Carbon Pricing Policies: Benefits & Challenges for the Transit Sector

A collaborative research initiative by the Ontario Public Transit Association (OPTA) and the Canadian Urban Transit Research and Innovation Consortium (CUTRIC) / Consortium de recherche et d’innovation en transport urbain au Canada (CRITUC)

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Introduction and Literature Review

Environmentalists and economists globally are converging around the opinion that putting a price on greenhouse gas (GHG) emissions is one of the most powerful tools in a public policy maker’s toolkit, when it comes to incenting, inspiring and financing “green” or “low carbon” mobility innovation. This logic is based on the notion that carbon pricing “internalizes” the social, environmental, and health costs associated with greenhouse gases (GHGs), which emanate from the combustion of fossil fuels. When combined with pricing imposed on smog and noxious materials, carbon pricing can also help to reduce local air pollutants by internalizing the costs associated with negative health outcomes in local communities. Briefly put, carbon pricing mechanisms – which include direct pricing through carbon taxes and indirect pricing through “Cap and Trade” (C&T) market programs – create strong incentives to stop polluting the atmosphere, and encourages innovation through the integration of cleaner technology solutions.

According to researchers, carbon pricing mechanisms could help position Canada at the forefront of the clean-energy and clean technology economic boom expected over the next century. Green technologies – including low-carbon mobility technologies – have emerged as one of the fastest growing industrial sectors worldwide with an annual growth rate of 30 per cent over the past decade (Suzuki Foundation, 2017). Canada is well-positioned to benefit from the growth of this industrial landscape.

Public transportation – or “transit” – is generally considered the most efficient way to move people in dense urban areas. The individual tradeoff that riders make in selecting to use transit systems frequently juxtaposes time to money. Public transit might take more time as a mobility mode, but – if fuel and parking costs are high – it is usually cheaper than driving a single or even multi-occupancy car. In areas with high congestion and dense transit infrastructure, the availability of rapid buses, trams, and trains (especially in areas with dedicated transit ways) may allow this tradeoff to disappear entirely, as individuals find commuting via public transit services to be both cheaper and faster than individual passenger automobiles (Antweiler and Gulati, 2012).

However, while “transit” is oft-cited as a mechanism for reducing GHGs from transportation (i.e. by displacing individual passenger automobiles), it can also be a dirty emitter of GHGs and smog-related pollutants in and of itself. Specifically, diesel propelled buses and diesel propelled trains produce climate-affecting GHGs as well as smog-inducing noxious pollutants (Cooney et al., 2013). Carbon pricing that affects the costs associated with transit operations may serve as a mechanism for incenting transit agencies to go further in the fight against climate change by not only displacing individual passenger cars, but also by moving people using low- and zero-emissions propulsion systems.

In June 2016, the Government of Ontario published its Climate Change Action Plan, which served as a framework for announcing several large initiatives related to GHG-reduction policies. The Climate Change Action Plan helps to define how the revenues from the carbon pricing system will be allocated. The Cap and Trade system was formally implemented on January 1st 2017 under the Climate Change Mitigation and Low Carbon Economy Act, which was introduced in 2016.

The first auction of “allowances” commenced on March 22nd 2017. Industries and institutions that are captured within the C&T framework will be required to have obtained allowances (through auctions) or demonstrate a reduced GHG footprint starting in the early-2020s. Failure to reduce emissions footprints below the level they were “capped” at in the C&T regulation will result in a financial penalty.
Without doubt, the C&T policy will have an effect on the Ontario economy and its transportation matrix – which is precisely what it is designed to do. The policy is intended to motivate private sector stakeholders, transportation fleets, and institutions of all sizes to adopt and integrate lower emissions or “net zero” technologies. From a transit perspective, the goal of C&T is to drive up the price of diesel and natural gas to motivate transit fleets to buy zero-emissions or lower-emissions vehicle systems, such as battery electric buses (BEBs) and fuel cell electric buses (FCEBs). It may also motivate transit agencies to integrate cleaner energy planning systems at the site of their facilities, such as solar panel rooftops or energy storage devices at garages, which are intended to capture renewable electricity supplies during peak periods of renewable power. These installations would help to power garages during peak periods of non-renewable electricity supply to the grid. In brief, carbon pricing is meant to make gasoline, diesel, and natural gas energy systems less attractive and “green” electricity energy systems more attractive.

Problematically, there has been very little research carried out in Ontario with regards to the specific effects the C&T system will have on Ontario’s transit systems over the short-term (next 5 years), the mid-term (next 10 years) and the long-term (next 20 years). Additionally, there have been no consultation efforts carried out with Ontario’s transit community to inform, educate, or prepare transit for the complexities associated with the C&T system as well as the opportunities for new potential revenue growth that C&T policies could create in the mid- to long-term future.

In its current form, Ontario’s C&T program will have impacts on the transit industry through carbon pricing that affects the cost of diesel and natural gas fuels. These costs will be borne in the first instance by petroleum fuel providers who will need to buy allowances in the C&T marketplace starting this year to meet their C&T regulatory commitments starting in the early-2020s. The cost of these allowances will almost certainly be passed onto consumers of fuel, including transit agencies.

