2015). For Ontario, a potential way to monitor and protect the environment from adverse changes could include consideration of social and environment safeguards to mitigate adverse impacts, which is an initiative that California is exploring.

Assess potential with exergy analysis. Exergy is a thermodynamic analysis that assesses the quality of the energy input (or the work potential) to the output produced. This approach can identify efficiency improvements, reductions in thermodynamic losses attributable to sustainable technologies, and the environmental and economic benefits of green technologies to increase their utilization (Rosen et al., 2008). The use of exergy analysis is known to be effective at finding opportunities and has potential to increase the penetration of renewable energy technologies, evaluating hydrogen production technologies, and measuring emission reductions (Rosen et al., 2008; Jalalzadeh-Azar, 2008). Using exergy analysis to evaluate the feasibility of new action plan initiatives can support the growth and penetration of renewable energy and energy storage technologies.

Model carbon flows to measure the emissions from biomass production. In the climate change action plan, there is a focus on sustainable forestry management, tree planting, soil and grass production, and the development of a land-use carbon inventory to track data on carbon flows. Due to the significance of biomass to mitigate climate change, it has warranted greater understanding of the cycling of carbon from biomass production to assess how efficient and effective carbon can be stored on land. It is anticipated that deeper understanding in this area

will take place to learn how to achieve true carbon neutrality, prompting the need to monitor the production and consumption of biomass.

Various factors need to be considered in managing land-use and biomass development. An example is provided to illustrate the considerations (Cushman, Marland and Schlamadinger, n.d.). If there is high quality soil, the land will be more productive to support the growth of new trees. Fast growing trees can displace more fossil fuels for each harvest in each cycle, but it could be slower for a mature tree depending on previously absorbed emissions. When biomass is burned, the release of carbon will harvest growth of new trees. If the rate of new tree growth is slower than the rate of carbon emitted from the burning of biomass, the net carbon emissions can increase and negate the fact that biomass is indeed carbon neutral. Carbon cycling is also affected by whether or not the biomass product displaces short or long lived products. Therefore, the net carbon balance depends on the amount of biomass on the land, how fast the trees can grow, and how efficiently it is harvested and converted to useful energy. These factors should be considered in land-use management practices to support the production and consumption of biomass.

9.5 Assessment

Due to the harmonization of systems with the WCI, Ontario's quantification, reporting and verification methods have been revised to be similar to the reporting regulation in Quebec and California. The emissions reported must be accurate within 5% and 0.1% of the measurement and production of greenhouse gas emissions. The reporting threshold in Ontario has been lowered from 25,000 tonnes to 10,000 tonnes of CO_2e per year, which includes mandatory reporting from voluntary facilities. A robust measurement, reporting and verification process for greenhouse gas emissions will promote consistency and standardization across the WCI.

The requirement to report greater detail on biomass types in Ontario appears to be necessary, as the use of biomass can affect the amount of free allowances provided to the industry. Emissions from the combustion of biomass at facilities will not require verification. However, the use of biomass will be significant as it allows carbon-neutral facilities to retain more free allowances as permitted by the moderate decline in the cap adjustment decline factor.

The accuracy in the measurement of process emissions can prevent the risk of over-allocation of free allowances. From a measurement perspective, the persistence of facility emissions can be achieved with continuous monitoring of emissions and a better understanding how GHG emission reductions are driven from different processes. To ensure sustained emission reductions, it will depend on the measurability of emission sources from GHG reduction activities. The measurability of emissions will pertain to the reductions in a facility's combustion emissions that are subject to an annual decline factor by 2020.

From a reporting perspective, only emissions greater than 25,000 tonnes of CO_2e at facilities require mandatory verification. Emissions between 10,000 and 25,000 tonnes of CO_2e are reported. Emissions below 10,000 tonnes of CO_2e and the use of biomass do not require reporting. The reporting process ensures that larger emitters producing a larger share of the emissions will be verified. The emissions from smaller sources could be expected to grow at a faster pace, as voluntary facilities may participate and trade excess allowances with mandatory participants.

The opportunities available to reduce emissions will be policy-driven to enforce significant changes to the built environment. As the cap and trade system will generate proceeds to support further emission reduction activities, it will be critical to ensure enforceability and implementation of the climate change action plan activities. Although the conditions for a low-carbon economy are created in the action plan, some initiatives beyond building retrofits and electric vehicle implementation may be more complex and require longer implementation timelines to realize the greenhouse gas benefits. Successful implementation of the action plan will be dependent on timing, program uptake and the cost of achieving the emission reductions.

California uses complementary policies to achieve 85% of its emission reductions with 15% of emission reductions achieved with carbon prices at less than $18 per tonne. This compares with British Columbia that has achieved 5-15% emission reductions and reduction in fuel consumption with its $30 per tonne carbon tax (Murray and Rivers, 2015). To ensure impact in Ontario, it will continue to be important to clearly attribute emissions reductions from policy initiatives, codes and standards, and emissions trading to assess the drivers of emission reductions and the costs to achieve the reductions. As Ontario is in its early years of the 2050 deep decarbonisation pathway, it could be useful to enhance measurability of emissions by

assessing how the industry is responding to the increased cost of production, how allowances are used, and how emission reduction opportunities are identified.

As the demand for energy is generally inelastic and carbon prices will be relatively contained in the next few years, it enhances the attractiveness of complementary policies to support the cap and trade program and encourage economy-wide change. As a result, achieving significant economy-wide emission reductions are likely to be achieved with the scale and scope of complementary policy measures. However, significant emission reductions will be realized after the measure's implementation.

A forthcoming consideration is the potential role and scale of offsets from agriculture, forestry and lands. Offsets should yield reductions that are real, quantifiable, additional, enforceable, verifiable and permanent. As discussed earlier, Ontario could consider the costs and benefits of enforcing harmonized protocols within the WCI and increasing stakeholder engagement in the development of its offsets protocols. This can ensure standardization in the baseline of offsets, comparability and acceptability of projects in all jurisdictions. A common offset protocol and offset registry system in the WCI could support the measurability of emission reductions from offsets.

To complement the climate change action plan initiatives, the consideration of sustainability indicators to evaluate future mitigation activities is anticipated to improve the social-economic and environmental relationships of implementing climate policy on the environment.

10. Integration with Other Measures

The low-carbon transition set out in the climate change action plan establishes the climate policy context in Ontario. This analysis focuses on the integration of the climate change action plan initiatives with broader political, economic and environmental policy objectives.

10.1 Politics of Ontario's Climate Policy

The political effort to re-introduce cap and trade after 2008 was led by the provincial Liberal government and resulted in Ontario's first major climate policy announced in 2016. This announcement came at time when the new federal Liberal government came to power in 2015 and supported putting a price on carbon. The decision to use a cap and trade program in Ontario

owes to the flexibility of using multi-year compliance periods, providing businesses with the option to choose their compliance path to meet climate change goals (MOECC, 2016c). The basis of the climate change action plan initiatives were informed by the Ontario Climate Strategy, which was developed on the feedback from consultations with the public on an Ontario-made strategy to fight climate change.

The analysis that follows will provide an overview of the expectations that Ontario's climate policy can have on the politics within government, relationships with stakeholders, and its alignment with provincial and federal climate policy goals.

Politics within government. With the climate change action plan, it laid out near-term changes that will be affected by climate change mitigation strategies. With changes to legislation to come, policymakers will need to coordinate within the government and manage the policy and approvals processes. There are plans to amend a broad range of frameworks that include changes in the municipal land-use process, energy planning process, provincial environmental assessments, Ontario Building Code, renewable fuel standards, renewable content requirement for natural gas, and tax changes for zero emission vehicles and low-carbon technologies. Because of the time required to institutionalize changes to the built environment, it will be challenging to achieve significant emission reductions across the economy until after the policies are implemented.

It is expected that the provincial government will work with the federal government to secure funding and ensure that federal infrastructure support aligns with provincial climate change objectives (MOECC, 2016c). These collaborations are expected to develop inter-governmental climate mitigation initiatives. To ensure that enabling policies in the action plan are implemented, the government will need to manage potential barriers affecting the policy's implementation.