While there has been some preliminary research completed to explore the impacts and opportunities associated with carbon pricing programs for Metrolinx, there has been insufficient research into the full impacts of carbon pricing on municipal transit fleets which are heavily dependent upon diesel and natural gas today. And there has been no research carried out to date that provides transit-led recommendations (i.e. normative policy prescriptions) to the Government of Ontario based on opportunities, challenges and solutions identified by transit agencies themselves.

Given the structure, framing and regulatory content codified within the C&T program is not determined a priori – it is, rather, based on cultural norms, global practices, politicking and lobbying, empirical evidence, and philosophical/normative beliefs about how a carbon priced market ought to be structured and how it ought to behave. There is still ample opportunity still for transit agencies to affect the shaping, design, growth, expansion, amelioration and re-orientation of the C&T program and/or its subsidiary programs. This could include playing a role – as a transit community – in helping government formulate appropriate and effective policies that run parallel to the current (or future instantiations of) Ontario’s C&T system. These policies may be housed in several Ontario ministries, which include but are not limited to the Ministry of Transportation.

The present literature review provides an initial starting point for transit agencies that are interested in collaborating in a consultative fashion to identify opportunities, challenges and solutions associated with Ontario’s C&T carbon pricing system and associated climate action policies. This review provides transit agency decision-makers with background information related to
varied national (Canadian) and global experiences with carbon pricing regimes, including a discussion of the extent to which those carbon pricing policies have affected (positively or negatively) transit agencies elsewhere.

A review of experiences borne by transit agencies operating in other carbon priced marketplaces might help to guide contemporary discussions in Ontario and help local transit agencies identify the nature of the transit role in a future carbon priced landscape.

In the following section, we provide a brief review of the literature on various types of carbon pricing adopted around the world. Next, we discuss selected carbon pricing policies and their impact on the transportation sector in British Columbia, Quebec, Alberta, and the European Union (EU). Lastly, a brief discussion is provided regarding Ontario’s Cap and Trade mechanism.

**Carbon Pricing Policies**

The two most commonly used methods for pricing carbon include a direct carbon tax and a market-led Cap and Trade approach. Both approaches, if well-designed, can be powerful tools for encouraging GHG reductions and concomitant investments in cleaner technologies (Jenkins, 2014). These tools can be used, therefore, to both reduce emissions and diversify local economies.

**Direct levy: Carbon Tax**

A “carbon tax” is a direct fee placed on a given unit of greenhouse gas (GHG) pollution – including carbon dioxide (CO₂), carbon monoxide (CO), and other molecules that cause atmospheric warming – produced mainly from the burning of fossil fuels. This surcharge is usually placed on carbon-based fuels (i.e. gasoline at the gas pump) and other sources of direct pollution, such as industrial processes and manufacturing activities. Several industrialized countries have used carbon taxes to reduce emissions and promote investments in energy-efficiency and renewable energy. For example, Sweden has used a carbon tax since 1991 (Suzuki Foundation, 2017). In Canada, British Columbia, Quebec and Alberta use carbon taxes as part of their strategies to tackle climate change obstacles.

**Indirect levy: Cap and Trade**

In a C&T system, a government establishes a limit (i.e. a “cap”) on the overall level of carbon that any given industry or source can produce or emit in a year. The cap is then reduced year after year to drive steeper and steeper reductions in GHGs by those industries and other sources. The drop in the cap on carbon is intended to incent an industrial shift away from inefficient carbon-intensive processes or sources of energy towards efficient processes and low-carbon and “green” sources of energy. Usually, in establishing a cap, a government will be fairly lenient in the first years of the program with the dropping cap becoming more and more strict over the years. The leniency upfront is intended to provide industries with time to replace equipment, innovate new processes, and redesign business plans.

Each industry or source of carbon pollution is usually also offered a certain amount of “allowance” to pollute. “Allowances” constitute units of carbon that an industry or source of emissions is permitted to produce in a year before fines or fees set in. Some industries or individual companies might choose to innovate and reduce their GHG footprint significantly over the years, meaning they may have more “allowance” to pollute than they require. The result is a surplus of carbon credits at the end of a given year. This surplus can be traded on the secondary C&T marketplace. Companies that are more efficient and which reduce emissions below their allowance will generate new revenues by selling those allowances domestically (or internationally, depending on the set up of the carbon credit marketplace in which they operate).
Those companies that are less efficient and do not reduce their emissions below their allowance will need to budget for the purchase of allowances domestically (or internationally, depending on the set up of the carbon credit marketplace in which they operate).

There are different mechanisms for a business to obtain allowances: through free allocation from the government, purchasing from a government-led auction, from the buying and selling on a secondary market, or direct purchase from the government at higher prices. The auction prices for a carbon credit are not set a priori – the government issues a floor price, and then submitted bids determine the actual price that the allowances are sold at (ECO, 2016). In most cases, the mechanism for exchanging allowances (i.e. “carbon credits”) is usually an auction. Polluters that exceed the cap established on their emissions allowance are able to buy unused carbon credits from other companies through a government-led auction process. The price of a unit of carbon depends on how much demand there is for allowances/carbon credits by companies that fail to innovate or reduce their GHG footprint; it depends on how much supply there is of allowances/carbon credits by companies that do innovate, and which do reduce their GHG footprint (and which may, therefore, have credits to sell). The ultimate goal of any C&T system is to encourage firms to reduce their emissions footprint so they can sell rather than purchase pollution allowances (Suzuki Foundation, 2017).

With regards to carbon trading specifically, the European Union introduced the EU Emissions Trading Scheme (EU ETS) in 2005, which is based also on a C&T regulation. Tokyo launched a similar system in 2010.

Therefore, while Ontario is a champion in the carbon pricing landscape, it is not necessarily a leader. It is, rather, building on positive and negative experiences by jurisdictions elsewhere for reducing GHG emissions from private and public sector industries that contribute directly to global warming and greenhouse gas (GHG) emissions.

Choosing an Optimal Carbon Pricing Mechanism

Figure 1 (below) demonstrates the relative placement of various global carbon pricing schemes on a spectrum ranging from “pure emissions trading” on the left to “pure carbon taxes” on the right.
Note that many emissions trading systems (ETS’s) – also referred to as Cap and Trade – contain some element of price certainty, such as a base fixed price for carbon below which the price of a unit of carbon credit/allowance cannot fall. This differentiates government-created Emissions Trading Systems from purely “free” and open marketplace system, such as stock exchanges, etc.

Meanwhile, most carbon tax systems worldwide contain some element of exchange value, trade and/or marketplace pricing. For example, governments might increase or decrease the fixed price of carbon per metric ton of CO$_2$ equivalent (CO$_2$e) based on global pricing signals, local effectiveness of the established price, and/or political pressures. Many carbon pricing schemes worldwide lie somewhere between the two ends of the spectrum. These are labeled “hybrid” carbon pricing approaches, which are a combination of ETS and carbon tax schemes (Jenkins, 2014). Examples of such systems are Alberta in Canada, and many European countries including Ireland, UK, Denmark, Norway, Sweden, Finland, France, Portugal, Switzerland, Slovenia, Poland, Latvia and Estonia (World Bank, 2016).

Considerable debate has been devoted to the relative advantages and disadvantages of carbon taxes versus C&T markets or “quasi-market” based regimes as a means of radically reducing emissions and/or spurring green technology innovation and adoption. In general, however, both mechanisms rest upon the common economic principle that pricing an entity – such as a carbon molecule – renders it economically visible and thus internalizes the costs of its use. In practice, both carbon taxes and C&T systems can be designed to render similar or equivalent results. The design of the pricing system will, however, determine the ultimate degree and nature of environmental and economic effectiveness. For example, a carbon tax system that sets the value of carbon at a low level – say $5.00 CAD per metric ton of CO$_2$e – may not effectively motivate behavioural or technological change within industry, because the costs of innovating to reduce emissions outweigh the costs of simply paying a higher price for the carbon. Similarly, a C&T system that grants too many free “allowances” to polluting industries at the outset of the system’s auction process (i.e. in the first few years of trading) may result in over-supply, which drives down the market value of carbon. Again, a low-priced carbon unit may not motivate significant technology adoption or innovation, let alone alter the general social appreciation for the pernicious effects of carbon.

In addition, in real world contexts significant differences exist between carbon tax-based systems and C&T systems already implemented (Aldy et al., 2010). For example, Carl and Fedor (2016) explain that while the form of a carbon pricing system may be theoretically interchangeable in terms of incentivizing emission reductions behaviours within firms, the system framework does seem to matter in terms of how revenues are used by governments. For instance, C&T systems tend to earmark a larger portion of revenues generated from the sale of allowances in regular auctions for spending on green technology development or adoption (e.g. solar panel development and/or adoption, wind farm development and/or integration, energy storage development and/or integration, electric vehicle (EV) or electric bus adoption and/or development, etc.). By comparison, carbon tax systems are more often set up as general revenue generators with revenues from carbon taxes often fed back into general government budgets for expenditure on any number of services.

As an example, British Columbia collects carbon taxes (valued currently at $30 CAD/metric tonne) from every British Columbian individual or firm that utilizes a carbon fuel. Those revenues are fed back into the province’s general budget, though they are tied to a specific policy of tax reduction in other domains of life (e.g. income tax, sales tax, etc.). Thus, B.C.’s system is deemed a “revenue neutral” system because its revenues are fed back into other tax reductions for British Columbians.
In brief, C&T systems tend to provide firms and individuals with more certainty about the amount of emissions that must be reduced (i.e. targets for reductions that are enforced by virtue of fines for failure to achieve those targets), but less certainty about the real-time price of carbon, which is subject to supply and demand factors in the marketplace. By comparison, carbon taxation systems tend to provide more certainty about the price of carbon on an annual basis, but less certainty about how much carbon will actually be reduced given that carbon reductions depend upon whether the tax is set high enough to motivate behavior (Suzuki Foundation¹, 2017).