Politics between government and stakeholders. Following the 2015 Fall Economic Statement, $325 million was made through the Green Investment Fund as a down-payment to the cap and trade program to fund potential emission reduction initiatives. With cap and trade, there will be differential impacts among industries. To maintain competitiveness and sustained GHG reductions that are not leaked outside of Ontario, the EITE sectors will receive transitional

assistance and accommodations until at least 2020. To ensure the cost of free allowances is accounted for, the government has confirmed through legislation that transitional assistance will be phased out with announcements to be made by 2021.

Alignment with provincial and federal climate policy goals. Based on the goals of the 2016-2020 climate change action plan, Ontario's climate policy direction is consistent with the spirit of decarbonizing the energy system and global trend to build a sustainable energy transition. By the end of the first compliance period, Ontario's cap and trade program is expected to meet provincial greenhouse gas targets in support of national emission goals. With a forthcoming national carbon pricing regime for Canada, there may be impacts on Ontario's minimum prices, if the national floor price were above $18 per tonne. Canada's forthcoming federal carbon policy is expected to send a strong signal for behavioural change from citizens, businesses and provincial governments.

10.2 Economic Policy Considerations

With the implementation of the Ontario's cap and trade program, there are implications on the economy including the prospect for jobs, exports, investment opportunities and trade impacts with Alberta.

Creation of clean jobs. To achieve emission reductions, this will need to be achieved by deploying low-carbon technologies and electrifying the energy system. Although pre-mature, it is expected that the climate policy will create new jobs in Ontario to build the low-carbon economy. Along with implementing infrastructure changes to the transportation and buildings sector to electrify the economy, the expectation for new jobs ought to come from the work needed in exploring R&D projects aimed at commercializing clean technologies (McCarthy, 2016b). As aging baby boomers also retire in the next few decades, the ability to build the low-carbon future creates an urgent need for skilled labour and expertise in the energy sector.

Development of a clean electricity exports market. Increased demand for electricity from the electrification of the economy is expected to require significant transmission infrastructure growth. This will depend on the approval of transmission infrastructure to transport power to the south (Yakabusiki, 2016). It is also anticipated that Ontario will support the U.S. and Mexico in reaching the 50% clean energy target by 2025 with Canadian electricity exports to meet the

Clean Power Plan goals (McCarthy, 2016b). For the next ten years, Ontario's clean energy exports to the U.S. could have implications on the role of natural gas, biomass and energy storage or other means, as the Darlington and Bruce nuclear stations complete refurbishment in 2025 and 2031.

Support for investment opportunities. The requirement to participate in the cap and trade program will increase the regulatory costs to investors that own carbon-intensive facilities in Ontario. The Ontario government plans to increase the adoption of clean energy technologies with incentives, tax credits for R&D, and favourable depreciation rates for low-carbon technologies to promote Ontario's investment climate (MOECC, 2016c). Climate change presents a $5 trillion global business opportunity in clean energy investments funded by private investors who need to understand the risks of climate change (Parkinson, 2016). From an investor's perspective, the cap and trade program should include transparent, consistent and reliable reporting of GHG emissions to help businesses price the value of carbon in their investments (Ibid).

The Ontario climate change action plan will create a Green Bank to provide low-interest financing for projects and aggregate larger commercial and industrial projects to reduce risk (Ibid). The Green Bank initiative was modelled from Vermont and New York to fund low-carbon technology growth. As access to financing has been a challenge experienced by homeowners and businesses to undertake deeper retrofits, the Green Bank is expected to serve the needs of Ontario consumers and save costs by aggregating the financing services of commercial banks. In Ontario, for example, heat pump technologies are prohibitively expensive to include as measures in residential natural gas demand-side management programs. These projects will not be economic for customers to pursue, even after the utility incentives are provided.[29] Now, with an independent entity that provides additional financing services to customers to encourage the adoption of clean technologies, the Green Bank will be critical in enabling the low-carbon transition.

[29] See technical conference materials in 2015-2020 DSM Proceeding for Ontario's DSM Plans.

Impacts on Trade. With a cap and trade program in 2017, petroleum products and electricity imports entering the Ontario market will be required to comply with the program. The carbon content of other traded goods and services are not subject to the regulation.

In terms of domestic trade impacts, it questions how the trade relationship between Ontario and Alberta may be affected. Alberta will be phasing out coal by 2030 and is moving towards a carbon tax by 2017. In Ontario, there are policies towards electrification, using renewable content in natural gas, and implementing greener codes and standards in buildings. In May 2016, Ontario and Alberta signed a Memorandum of Understanding to examine the opportunities to reduce GHG emissions in the production, transportation and use of natural resources, to accelerate renewable energy and storage development and to foster uses of carbon emissions (MOECC, 2016). Innovation in trade of cleaner energy and technological development continues to be expected from the strategic alliance.

In terms of international trade impacts, hypothetical situations are discussed below regarding the potential impacts that Ontario's climate legislation may have on trade. The free trade agreements that Ontario are engaged in include the North American Free Trade Agreement (NAFTA), the proposed Trans-Pacific Partnership (TPP) and Comprehensive Economic and Trade Agreement (CETA).

Trade with U.S. and Mexico in NAFTA (in force). Since 1994, the NAFTA came into effect and has doubled the GDP of North America to $20 trillion in 2014 (Global Affairs Canada, 2016). The North American Agreement on Environmental Cooperation was created as a side treaty to NAFTA to collectively conserve, protect and enhance the environment for the well-being of present and future generations (North American Agreement on Environmental Cooperation, n.d.).

It has been questioned whether lax environmental regulations in Mexico within the NAFTA incentivized U.S. firms to relocate, which increased U.S. job losses, reduced competitiveness in U.S. products, and increased border-area pollution (Tiemann, 2000). The impact of Ontario's cap and trade regulation on the reshuffling of products and relocations to other jurisdictions within the NAFTA has not been examined extensively. Although the potential for carbon leakage has been assessed to be insignificant, the interest in a federally-administered border

adjustment appears to be reasonable to mitigate the risk of reshuffling goods to jurisdictions without a carbon price.

Trade with Asia-Pacific Countries in TPP (in consultation). If the TPP comes into effect, it replaces NAFTA and forms the largest free trade zone in the world comprised of 12 countries[30] making up 40% of the world's GDP ($28.5 trillion) (Curry, 2016). In the TPP agreement, there are environmental stipulations that demonstrate support for climate change mitigation. This shows that cooperation in the transition to the low carbon economy was stipulated to prevent investor-state disputes:

> *"The Parties recognise that each Party's actions to transition to a low emissions economy should reflect domestic circumstances and capabilities and, consistent with Article 20.12 (Cooperation Frameworks), Parties shall cooperate to address matters of joint or common interest.*
>
> *Areas of cooperation may include, but are not limited to: energy efficiency; development of cost-effective, low emissions technologies and alternative, clean and renewable energy sources; sustainable transport and sustainable urban infrastructure development; addressing deforestation and forest degradation; emissions monitoring; market and non-market mechanisms; low emissions, resilient development and sharing of information and experiences in addressing this issue. Further, the Parties shall, as appropriate, engage in cooperative and capacity-building activities related to transitioning to a low emissions economy."* [31]

Trade with the European Union in CETA (not yet in force). The Canada and European Union free trade agreement will provide Canada with access to the world's largest market, totalling $20 trillion in GDP (Global Affairs Canada, 2016a). The CETA contains parallel provisions with Canada's North American Agreement on Environmental Cooperation that includes a commitment that parties must enforce domestic environmental laws (Global Affairs Canada, 2016b).

[30] The 12 countries in the TPP include Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, U.S. and Vietnam.
[31] See Article 20.15 of the Trans-Pacific Partnership Agreement (Global Affairs Canada, 2016).

Prospect for Border Carbon Adjustments. As discussed earlier, Ontario indicated an interest to have a federally-administered border carbon adjustment (MOECC, 2016c). Border adjustments can ensure that there is no cost advantage to produce goods in non-regulated jurisdiction.

The urgency with border carbon adjustments can also be seen by the fact that Ontario's record of GHG emissions with imported GHG emissions could go up by 50% (Dolter and Victor, 2016). This measure may be useful for managing carbon leakage, as transitional assistance is planned to be phased out.

Along with the political and legal challenges, there could be complications to trade agreements regarding the goods and services entering Canadian borders, especially when other trade partners do not use border adjustments. With border adjustments, the issue of re-shuffling may not be resolved and there could be administrative costs associated with using and regulating the border adjustment (Whitmore, 2012).

10.3 Environmental Policy Considerations

In terms of environmental policy considerations arising from Ontario's cap and trade program, the vision towards climate change mitigation broadly affects two areas: updates to Environmental Assessments to account for climate change and sustainable use of agriculture, forests and lands to store carbon.

Impact of Climate Change on Environmental Assessment. Environmental assessments (EA) are a process to ensure that governments and public bodies consider the potential environmental effects before an infrastructure project begins (MOECC, 2016d). For federally-administered EAs, the inclusion of climate change impacts in the EA process is consistent with broader climate change policy. As the Canadian Environmental Assessment Agency (CEAA) notes, EAs should consider where a project can contribute to greenhouse gases and where climate change may affect a project at all stages of the EA process (Appendix 11 of this report). To manage the risks associated with climate change on projects, the CEEA argues for consistent consideration of climate change in the EA process across federal and provincial jurisdictions (Canadian Environmental Assessment Agency, 2016).

For provincially-administered EAs in Ontario, changes to the current EA process to consider climate change mitigation and adaptation could be significant. However, the draft changes to

Ontario's EAs to account for climate change impacts were not publicly available, so the changes and scope of the impacts are not known. It is expected that the incorporation of climate change mitigation in provincial-led environmental assessment will be similar to federal considerations.

Sustainable Resource Development of Agriculture, Forests and Lands. As noted in Ontario's action plan, maintaining productive and sustainable agriculture, nature and lands can set the pathway for creating offsets for the Ontario cap and trade program. There are major plans to strengthen these sectors, particularly to maximize carbon storage from agriculture, develop a forest carbon policy framework, expand the Greenbelt to enable sequestration potential, and protect grasslands to store carbon (MOECC, 2016d). These initiatives are not known at the implementation stage. It reinforces the need to develop a strategy to monitor the development and the use of carbon sinks to support the cap and trade program in Ontario.

10.4 Assessment

Ontario's environmental policy shift towards decarbonizing the energy system supports Canada's commitment on climate change mitigation. This section explored the potential implications of the Ontario climate policy for political, economic and environmental policy considerations.

In terms of political considerations, there will be major energy use changes from switching fossil fuels to renewable energy and electricity. This policy shift affects how transportation will be fuelled and how heat and power are sourced for heating and cooling needs in residential, commercial and industrial buildings. The Ontario Building Code is planned to include long-term GHG targets to align with provincial emission goals, and the renewable fuel content for petroleum products and natural gas are expected to increase. In addition, there are planned changes to municipal land-use planning and environmental assessment, consumer protection measures for low-income consumers affected by carbon prices, and the need for community empowerment. Besides the challenge that many of these policies are at a formative stage, the changes are complex and require time to implement and enforce. The climate change challenge on the political process strengthens the need for collaboration between all levels of government. There is an ongoing need for alignment in provincial long-term goals and objectives with forthcoming federal climate policy to ensure effective execution of climate policy.

In terms of economic policy considerations, there are major economic opportunities from increasing the deployment of low-carbon technologies to accelerate the low-carbon transition. Clean jobs and investment opportunities are expected to come with the implementation of the climate change action plan. Low-interest financing opportunities will be accelerated with the Green Bank, provided that its implementation is successful in accelerating low-carbon technological growth. In the future, it could be useful to study how sustainable technologies accelerated through Ontario's climate policy, particularly from cap and trade, are contributing to behavioural transitions in the economy that can guide the future of technological development.

In terms of environmental policy considerations, the inclusion of climate change in the EA process has the potential to identify project risks earlier and lower future costs of compliance. With considerable interest in leveraging the natural environment as carbon sinks, it supports continued monitoring of the environment and how it will be used to displace emissions from fossil fuels. To build greater resiliency and adaptive capacity to climate change, it would be beneficial to review the implementation of the cap and trade program, progress on the climate change action plan, long-term goals and alignment with forthcoming federal climate policy.

11. Risk Analysis

The Ontario market design has closely mirrored the market design of Quebec and California to facilitate the transition process once Ontario links within the WCI. As allowances are traded in the market, it is expected to facilitate price discovery of the marginal cost to abate. Liquidity in the market is expected in the Ontario market as the price relies on the same carbon price in the joint Quebec and California auctions. The market design features promote cost containment (e.g. price floor, price ceiling and strategic reserve) but allow for flexibility within the rules that can increase program costs.

As for the re-investment of cap and trade proceeds into activities that reduce greenhouse gases, the measurability and sustainability of the emission reductions are largely expected to come from the projects invested. There will be a significant cost to implement the climate change action plan. The policy design assumes $1.8-1.9 billion in revenues to be collected each year, but expected revenues may fall if fuel distributors purchase fewer emission allowances than expected. Additionally, as 20% of the action plan activities do not yield greenhouse benefits

until after 2020, some action plan initiatives may impose higher costs for monitoring and evaluation. Generally, emissions that cannot be measured easily are less feasible to administer (Pew Centre on Global Climate Change, 2008).

Other issues associated with the policy implementation are the significant upgrades to the transmission and distribution system to accommodate electrification of transportation (Pollitt, 2008). To enable integration of low-carbon technologies with the energy system, there may be potential costs of recovery of long-term stranded assets that could be replaced with shorter-life distributed generation technologies. This will be fuelled by the adoption of sustainable technologies with incentives and low-interest financing that is expected to increase the technology's achievable potential in the marketplace. With the accelerated pace to the low-carbon transition, there may be further consideration on future energy system planning to optimize GHG emissions, which may be considered along with the current challenges of reforming the distribution network to enable greater participation of distributed technologies on the electricity network.

12. Conclusion and Recommendations

In summary, the findings from this evaluation indicate that complementary policies funded by the cap and trade program will be an important aspect of enhancing emission reductions and achieving low-cost compliance through the carbon market. The scope of Ontario's climate policy set out a preliminary action plan describing the potential impact of the $8.3 billion in cap and trade proceeds in forthcoming initiatives and policies to reduce greenhouse gases significantly. If the action plan is implemented successfully, it will create the conditions to help Ontario achieve long term, sustainable emission reductions.

There are areas of the cap and trade regulation that are not finalized, including the criteria for offsets and early reduction credits, administrative penalties, and complementary policies for reserve fuels used on First Nations lands. Due to potential concern on the carbon neutrality of biomass, expected progression of the price path, enforceability of the submission requirement and required time to implement the action plan, it can be perceived to weaken the success of the cap and trade program. Nevertheless, the design of the cap and trade program is accommodating and flexible to industry participants, whose design adheres to WCI design principles. With

multi-year compliance periods to achieve emission reductions in a cost-effective manner, it creates the opportunity to assess how program participants will best respond to carbon prices, either through investments in long-term abatement technologies or purchases of allowances or credits. Finally, it is difficult to assess the effectiveness of the carbon price in isolation of complementary policies as the mechanisms should work hand-in-hand. This evaluation of the cap and trade regulation has offered some insight on the program's effectiveness using the six criteria framework.

First, there is comprehensive coverage of emissions that supports low-cost compliance, fair treatment of emissions in the cap and trade program, and sufficient annual declines to meet the 2020 targets. During the first compliance period, 82% of the province's emissions will be regulated under the cap that declines annually at an average rate of 4.1% to achieve a 15% emissions reduction target by 2020. There is a level playing field established for domestic electricity generation and imports, regulation of emissions from combined heat and power facilities, as well as facilities generating thermal energy directly and indirectly.

Second, based on quantifiable costs and benefits, there could be greater gains from the allocation of allowances accruing to the industry than to consumers in the first compliance period. This is initially owing to the cost of free allowances and the allowances for the fuel distributors paid by consumers. Over time, it is expected that the cap and trade proceeds will be re-invested in activities that significantly reduce the energy costs for households and contribute to greater societal benefits that persist after 2020. This is also supported by an estimate that 80% of the benefits from cap and trade proceeds will accrue to consumers. However, many action plan initiatives beyond building retrofit and electric vehicle implementation are formative at this time, and may require more time to be implemented to realize the emissions reduction benefits. Although it is not known with certainty when free allowances will cease, transitional assistance is planned to be phased out.