Due to the fact it does not require a market auction or regulatory framework that involves auditing firms to determine the veracity of reported carbon reductions by firms, carbon taxation is seen as a simpler and less politically challenging system for governments to implement. A carbon tax is also considered to be more comprehensible to voters, because it is set up just like any other sales tax that individuals and firms are familiar with. Because a carbon tax usually relies on existing administrative structures for taxing fuels, it can generally be implemented in just a few months from a government administrative perspective (i.e. by adding an additional tax line on top of goods and services tax or any other tax, such as gas tax).

By comparison, a C&T system tends to be viewed as much more complex. It requires an understanding of marketplace economics, government-led auctions, variable pricing based on supply and demand, and marketplace size (e.g. the size of a C&T marketplace is important in determining whether firms have access to allowances offered “on the market” in other national or global jurisdictions). This complexity makes it challenging to educate the electorate and general population vis-à-vis carbon pricing, and it can be difficult for firms and individuals to differentiate a C&T pricing mechanism from – say – a straightforward carbon tax at the fuel pump, when all that they experience is a higher price in fuel (which is similarly experienced in both systems).

Cap and Trade systems also require more government administrative investment to design and launch, which means more of the civil service needs to be internally educated and dedicated to the process to ensure its proper design, its legitimacy, and its ability to adapt over time. As a marketplace based on trading, a C&T system is generally more susceptible to innovative and creative loophole creation by firms that seek to avoid paying for carbon while also avoiding a reduction in GHG emissions.

Scholars tend to agree that both carbon taxation and C&T systems can work well in achieving long-term GHG reductions and economic growth (through re-investment in development and innovation), as long as they are designed to provide strong economic signals to the firms and/or individuals affected by the pricing system.

**Carbon Pricing in Practice**

Global momentum impelling more robust and effective carbon pricing has been building over the past decade – motivated heavily by GHG-aware policies in the United States during the administration of President Barack Obama, as well as at a state-level.

California is generally deemed a global leader in carbon pricing. Having been recently joined by the Canadian provinces of Quebec and Ontario, which the latter will officially join in 2018, California’s current C&T system prices approximately 85 per cent of GHG emissions produced within the state at a carbon price of approximately $12 USD per metric tonne of CO₂e. Federally, the U.S. Clean Power Plan also encourages states to meet emissions-reduction targets through market-based mechanisms (Wagner, 2015).

The European Union (EU) meanwhile has a separate system – the largest in the world – that affects approximately 45 per cent of all GHG emissions produced within the region. However,
the EU market rate for carbon is generally viewed as being too lowly priced – at approximately $8 USD per tonne – to merit significant behavioral shifts on its own among Europe’s major emitters. Contrarily, Sweden boasts the world’s highest value on carbon with its market system pricing carbon emissions at up to $125 USD per tonne.

In Asia, China is experimenting with regional C&T systems. In 2009, at the Copenhagen UN Climate Change Conference, China set a goal to lower its CO₂ emissions per unit of GDP to 40-45 per cent below 2005 levels by 2020. Pilots for emissions trading system were launched in 2011 with seven participating provinces and cities: Beijing, Tianjin, Shanghai, Chongqing, Hubei, Guangdong and Shenzhen. The national ETS was planned to be established as China’s unified national carbon market by 2017 which covers power generation, petrochemicals, chemicals, building materials, steel, non-ferrous metals, paper and aviation. Among the pilots, only Guangdong held auctions in 2015, raising $2.4 million USD of revenue (Dong et al., 2016; World Bank, 2016).

As shown in Figure 2, carbon pricing has been implemented or is scheduled to commence in 40 national and over 20 sub-national jurisdictions (this latter category includes Ontario). Combined, these carbon pricing initiatives cover about 13 per cent of annual global GHG emissions. Specifically, varied forms of ETS cover about 9 per cent of annual global GHG emissions, while a further 4 per cent are covered by direct carbon taxes. Interestingly, about a quarter of all jurisdictions with carbon pricing initiatives have both an ETS and carbon tax in place (World Bank, 2016).
For the purposes of informing the OPTA-CUTRIC Cap and Trade consultation process being initiated this year, the following sections will explore how carbon pricing may result in investments into green transportation, and the degree to which transit agencies in other jurisdictions have benefitted from revenue generation by virtue of carbon pricing regimes.
**British Colombia Carbon Tax**

British Columbia’s (B.C.) carbon tax was implemented on July 1, 2008. It covers most types of fuel use and carbon emissions. It applies to the purchase of fossil fuels in the province, including gasoline, diesel, jet fuel, natural gas, propane, and coal.

The province’s carbon pricing regime commenced with a relatively low price of $10 per metric tonne of CO$_2$e, which rose gradually due to direct government policies (and political commitment by elected officials) to the current rate of $30 per metric tonne of CO$_2$e. This final (scheduled) increase took effect formally on July 1, 2012.