Third, Ontario's market design is consistent with Quebec and California to enhance linkage opportunities in the future. The evaluation of the market design shows that Ontario's program meets the criteria of being efficient and transparent, but it requires further studies to determine effectiveness of the carbon price in achieving significant emission reductions. In expectation of a carbon price that reaches $100 per tonne in Ontario by 2030, the starting prices today may not

be a large enough opportunity cost to signal immediate behavioural change. This places emphasis on the re-investment of cap and trade proceeds to finance complementary measures that transform the market and reduce emissions across the economy. Over the course of the next couple of decades from 2030 to 2050, the baselines for greenhouse gas reductions would have risen with the deployment of low-carbon technologies in homes and businesses, market transformation from renewable fuel content standards and electrification, and increasing cost-effectiveness of new technologies that become deployed to lower the demand for natural gas and emission allowances in Ontario. Given the potential negating impact that low-carbon and renewable policies can have on carbon pricing, it is unclear whether the future carbon price trajectory needs to remain between $100 and $300 per tonne in 2030 and 2050. It is also pre-mature to comment on the enforceability of the submission requirement, pending finalization of the administrative penalties. However, stipulating timelines for the 3 to 1 submission requirement could enhance enforceability of the submission requirement. Ontario's cap and trade market is expected to use the CITSS to save infrastructure costs once linking occurs. Due to the checks in the bid and auction processes that enforce the purchase and holding rules, higher monitoring and oversight costs could be expected.

Fourth, in terms of accommodations, the cost of free allowances represents a total of $3.27 billion by the end the first compliance period. The basis for allocations will be supported by verified emissions prepared in accordance with the requirements of the Reporting Regulation. The accommodations to industry are generous, but should be reasonable in the context of expected emissions growth in the coming years, and appropriate to provide for transitory assistance to mitigate uneconomic investments to reduce process and combustion emissions. The use of auction and transitional assistance also attains the highest net GHG reductions at the lowest cost. The extent of transitional assistance provided is expected to help the industries that need it the most.

In terms of flexibility arrangements, there will be exemptions primarily for large increases in production for large emitters and a more moderate decline of free allowances for facilities using biofuels. Transitory assistance appears to be provided to help large emitters prepare for significant actions after 2020. With free allowances and flexibility arrangements that relaxes certain program rules, it will be important to ensure accurate reporting of the emissions produced

and true-up of the allowances. For those receiving transitory assistance, this ensures that program participants are accountable for the cost of producing emissions that are covered with free allowances.

Fifth, in terms of the measurability of emissions, a robust measurement, reporting and verification process is in place in Ontario to enable effective and consistent quantification and reporting of emissions with Quebec and California. To ensure sustainable reductions in the long run, it requires successful enforcement of action plan initiatives, monitoring of the initiatives funded by cap and trade proceeds, and consideration of complementary metrics to evaluate prospective climate change action plan initiatives.

Sixth, Ontario's climate policy will integrate well with broader provincial and federal government objectives. Some actions have immediate implication to make changes to current legislation that will affect the built environment. The creation of the cap and trade program is expected to integrate with economic policy, as climate policy is expected to build economic prosperity from clean jobs, a clean exports market and investment opportunities. Due to the expanded function of the environment in their potential capacity as offsets, it indicates a significant need to protect and maintain the environment. The following recommendations are provided to inform near-term development of the cap and trade program regulation.

Recommendations

1. Continue to monitor the performance of the market rules to create an efficient, transparent, enforceable and effective market for many years to come.
2. Monitor the rates of emission decline by industry and GHG activity to identify where emission reductions are occurring and the cost of reductions at the facility level.
3. Assess the performance of Ontario's flexibility arrangements provided over time, along with the potential impact of accommodations and flexibility arrangements on the pace of change and stringency of the emissions cap.
4. Ensure that the action plan initiatives are implemented in a cost-effective and sustainable manner. This should be considered with sustainability metrics to evaluate the potential and impact of emission reductions in future policy actions.

5. Continue to engage in understanding the flow of carbon in the environment and ways to achieve true carbon neutrality from the production and consumption of biomass.
6. Monitor the purpose of the offsets, how they will be used and maintained. There could be standardization in the baseline of offsets to enhance comparability and the acceptability of projects through harmonized offset protocols within the WCI, where feasible.
7. Review the implementation of the cap and trade program, progress of the action plan, long-term goals of the program, and alignment with forthcoming federal climate policy.

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Ontario Reporting Regulation, O. Reg. 143/16

Quebec Cap and Trade Regulation

Appendix 1: Emissions in Ontario by Sector and Source (2013 Actuals)

2013 GHG Emissions (MT of CO2e) in Ontario	CO_2	CH_4	N_20	HFC	SF_6	PFC	NF_3	Total	% of Total: By Sector
Transport	59	0.2	2	-	-	-	-	**61**	**36%**
Road Transportation	45	0.1	1					46	
Other Transportation	9	0.1	1					10	
Railways	2	0.002	0.1					2	
Domestic Aviation	2	0.002	0.02					2	
Domestic Navigation	1	0.003	0.03					1	
Industry	43	1	0.2	2.3	0.3	-	-	**47**	**27%**
Petroleum Refining Industries	6	0.0011	0.009					6	
Mining and Upstream Oil and Gas Production	0.6	0.0003	0.008					1	
Manufacturing industries	16	0.02	0.1					16	
Construction	0.4	0.0002	0.004					0.4	
Agriculture and Forestry	2	0.001	0.01					1.6	
Fugitive Sources (e.g. coal mining and natural gas and oil)	0.3	1	0.01					1	
Mineral Products (e.g. cement, lime and mineral products use)	4							4	
Metal Production	8				0.2			8	
Production and Consumption of Halocarbons				2	0.1			2	
Non-Energy Products from Fuels and Solvent Use	7							7	
Other Product Manufacture and Use	0.01		0.1					0.1	
Buildings	31	1	0.4	-	-	-	-	**32**	**19%**
Residential	19	1	0.3					20	
Commercial and Institutional	12	0.01	0.1					12	
Electricity	11	0.1	0.1	-	-	-	-	**11**	**6%**
Agriculture	0.2	5	6	-	-	-	-	**10**	**6%**
Waste	0.2	9	0.3	-	-	-	-	**9**	**5%**
Total Emissions by Source (MT of CO2e)	**144**	**17**	**8**	**2**	**0.3**	**-**	**-**	**171**	
% of Total: By Emission Source	**84%**	**10%**	**5%**	**1%**	**0.1%**				**100%**

Source: Re-organization of Table A10–13 of the National Inventory Report for Ontario's 2013 GHG emissions in the Part 3 submission to United Nations Framework Convention on Climate Change (UNFCCC) by sector.

Notes: CO_2 accounted for 84% of 2013 emissions. CH_4 accounted for 10% of 2013 emissions (GWP of 21). N_2O accounted for 5% of 2013 emissions (GWP of 310). HFC accounted for 1% of 2013 emissions. SF_6 emissions from electrical equipment are accounted for in "Production and Consumption of Halocarbons" and represented 1% of 2013 emissions (GWP of 23,900).

Appendix 2: Product-Output Benchmark and Historical Absolute Allocations

Table 1a: Method A - Product Output Benchmarks for Product Produced

Item	Column 1 Specified GHG activity or component of a specified GHG activity	Column 2 Product produced	Column 3 Product produced units	Column 4 Benchmark for fixed process emissions (BM_{p_i})	Column 5 Benchmark for combustion emissions (BM_{c_i})	Column 6 Benchmark units
1	Cement production -grey cement Production	Grey cement	Tonnes	0.487	0.316	Emission allowances per tonne of grey cement produced
2	General stationary combustion - beer production	Beer	Hundred Litres	0	0.007	Emission allowances per hundred litres of beer produced
3	Hydrogen production	Hydrogen	Tonnes	5.5	4.15	Emission allowances per tonne of hydrogen produced
4	Iron and steel production	Liquid iron	Tonnes	1.034	0.396	Emission allowances per tonne of liquid iron produced
5	Iron and steel production	BOF steel	Tonnes	0.147	0	Emission allowances per tonne of BOF Steel produced
6	Iron and steel production	EAF steel	Tonnes	0.067	0	Emission allowances per tonne of EAF Steel produced
7	Iron and steel production	Coke	Tonnes	0	0.522	Emission allowances per tonne of coke produced

Table 1b: Method A - Product Output Benchmarks for Product Used

Item	Column 1 Activity and sub-activity	Column 2 Product used	Column 3 Product produced units	Column 4 Benchmark for fixed process emissions (BM_{P_i})	Column 5 Benchmark for combustion emissions (BM_{c_i})	Column 6 Benchmark units
1	Iron and steel production	Limestone	Tonnes	0.44	0	Emission allowances per tonne of limestone used
2	Iron and steel production	Dolomite	Tonnes	0.48	0	Emission allowances per tonne of dolomite used

Table 1c: Method A - Product Output Benchmarks for Process Parameter

Item	Column 1 Activity and Sub-activity	Column 2 Process parameter	Column 3 Benchmark for Fixed Process Emissions (BM_{P_i})	Column 4 Benchmark for Combustion Emissions (BM_{c_i})	Column 5 Benchmark Units
1	Petroleum refining	CAN-CWB	0	0.0047	Emission allowances per Complexity-Weighted Barrel

Source: Methodology for Free Allowances Distribution (Ontario's Cap and Trade Program)

Table 180-1—CO_2 Emission Factors for Common Carbonates

Mineral Name – Carbonate	CO_2 Emission Factor (tonnes CO_2/tonne carbonate)
Limestone - $CaCO_3$	0.43971
Magnesite - $MgCO_3$	0.52197
Dolomite - $CaMg(CO_3)_2$	0.47732
Siderite - $FeCO_3$	0.37987
Ankerite - $Ca(Fe,Mg,Mn)(CO_3)_2$	0.47572
Rhodochrosite - $MnCO_3$	0.38286
Sodium Carbonate/Soda Ash – Na_2CO_3	0.41492
Others	Facility specific factor to be determined through analysis or supplier information or using stoichiometric ratio

Source: Reporting Guidelines *Notes:* Example showing emission factors used for limestone and dolomite in the product-output method above (Items 1 and 2 of Table 1b)

Table 3: Method C - Historical Absolute

ID	Column 1 Company Name and Facility Name	Column 2 Facility City	Column 3 Specified GHG activity or component of a specified GHG activity	Column 4 Historical average fixed process emission allocations (B_{hp})	Column 5 Historical average combustion emission allocations (B_{hc})
1006	Atlantic Packaging Products Ltd. - 111 Progress	111 Progress Avenue	Pulp and paper production	0 tonnes	45,616 tonnes
1138	AV Terrace Bay Inc. - AV Terrace Bay	Terrace Bay	Pulp and paper production	0 tonnes	140,530 tonnes
1011	Brampton Brick Limited - Brampton Brick	Brampton	General stationary combustion and carbonate use - brick making	28,957 tonnes	31,438 tonnes
1023	Cascades Canada ULC. - Norampac Trenton Division	Trenton	Pulp and paper production	0 tonnes	43,977 tonnes
1032	Domtar Inc. - Dryden Mill	Dryden	Pulp and paper production	0 tonnes	87,886 tonnes
1033	Domtar Inc. - Espanola Mill	Espanola Mill	Pulp and paper production	0 tonnes	176,136 tonnes
1080	Dunn Paper Inc. - St. Catharines Paper Facility	St. Catharines	Pulp and paper production	0 tonnes	27,393 tonnes
1046	Flakeboard Company Limited - Flakeboard Company Limited	Sault Ste. Marie	Pulp and paper production	0 tonnes	38,163 tonnes
1066	Forterra Brick - Forterra Brick, Burlington	Burlington	General stationary combustion and carbonate use - brick making	14,821 tonnes	26,265 tonnes
1158	Glencore Canada Corporation - Sudbury Nickel Smelter Complex	Falconbridge	Copper and nickel production -mining, base metal smelting, refining	86,464 tonnes	36,405 tonnes
1163	Greenfield Specialty Alcohols Inc. - Tiverton Plant	Tiverton	General stationary combustion	0 tonnes	10,608 tonnes
1078	Innophos Canada Inc. - Port Maitland Plant	Lowbanks	General stationary combustion and carbonate use - phosphate product production	12,056 tonnes	19,985 tonnes
1083	Irving Tissue Corporation - Weston Plant	Weston Plant	Pulp and paper production	0 tonnes	51,920 tonnes
1094	New Forest Paper Mills LP - New Forest Paper Mills	333 Progress Avenue	Pulp and paper production	0 tonnes	55,323 tonnes
1120	Resolute Forest Products Canada Inc. - Thunder Bay Operations	Thunder Bay, ON	Pulp and paper production	0 tonnes	214,792 tonnes
1121	Roxul Inc. - Roxul Inc.	Milton	Glass production - mineral wool insulation production	0 tonnes	73,348 tonnes
1127	Sonoco Canada Corporation - Trent Valley Mill	Trenton, ON	Pulp and paper production	0 tonnes	40,293 tonnes
1131	Strathcona Paper GP Inc. - Strathcona Paper LP	Napanee	Pulp and paper production	0 tonnes	30,567 tonnes
1135	Tembec - Kapuskasing Operations	Kapuskasing	Pulp and paper production	0 tonnes	36,207 tonnes
1168	Vale Canada Limited - Copper Cliff Mining, Smelting and Refining Complex	Sudbury	Copper and nickel production - mining, base metal smelting, refining,	104,158 tonnes	299,292 tonnes

Source: Methodology for Free Allowances Distribution (Ontario's Cap and Trade Program)

Appendix 3: Potential Distribution of Free Allowances by Allocation Method (a simplified approach using 2013 emissions)

Allocation Methodology for Free Allowances	2013 GHG (MT)	2013 GHG (tonnes)	Percentage Allocation of Total	Potential Allocation by NAICs	
Product Output Benchmark	**17**	**15,058,265**	**58%**		**58%=100**
Iron & Steel Mfg.	10	10,428,497	36%		62%
Cement Mfg.	4	4,396,389	15%	**Method A**	26%
Petroleum Refineries	1.4	1,350,373	5%		8%
Hydrogen	1	508,641	2%		3%
Beer Mfg.	0.1	92,932	0%		1%
Energy Use Allocations	**3**	**7,412,303**	**9%**		**9%=100**
Chemical Fertilizer (except Potash) Mfg.	1	798,641	3%		31%
Automobile & Light-Duty Motor Vehicle Mfg.	1	535,038	2%		21%
Food Mfg.	1	511,869	2%		20%
Other Basic Organic Chemical Mfg.	0.5	478,053	2%	**Method B**	19%
Particle Board & Fibreboard Mills	0.1	89,460	0%		3%
Chemical	0.1	68,878	0%		3%
Pharmaceutical & Medicine Mfg.	0.05	46,456	0%		2%
Gold & Silver Ore Mining	0.03	32,661	0%		1%
Historical Allocations	**9**	**7,074,244**	**31%**		**31%=100**
Pulp and paper	2	1,572,907	5%		18%
Chemical Pulp Mills	4	3,534,787	12%		40%
Petrochemical Mfg.	2	1,624,010	6%		18%
Non-Ferrous (except Al) Smelting & Refining	0.5	491,717	2%		6%
All Other Basic Inorganic Chemical Mfg.	0.4	430,655	1%	**Method C**	5%
Other Petroleum & Coal Products Mfg.	0.4	373,605	1%		4%
Artificial & Synthetic Fibres & Filaments Mfg	0.3	319,449	1%		4%
Steam & Air-Conditioning Supply	0.2	196,878	1%		2%
All Other Non-Metallic Mineral Product Mfg.	0.1	131,343	0%		1%
Resin & Synthetic Rubber Mfg.	0.1	92,779	0%		1%
Glass Mfg.	0.1	65,487	0%		1%
Clay Building Material & Refractory Mfg.	0.1	56,104	0%		1%
Direct Allocations	**0.6**	**224,199**	**2%**		**2%=100**
Universities	0.3	345,316	1%	**Method D**	5%
Energy from Waste	0.2	150,607	1%		67%
Waste Treatment & Disposal	0.1	73,592	0%		33%
Indirect Useful Thermal Energy (Imported)	n/a	n/a	n/a	**Method E**	n/a
Grand Total	**29**	**29,769,011**	**100%**		

Source: 2013 greenhouse gas emissions reporting by facility. *Note:* This chart shows estimated allocation proportions by method that assumes for simplicity one allowance per emission produced undifferentiated by emission type, and may have discrepancies with the final allocations in the Methodology for Free Allowances Distribution released on May 16, 2016.