According to B.C.’s carbon tax legislation, the province’s carbon tax must be “revenue-neutral”, meaning the policy requires equivalent reductions in other taxes levied in the province (e.g. personal and/or corporate income tax cuts). To protect low-income individuals and families from the added living costs associated with the carbon pricing system, B.C. created a refundable Low Income Climate Action Tax Credit designed to help offset the carbon taxes paid by low-income individuals and families (B.C. Ministry of Finance, 2017).

Figure 3 illustrates the distribution of uses of the carbon tax revenue stemming from its inception in fiscal year 2008–2009 through to planned future budgets ranging out to 2017–2018. The solid line represents revenue from the carbon tax, and the bars represent expenditures of carbon tax revenue.

*Figure 3: Distribution of uses of B.C. carbon tax revenues: 2008–2018 (Murray and Rivers, 2015)*
By reducing fuel consumption, increasing fuel efficiency, using cleaner fuels and adopting new technology, businesses and individuals can reduce the amount they pay in carbon tax, or even offset it altogether (B.C. Ministry of Finance, 2017). According to a *Globe and Mail* report published on July 09, 2014, since the carbon tax came into effect, fuel use in B.C. has dropped by 16 per cent, while in the rest of Canada, fuel use has increased by 3 per cent (counting all fuels covered by the tax).

Based on empirical and simulation models, Murray and Rivers (2015) have concluded that the carbon tax has reduced emissions in the province by between five per cent and 15 per cent since being implemented. With these results, B.C.’s carbon tax has gained global praise from organizations such as the OECD, the World Bank and *The Economist*. Nonetheless, there are also several criticisms of this policy. For instance, Cross (2016) in his article for the *Financial Post*, states other variables in addition to or in lieu of the carbon tax may be the cause of fuel consumption declines. Those variables include (1) the fossil fuel consumption that initially dropped due to the recession in 2008, and (2) the reduction of fuel use due to cross-border purchases of vehicle fuel. Additionally, gasoline consumption in B.C soared by six per cent after 2012 in the post-recession recovery period, which overwhelmed the 4.8 per cent drop in consumption demonstrated between 2008 and 2012. According to the researchers, this bump in consumption during positive economic growth periods shows the carbon tax effect in B.C. may have been transitory with less long-lasting impact on carbon emissions than originally hoped for.

**Carbon Tax Impacts on British Columbia’s Transportation Sector**

In the South Coast Region (which includes Metro Vancouver), TransLink operates a system of buses, light trains, commuter trains, and sea-bus ferries. TransLink receives almost a third of its funding from fuel levies (TransLink Business Plan, 2012). Regional gas taxes are currently dedicated to transportation in the province. In the Metro Vancouver Area there is currently a $0.17/L surcharge on fuel, which is dedicated to TransLink for operating and capital investments. In Vancouver, TransLink is the statutory authority responsible for the allocation of these funds (AECOM, 2013).

On the contrary, due to the revenue-neutral nature of B.C.’s carbon tax, the province rejected the *Metro Vancouver Mayors’ Plan* to use carbon tax revenues to help fund $7.5 billion in transportation infrastructure, which would include a new four-lane Pattullo Bridge, more buses and more rapid transit projects in Surrey and Vancouver.

On June 12, 2014, B.C.’s Transportation Minister stated the province would not reallocate carbon tax funding to TransLink for Metro transportation purposes. However, the province did express interest in the possibility of creating a new regional carbon tax to help fund transit investment plans (Vancouver Sun, 2014).

As an indication of the province’s continued policy commitment to using carbon taxes to reduce the general tax load of British Columbians – rather than fund specialized projects or theme areas –B.C.’s Community Minister adamantly confirmed that the province would not provide the other $50 million per year needed to fund the Metro Mayor’s Plan over the next 10 years from carbon tax revenues. This decision followed an announcement on June 16, 2016 by the federal government that it would contribute $460 million in transit funding for B.C., thereby increasing the federal government’s share of major transit projects from one third to one-half. (The Globe and Mail, 2016).

From a fuel consumption perspective, it is still predicted that high fuel taxes, combined with the carbon tax, will reduce the consumption of gasoline and diesel fuel over the long term. In addition, it is predicted that in several jurisdictions the availability of high-quality public transit will further reduce private vehicle use (Antweiler and Gulati, 2012). However, it seems that
carbon taxes and transit investments remain bifurcated in B.C., as carbon tax revenues do not play a leading role in raising capital or operating funds for public transit, nor is funding likely to emanate from carbon tax revenues for municipal transit agency plans in order to invest in green technologies (e.g. electric buses).

In addition, fuel price increases across the province are seen to pose a triple threat in the form of (1) higher demand for public transit services, (2) higher operating costs for transit operations as a result, and (3) lower tax revenues (from fewer resulting fuel taxes) to fund the operating deficit for public transit. Inevitably, transit agencies may need to increase their fares to accommodate for these demands – an ironic outcome of carbon pricing, which is intended to drive forward lower carbon modes of transportation (as well as lower carbon industrial production processes).

This triple threat adds layers of pressure on top of transit agencies. For example, starting in July 2017, TransLink will increase its property taxes and transit fares annually for the next three years to launch a long-awaited service expansion that should begin to ease transit overcrowding (Global News, 2017). Some residents who don’t have a practical alternative to driving to work – i.e. they live in areas not served by public transit – would be unresponsive to an increase in the price of gasoline. In this case, earmarking some of the carbon tax revenue for the expansion of public transit infrastructure may be desirable, even if politically challenging for the government of the day.