Appendix 4: Regression Methodology to Estimate Competitiveness Effects on EITE Industries in Ontario

Methodology

The regression methodology used in testing the Ontario's competitiveness effects follows the economic theory used in Aldy and Pizer of Resources of the Future in 2009 to assess the competitiveness impacts of climate change mitigation policies in the U.S.

For Ontario, it is analyzed for six EITE industries using data from 2005-2015 that could be compared with the results of the U.S. study. Production is measured by total exports leaving Ontario and domestic consumption is measured by the gross domestic product. The percent difference between production and consumption is the net production effect outside of the province that could assess the degree of leakage, or a lost competitiveness, due to the internalization of the price of carbon. In the U.S. study, the impacts of competitiveness of the manufacturing firms were estimated with a $15/tonne carbon price. The carbon price of $18/tonne for Ontario is modelled through a 10% increase in wholesale electricity price to be used as a proxy for industrial electricity prices and were regressed on exports (for production) and GDP (for consumption) while controlling for other economic factors.

Variables

In the production and consumption models, a consistent set of variables were used in most cases in formulating a demand model for various EITE sectors. The impacts of exports and consumption as dependent variables were modelled separately as a function of increased industrial electricity prices and other economic factors.

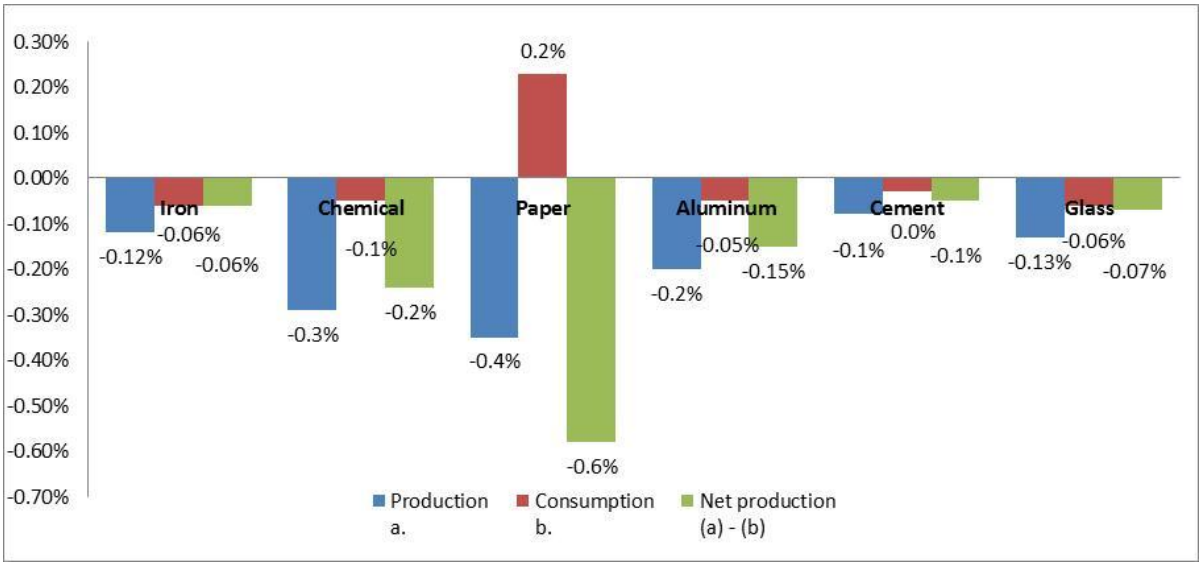
Within each sector that was assessed, the explanatory variables included manufacturing level multifactor productivity levels, industry specific GDP or the value of manufacturing in the industry as a proxy for demand and production. The expected sign on these variables were to be positive. In the production model, the impact of positive demand estimated through GDP (as an explanatory variable) could result in higher exports (dependent variable). In the consumption model, the impact of positive demand modelled through multifactor productivity levels (as an explanatory variable) could result in higher domestic consumption of goods.

In some cases, the US-CAD exchange rate was included as an explanatory variable for certain industries that were particularly trade exposed. A negative relationship is expected as a lower Canadian dollar can increase exports and trade competitiveness.

The electricity price was increased by 10% as a proxy to capture the increasing costs of inputs with carbon pricing. A negative relationship is expected as higher electricity prices can result in reduced competitiveness of exports and domestic consumption.

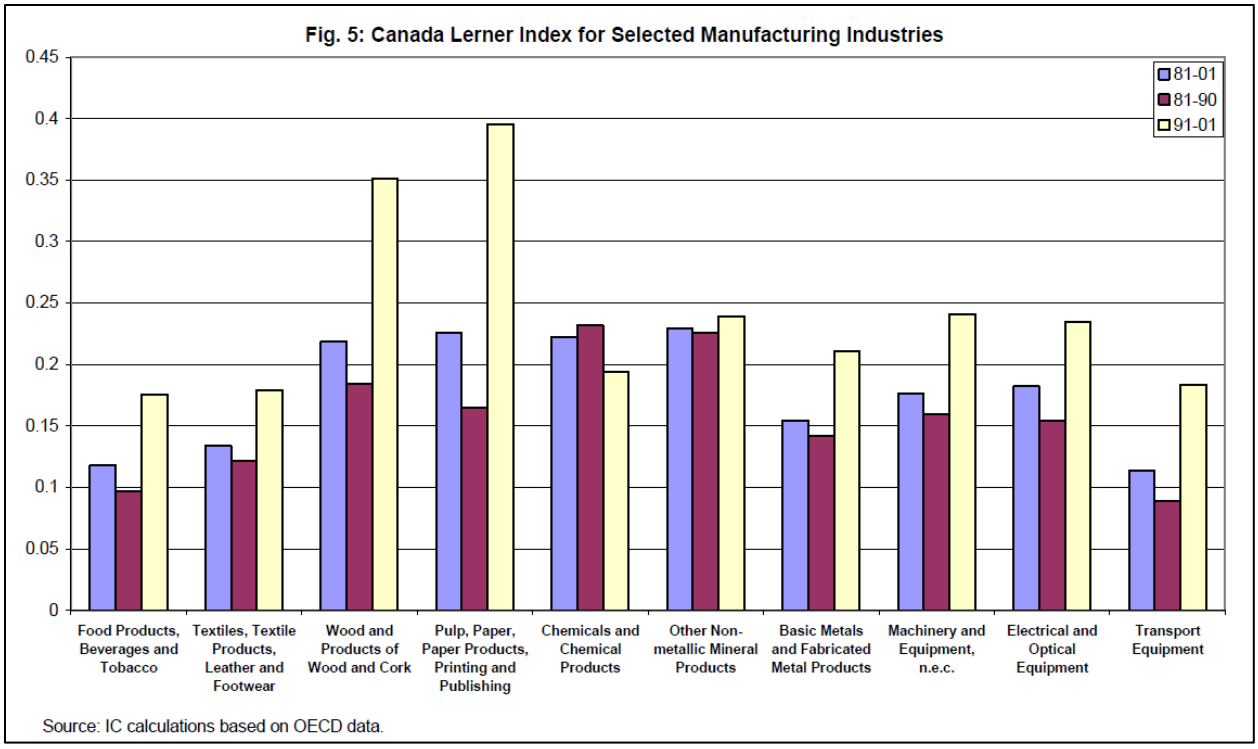
The percentages below show the elasticities from the regressions, as the dependent variable and electricity prices were in logs. Through this modelling exercise using Ontario data, it confirms industry findings that the leakage risk is small to date with relatively low carbon prices.