Exemptions from the tax were granted starting in 2012 to some agricultural sub-sectors and in 2014 to liquid fuel use for the entire agricultural sector. In addition, in recent years some of the tax revenue has been used to support particular industries (e.g. the film production industry) through targeted tax credits (Murray and Rivers, 2015).

The primary objective associated with B.C.’s carbon tax is to reduce GHG emissions. Essentially, many studies have shown the program is achieving or has achieved that goal to some extent. But the evidence does not point in favour of a strong form of double dividend – i.e. pollution reductions and investments in green technologies, specifically in the transportation section.

**British Colombia Carbon Trading System**

The B.C. government’s new law for GHG emissions came into force in January 2016. *The Greenhouse Gas Industrial Reporting and Control Act* established pollution limits for industry. The new Act sets out a benchmark for GHG emissions from any new liquefied natural gas facilities that may be built in B.C. At the same time, the Act repeals the *Cap and Trade Act*, which was part of the government’s *Climate Action Plan* (Globe and Mail®, 2014).

Under former government, the province introduced the C&T program to impose hard caps on GHG emissions from large polluters, and allowed industry to buy offsets for excess emissions. The new *Greenhouse Gas Industrial Reporting and Control Act* would establish pollution limits for industry, but critics worry the law would undermine the tough GHG reduction targets for the province as a whole because the new rules target the “intensity level” of pollution rather than the absolute amount of pollution, and an emissions intensity scheme wouldn’t limit the overall carbon emissions (Greens of B.C., 2014).

It seems that with today’s infrastructure it is not possible to achieve zero emissions. Therefore, to become carbon neutral the B.C. government decided to support investments in emission reduction projects as well as build up the province’s offset portfolio to reduce its emissions to net-zero.
An offset represents a reduction in GHG emissions that can be used to compensate for, or offset, emissions from other sources, which is measured in tonnes of CO$_2$e. Offsets can be purchased to satisfy legislative requirements such as those for B.C.’s carbon neutral public sector$^1$ and the liquefied natural gas industry’s emission benchmark. There are four primary types of offset projects: (1) energy efficiency: use of new technologies to reduce fuel or energy consumption; (2) fuel switching: transition from a higher GHG-emitting fuel to one with lower emissions; (3) sequestration: activities that remove carbon from the atmosphere through activities such as planting trees and other forest management practices; and (4) GHG destruction: activities that convert GHGs to less intense forms to reduce the associated “Global Warming Potential”, e.g. the destruction of refrigerants or methane and their conversion into CO$_2$ (Government of B.C.$^1$, 2017). These offset mechanisms provide an excellent opportunity for transit agencies to switch to low-emission fuels, invest in clean technologies (such as battery electric or hydrogen fuel cell electric buses), and integrate new technologies to reduce fuel and energy consumption overall.

Additionally, in pursuing these investments and improvements, transit agencies could in fact become offset providers in the future, thus generating new revenues through carbon pricing schemes. Moreover, offsets could be used as tools to encourage more investments in low carbon technologies and practices.

**Quebec Carbon Pricing System**

Quebec’s carbon tax came into effect on October 1, 2007, which made Quebec the first North American jurisdiction to charge a direct carbon tax. Energy producers are required to pay 0.8¢ per litre for gasoline (or about $3.50 per metric tonne of CO$_2$) distributed in Quebec and 0.9¢ per litre for diesel fuel. Though considered relatively small in terms of tax rates, Quebec’s carbon tax policy was predicted to raise about $200 million a year to pay for energy-saving initiatives such as improvements to public transit (Gunn and Ljomov, 2012).

Quebec deposits its carbon tax revenue into a Green Fund, which supports initiatives that reduce GHG emissions and improve public transportation (Sumner et al., 2009). For instance, in October 2016, the Quebec government announced $8.6 million investment in the development of electric buses and trucks from the province’s Green Fund (Global News, 2016).

As previously mentioned, in addition to implementing their own carbon tax policy, both British Columbia and Quebec belong to the Western Climate Initiative (WCI), a partnership that seeks to lower GHG emissions through a multi-regional C&T system. Other participants now include Ontario, Manitoba, Washington, California, Arizona, Oregon, Utah, Montana, and New Mexico. Although the WCI is a governing body for these regions, currently in Canada, only Quebec’s C&T market is linked with that of California. Ontario plans to eventually link its market to the Quebec-California market, but have not done so as of yet.

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1 B.C.’s *Greenhouse Gas Reduction Targets Act* and the Carbon Neutral Government Regulation requires all public sector organizations (PSOs) to (1) reduce emissions as much as possible each year; (2) measure any remaining GHG emissions from buildings, vehicle fleets, paper use, and government travel; (3) purchase an equivalent amount of emission reductions (offsets) to get to net-zero; and (4) report on achievements. The province declared the public sector carbon neutral in 2010, meaning that public institutions have driven their greenhouse gas emissions to zero. Hospitals, universities and schools should pay $25 per tonne of greenhouse gas produced into the Pacific Carbon Trust. The money collected by the trust was used to fund greenhouse gas reduction projects at private sector. (Government of B.C.$^2$, 2015).