Estimated Competitiveness Effects for Ontario, Net Production as Proxy for Production Leakage.



Source: author calculations using data noted in Table 4 of this report

Appendix 5: Market Power of Canadian Industries (2010)



Source: The robustness of international benchmarks of competition intensity: the case of mark-ups, Working Paper 2008-10 (Crépeau and Peter, 2008)

Appendix 6: Climate Change Action Plan Initiatives

No.	Action	Cost of GGRA Funding	% of total proceeds (max. estimate)	Estimated GHG Reduction in 2020	Cost of reduction ($/tonne)
		Transportation Sector			
Action area 1	Increase availability and use of lower-carbon fuel	$115-175 million	2%	2 million tonnes	$20/tonne
Action area 2	Increase the use of electric vehicles	$247-277 million	3%	50,000 tonnes	$75/tonne
Action area 3	Support cycling and walking	$150-225 million	3%	Reductions occur post-2020	$500/tonne
Action area 4	Increase use of low-carbon trucks and buses	$215-290 million	3%	400,000 tonnes	$100/tonne
Action area 5	Support accelerated construction of GO Regional Express Rail	$355-675 million	8%	Reductions occur post-2020	$525/tonne
		Buildings and Homes			
Action area 6	Improve energy efficiency in multi-tenant residential buildings	$680-900 million	11%	99,000 tonnes	$425/tonne
Action area 7	Improve energy efficiency in schools and hospitals	$400-800 million	10%	113,000 tonnes	$270/tonne
Action area 8	Reduce emissions from heritage buildings	$40-80 million	1%	Reductions occur post-2020	n/a
Action area 9	Help homeowners reduce carbon footprint	$681-824 million	10%	180,000 tonnes	$225/tonne
Action area 10	Set lower-carbon standards for new buildings	n/a	n/a	n/a	n/a
Action area 11	Promote low-carbon energy supply and products	$60-100 million	1%	1 million tonnes	$5/tonne
Action area 12	Help consumers manage energy use and save money	$200-250 million	3%	Reductions to occur in building sector	n/a
Action area 13	Training, workforce and technical capacity	$45-70 million	1%	Reductions to occur in building sector	n/a
		Land Use Planning			
Action area 14	Strengthen climate change policies in the municipal land-use planning process	n/a	n/a	n/a	n/a
Action area 15	Support municipal and stakeholder climate action	$270-325 million	4%	100,000 tonnes	$165/tonne
Action area 16	Reduce congestion and improve economic productivity	$10-20 million	0%	n/a	n/a
		Industry and Business			
Action area 17	Help industries adopt low-carbon technologies	$875-1,100 million	13%	2.5 million tonnes	$30/tonne
Action area 18	Help agri-food sector adopt low-carbon technologies	$50-115 million	1%	150,000 tonnes	$60/tonne
		Collaboration with Indigenous Communities			
Action area 19	Collaboration activities	$85-96 million	1%	n/a	n/a
		Research and Development			
Action area 20	Support innovation and commercialization of new low-carbon technologies	$140-235 million	3%	Reductions occur post-2020	$75/tonne
Action area 21	Set tax and regulatory policy to encourage innovation	Up to $1 milllion	0%	Reductions to occur in all sectors	n/a
Action area 22	Support research and development through Global Centre for Low-Carbon Mobility	$100-140 million	2%	Reductions to occur in transportation	n/a
		Government			
Action area 23	Reduce emissions and energy costs	$165-175 million	2%	200,000 tonnes	$70/tonne
		Agriculture, Forests and Lands			
Action area 24	Reduce emissions from waste	$20-30 million	0%	40,000 tonnes	$50/tonne
Action area 25	Increasing understanding of how agricultural and natural lands emit and store carbon	$2-3 million	0%	Supports sequestration	n/a
Action area 26	Maximize carbon storage from agriculture	$30 million	0%	Supports sequestration	n/a
Action area 27	Understand and enhance carbon storage in natural systems	$0.5-1.5 million	0%	Supports sequestration	n/a
Action area 28	Update Environmental Assessments to account for climate change	n/a	n/a	Supports reductions in sectors where EA applies	n/a
Total investments		**$5.96-8.30 billion**		**9,832,000 tonnes**	

Source: Ontario's Climate Change Action Plan, 2016

Appendix 7: Auction Results for Joint Cap and Trade Program in Quebec and California (2012 to Present)

Fiscal Year	Auction Results	Quebec (CDN$)	California (US$)
Nov. 2012- Aug. 2013	**Current Vintage**		
	Settlement Price (average)		$12.48
	Total Purchases		64,438,402
	Future Vintage		
	Settlement Price (average)	n/a	$10.63
	Total Purchases		27,091,000
	Total Allowances Purchased		91,529,402
	Total Proceeds *(weighted by auction period)*		**$1,072,036,704**
	Holding Limit ***/participant***		5,945,000 (4% of total allowances)
Nov. 2013 - Aug. 2014	**Current Vintage**		
	Settlement Price (average)	$11.23	$11.49
	Total Purchases	3,803,111	75,573,344
	Future Vintage		
	Settlement Price (average)	$11.23	$11.29
	Total Purchases	5,750,000	29,326,000
	Total Allowances Purchased	9,553,111	104,899,344
	Total Proceeds *(weighted by auction period)*	**$107,060,814**	**$1,199,003,232**
	Holding Limit ***/participant***	2,455,000 (11% of total allowances)	5,867,500 (4% of total allowances)
Nov. 2014 - Aug. 2015	**Current Vintage - Joint Auction**		
	Settlement Price (average)	$15.06	$12.28
	Total Purchases	36,510,731	247,042,502
	Future Vintage - Joint Auction		
	Settlement Price (average)	$14.83	$12.09
	Total Purchases	5,861,463	41,462,000
	Total Allowances Purchased	42,372,194	288,504,502
	Total Proceeds *(weighted by auction period)*	**$650,259,016**	**$3,543,956,393**
	Holding Limit ***/participant***	13,370,000 (3% of total allowances)	
Nov. 2015 - Aug. 2016 (results up to Feb. 2016)	**Current Vintage - Joint Auction**		
	Settlement Price (average)	$17.32	$12.73
	Total Purchases	22,321,365	143,139,008
	Future Vintage - Joint Auction		
	Settlement Price (average)	$16.89	$12.69
	Total Purchases	2,794,037	19,792,500
	Total Allowances Purchased	**25,115,402**	**162,931,508**
	Total Proceeds *(weighted by auction period)*	**$434,156,630**	**$2,073,283,577**
	Holding Limit ***/participant***	13,014,750 (3% of total allowances)	
	Total Proceeds - To Date	**$ 1,191,476,460**	**$ 7,888,279,905**

Sources: Results aggregated from California Air Resources Board, 2016; Quebec Ministry of Sustainable Development, Environment and the Fight against Climate Change

Appendix 8: Pooling of Allowances and Banking Provision, Linking with Ontario

Year	Quebec	QC Market Share	California	CA Market Share	Ontario	ON Market Share	Allowance Budget from Linking	Holding (banking) limit	% of banked allowances of total
2014	23,200,000	14%	159,700,000	86%	n/a	n/a	182,900,000	6,447,500	4%
2015	65,300,000		394,500,000		n/a		459,800,000	13,370,000	3%
2016	63,190,000		382,400,000		n/a		445,590,000	13,014,750	3%
2017	61,080,000		370,400,000		142,332,000		431,480,000	12,662,000	3%
2018*	58,960,000	11%	358,300,000	65%	136,440,000	24%	553,700,000	15,717,500	4%
2019*	56,850,000		346,300,000		130,556,000		533,706,000	15,217,650	4%
2020*	54,740,000		334,200,000		124,668,000		513,608,000	14,715,200	4%
2018-2020	**170,550,000**	**11%**	**1,038,800,000**	**65%**	**391,664,000**	**24%**	**1,601,014,000**		

Sources: Quebec and California Cap Regulations for the determination of caps and holding limit formula
* potential timeframe for Ontario to link with Quebec and California

Appendix 9: Ontario's EITE Sector Risk Ranking

Formula for Ontario EITE calculation developed by MOECC

Leakage Risk	Emission Intensity (EI)	Trade Exposure (TE)
High	$\frac{Emissions\ (t\ CO_2e)}{Value\ added\ (million\ \$)} \geq 1000$	$\frac{Value\ of\ exports + imports}{Value\ of\ domestic\ shipments + imports} \geq 10\%$
Medium	$\frac{Emissions\ (t\ CO_2e)}{Value\ added\ (million\ \$)} < 1000$	Same as for high (≥10%)
Low/Non-EITE	Same as for medium (<1000)	$\frac{Value\ of\ exports + imports}{Value\ of\ domestic\ shipments + imports} < 10\%$

NAICS code	NAICS Sector definition	Leakage Risk Ranking
2111	Oil and gas extraction	High
3241	Petroleum and coal product manufacturing	High
3251	Basic chemical manufacturing	High
3253	Pesticide, fertilizer and other agricultural chemical manufacturing	High
3273	Cement and concrete product manufacturing	High
3274	Lime and gypsum product manufacturing	High
3311	Iron and steel mills and ferro-alloy manufacturing	High
32211	Pulp mills	High
32213	Paperboard mills	High
32411	Petroleum refineries	High
32419	Other petroleum and coal product manufacturing	High
32511	Petrochemical manufacturing	High
32512	Industrial gas manufacturing	High
32518	Other basic inorganic chemical manufacturing	High
32519	Other basic organic chemical manufacturing	High
32531	Fertilizer manufacturing	High
32731	Cement manufacturing	High
33111	Iron and steel mills and ferro-alloy manufacturing	High

NAICS code	NAICS Sector definition	Leakage Risk Ranking
2122	Metal ore mining	Medium
3112	Grain and oilseed milling	Medium
3113	Sugar and confectionery product manufacturing	Medium
3114	Fruit and vegetable preserving and specialty food manufacturing	Medium
3212	Veneer, plywood and engineered wood product manufacturing	Medium
3221	Pulp, paper and paperboard mills	Medium
3252	Resin, synthetic rubber, and artificial and synthetic fibres and filaments manufacturing	Medium
3254	Pharmaceutical and medicine manufacturing	Medium
3271	Clay product and refractory manufacturing	Medium
3272	Glass and glass product manufacturing	Medium
3279	Other non-metallic mineral product manufacturing	Medium
3312	Steel product manufacturing from purchased steel	Medium
3314	Non-ferrous metal (except aluminum) production and processing	Medium
3315	Foundries	Medium
3361	Motor vehicle manufacturing	Medium
3372	Office furniture (including fixtures) manufacturing	Medium
3399	Other miscellaneous manufacturing	Medium

Source: (Sawyer et al., 2016) *Note:* The risk ratings were developed by the MOECC with support from EnviroEconomics

Appendix 10: California's Industry Assistance Factors from 2013-2020

Leakage Risk Classification	NAICS Sector Definition	NAICS Code	Activity(a)	Industry Assistance Factor (AF_a) by Budget Year		
				2013-2014	2015-2017	2018-2020
High	Crude Petroleum and Natural Gas Extraction	211111	Thermal EOR Crude Oil Extraction	100%	100%	100%
			Non-Thermal Crude Oil Extraction	100%	100%	100%
	Natural Gas Liquid Extraction	211112	Natural Gas Liquid Processing	100%	100%	100%
	Potash, Soda, and Borate Mineral Mining	212391	Mining and Manufacturing of Soda Ash and Related Products	100%	100%	100%
	All Other Nonmetallic Mineral Mining	212399	Diatomaceous Earth Mining	100%	100%	100%
	Paper (except Newsprint) Mills	322121	Tissue Manufacturing	100%	100%	100%
			Recycled Boxboard Manufacturing	100%	100%	100%
	Paperboard Mills	322130	Recycled Linerboard (Testliner) Manufacturing	100%	100%	100%
			Recycled Medium (Fluting) Manufacturing	100%	100%	100%
	All Other Petroleum and Coal Products Manufacturing	324199	Coke Calcining	100%	100%	100%
	All Other Basic Inorganic Chemical Manufacturing	325188	All Other Basic Inorganic Chemical Manufacturing	100%	100%	100%
	All Other Basic Organic Chemical Manufacturing	325199	All Other Basic Organic Chemical Manufacturing	100%	100%	100%
	Nitrogenous Fertilizer Manufacturing	325311	Nitric Acid Production	100%	100%	100%
			Calcium Ammonium Nitrate Solution Production	100%	100%	100%
	Flat Glass Manufacturing	327211	Flat Glass Manufacturing	100%	100%	100%
	Glass Container Manufacturing	327213	Container Glass Manufacturing	100%	100%	100%
	Cement Manufacturing	327310	Cement Manufacturing	100%	100%	100%
	Lime Manufacturing	327410	Dolime Manufacturing	100%	100%	100%
	Iron and Steel Mills	331111	Steel Production Using Electric Arc Furnace	100%	100%	100%
	Rolled Steel Shape Manufacturing	331221	Hot Rolled Steel Sheet Production	100%	100%	100%
Medium	Food Manufacturing	311	Food Manufacturing	100%	75%	50%
	Cut and Sew Apparel Manufacturing	3152	Cut and Sew Apparel Manufacturing	100%	75%	50%
	Breweries	312120	Brewing	100%	75%	50%
	Petroleum Refineries	324110	Petroleum Refining	100%	75%	50%
	Industrial Gas Manufacturing	325120	Gaseous Hydrogen Production	100%	75%	50%
			Liquefied Hydrogen Production	100%	75%	50%
	Biological Product (Except Diagnostic) Manufacturing	325414	Biological Product (Except Diagnostic) Manufacturing	100%	75%	50%
	Gypsum Product Manufacturing	327420	Plaster Manufacturing	100%	75%	50%
			Plaster Board Manufacturing	100%	75%	50%
	Mineral Wool Manufacturing	327993	Fiber Glass Manufacturing	100%	75%	50%
	Rolled Steel Shape Manufacturing	331221	Picked Steel Sheet Production	100%	75%	50%
			Cold Rolled and Annealed Steel Sheet Production	100%	75%	50%
			Galvanized Steel Sheet Production	100%	75%	50%
			Tin Steel Plate Production	100%	75%	50%
	Secondary Smelting and Alloying of Aluminum	331314	Secondary Smelting and Alloying of Aluminum	100%	75%	50%
	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (Except Copper and Aluminum)	331492	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (Except Copper and Aluminum)	100%	75%	50%
	Iron Foundries	331511	Iron Foundries	100%	75%	50%
	Turbine and Turbine Generator Set Units Manufacturing	333611	Testing of Turbines and Turbine Generator Sets	100%	75%	50%
Low	Pharmaceutical and Medicine Manufacturing	325412	Pharmaceutical and Medicine Manufacturing	100%	50%	30%
	Aircraft Manufacturing	336411	Aircraft Manufacturing	100%	50%	30%
	Support Activities for Air Transportation	4881	Support Activities for Air Transportation	100%	50%	30%

Source: California cap and trade regulation, sub-article 8

Appendix 11: General Guidance for Practitioners on Climate Change Considerations in Environmental Assessments

Figure 2.1: Incorporating Climate Change Considerations in Environmental Assessments: Recommended Procedures

Environmental Assessment Process	GHG Considerations, where a project may contribute to GHGemissions	Impacts Considerations, where climate change may affect a project
1. Scoping	Preliminary scoping for GHGconsiderations	Preliminary scoping for impacts considerations
2. Data and Information Collection	If needed, identify GHGconsiderations: • industry profile • project specifics	If needed, identify impacts considerations: • regional climate and related environmental considerations • project sensitivity
3. Analysis of Environmental Effects	Assess GHGconsiderations: • direct and indirect emissions • effects on carbon sinks	Assess impacts considerations: • impact on project • risks to public and the environment
4. Identification of Mitigation Measures [1]	If needed, prepare GHGmanagement plan: • jurisdictional considerations • project specifics, if appropriate	If needed, prepare impacts management plan: • project specifics • ongoing data clarification
5. Monitoring and Follow up	Monitoring, follow-up and adaptive management	Monitoring, follow-up and adaptive management

Source: (Canadian Environmental Assessment Agency, 2016)