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Quebec first implemented its C&T system in 2013. The provincial government continues to express confidence that it will reach its 2020 goal as a result of this C&T system, which now covers 85 per cent of all emissions in the province.

Quebec set its initial C&T floor price to $10.75 per tonne in 2013, and increased that floor price annually at a rate of five per cent plus inflation. At a 2 per cent inflation rate, the floor price would be roughly $17.30 a tonne in 2020 (The Globe and Mail, 2016). The government estimates the C&T system will raise $2.8 billion by 2020, which will go into Quebec's Green Fund to finance projects outlined in its Climate Change Action Plan. Several of the Climate Change Action Plan commitments relate to investments in EV charging infrastructure, as well as electric bus deployments.

Quebec touts itself as Canada's leader on climate change, certainly in terms of emissions reductions. The most recent available provincial government data shows that Quebec achieved its initial goal of reducing GHG emissions to six per cent below 1990 levels in 2012. Its next goal is to lower emissions to 20 per cent below 1990 levels by 2020. However, in September 2015, Quebec’s Environment Minister announced the most ambitious GHG reduction target in Canada: 37.5 per cent GHG emissions reductions below 1990 levels by 2030 (Montreal Gazette, 2015).

Carbon Pricing Impacts on Quebec Transportation Sector

Based on statistics presented in the Quebec Climate Change Action Plan (CCAP) revealed in 2012, transportation is the leading sector emitting GHGs in Quebec with 43.5 per cent of the inventory of total GHGs in 2009. Therefore, transportation GHG reductions must contribute significantly to GHG emissions reduction if the province intends to achieve its 2020 goals.

However, despite the technological improvements and efficiency gains achieved in all modes of transportation since 1990, the sector’s emissions have risen markedly since then. Thus, Quebec is earmarking a substantial portion of its carbon market revenue from both carbon taxes and C&T revenues to address transportation emissions reductions specifically. Indeed, two-thirds of the revenues from the market and the extension of the levy on fuels will fund initiatives that will reduce GHG emissions in the transportation sector.

The CCAP 2006-2012 focuses extensively on the transportation sector, which again appears at the forefront of Quebec’s GHG reduction efforts for 2020. In the updated CCAP, Quebec’s main focus is to support public transit and alternative transportation technology integration, technological efficiency, and innovation to make broader use of less-polluting forms of energy for propulsion applications.

The following policies constitute initiatives outlined in the CCAP 2013-2020 for the sector:

1. To promote public transit and alternative transportation by enhancing the availability of transit options and developing infrastructure that supports sustainable choices, and to shift from single occupancy vehicles and support the use of public transit and alternative transportation modes of mobility:

Since the implementation of the Quebec Public Transit Policy in 2006, the services offered increased by 21 per cent and ridership increased by 11 per cent between 2006 and 2011 (CCAP, 2012). Within the framework of the CCAP 2020, substantial investments are planned for public transit in particular to consolidate the services in cities, between regions and across rural areas, and to enhance the efficiency of rolling stock, e.g. the acquisition of hybrid and electric buses. Moreover, through the CCAP 2020, the government will actively promote the development and use of alternative modes of transportation to shift mobility away from single occupancy
vehicle use toward carpooling, car-sharing, taxi-sharing and active transportation such as walking and cycling. It will support, in particular, initiatives that facilitate carpooling to travel to work and the construction of new utilitarian bicycle lanes.

2. To create a greener car fleet through more fuel-efficient and better maintained vehicles:
   Through its Electric Vehicles 2011–2020 Action Plan, the Quebec government wishes to ensure that 25 per cent of new light-duty passenger vehicles sold in 2020 are electric (rechargeable hybrid or entirely electric) by offering financial support (tax incentives) to Quebecers who wish to reduce the environmental impact of their travel.

3. To invest in inter-modality and logistics to optimize freight and passenger transportation:
   The investments will develop rail and maritime transport, make them more efficient and attractive, and make known their benefits to broaden reliance on them and build customer loyalty. The goal is to increase the share of less energy-consuming modes of transportation.

4. To enhance the efficiency of maritime, rail, air, and off-road transportation:
   Investments in energy efficiency measures, conversion to less-polluting energy sources, and the modernization of equipment.

5. To reduce the environmental footprint of road freight transport:
   Financial support for fleet owners who wish to invest in energy efficiency improvements of vehicles and thus reduce operating costs. For instance, the installation of equipment to enhance vehicle aerodynamics, the conversion of trucks to electric hybrid vehicles, and the conversion to less-polluting energy sources, such as natural gas or biogas. Also, there is a financial support for the fleet owners who wish to train their employees regarding fuel-efficient driving techniques.

In April 2016, due to the importance of the transportation sector in achieving emissions reductions, Quebec introduced its Transportation Electrification Action Plan for 2015-2020. The government of Quebec intends to invest $156 million by 2020 to expand the availability of electric public transportation in Quebec through various initiatives outlined in the Transportation Electrification Action Plan (TEAP, 2016).

Some examples of these initiatives include programs to support public transportation showcase projects with the allocated budget of $24.5 million; programs to support the acquisition of electric school buses ($30 million); funding to carry out pilot projects for the electrification of taxi fleets ($6.6 million); funding for the Montreal City Mobility electric bus project ($11.9 million); funding for major public transportation projects ($83 million) including the public transportation system on the new Pont Champlain; funding for the expansion of the Montreal metro network; and electric public transit systems to Montreal’s West Island.

According to Quebec’s Transportation Electrification Action Plan, the province will promote electric transportation as part of its broader efforts to develop the economic viability of associated industries (e.g. electric bus manufacturers), and to create an environment conducive to an overall social shift from fossil fuel-powered vehicles towards EVs. With the availability of renewable electricity (i.e. hydroelectric power) across Quebec, as well as a strong industrial foundation in land transportation manufacturing (i.e. Bombardier Transport, Nova Bus, and Prévost), achieving the objectives outlined in Quebec’s Climate Change Action Plan – i.e. a 20% emission reduction below the 1990 level by 2020 – does not seem impossible nor improbable. Additional investments directed from carbon pricing into technology development.
and manufacturing in the province may help to make Quebec a leader in the use of electric-powered modes of transportation globally.

**Alberta Carbon Tax**

As of January 1, 2017, Alberta became the third Canadian province to adopt a carbon tax. Carbon emissions from heating and transportation fossil fuels are taxed at a rate of $20 per tonne, which will be increased to $30 per tonne in 2018. The price is expected to increase to $50 per tonne by 2022. This means that in 2017, Albertans should pay extra 4.49¢ per litre carbon tax on gasoline, 5.35¢ on diesel, 3.08¢ for propane, and $1.011 per gigajoule on natural gas. It is important to note that certain fuels, such as gas and diesel used on farms, will be exempt and the carbon tax does not apply to electricity rates.

In addition to direct costs associated with Alberta’s carbon pricing regime, there will be indirect costs from the carbon tax in the form of higher prices for other goods and services due to higher transportation costs overall (CBC, 2016).

According to the Alberta government, all revenue from the levy will be back into Alberta for economic growth and carbon pollution reduction. Moreover, rebates will be provided to lower- and middle-income families to offset higher costs associated with the carbon tax system, and to protect those who spend a higher percentage of their income on energy costs.

Over the next three years, revenue from the *Climate Leadership Plan*, including the carbon tax program, is expected to raise $5.4 billion. The following is a list of planned investments and rebates (Government of Alberta, 2017):

- $1.5 billion for carbon rebates to help low- and middle-income families
- $1.3 billion for green infrastructure (e.g. public transit)
- $998 million for large scale renewable energy, bioenergy and technology, coal community transition and other Climate Leadership Plan implementation initiatives
- $566 million for energy efficiency, which includes Energy Efficiency Alberta, a new provincial agency that will support programs and services for homes and businesses
- $565 million to pay for a cut in the small business tax rate from 3 per cent to 2 per cent
- $291 million in transition payments as part of the coal phase out agreements
- $151 million to assist Indigenous communities transition to a cleaner economy

The introduction of the new carbon tax will result, therefore, in an increase in both direct and indirect costs for individuals and households which should motivate “greener” choices among individuals, families and within communities. For example, investments into renewable energy, public transit systems and energy efficiency technologies should make it feasible for industries and individuals to reduce their carbon footprint through energy, transportation and technology shifts. Transit agencies could benefit from investments in greener technologies to reduce their respective emissions footprint and long-term operational costs within a carbon-priced economy, while households and individuals might deem large pickup trucks and sports utility vehicles (SUVs) to be overly expensive and unaffordable due to increases in pump prices.

The carbon pricing system in Alberta is intended to affect and re-shape individual, household, community and industrial decision-making among Albertans to drive forward fuel efficiency measures, to promote EVs, and to encourage the use of public transit wherever possible.
European Union Carbon Pricing Policies

In 2005, the European Union (EU) launched its first significant set of climate change policies, including the European Emissions Trading Scheme (EU-ETS) - the first of its kind in the world, and still the world's largest carbon pricing market today.

The EU-ETS regulates about half of the EU’s CO₂ emissions. The EU ETS works on the C&T principle and it includes more than 11,000 factories, power stations, and other installations in 30 countries (all 27 EU Member States along with Iceland, Norway, and Liechtenstein). The caps for 2020 are set at 21 per cent below 2005 emissions. The EU-ETS is now in its third phase (2013-2020), which is significantly different from phase 1 (2005-2007) and phase 2 (2008-2012). The main changes in the third trading phase are (1) allowances will be allocated centrally by an EU authority (as opposed to national allocation plans); (2) a considerably larger share of allowances are auctioned (more than 60 per cent) rather than allocated freely; (3) other GHGs, such as nitrous oxide and perfluorocarbons have been included; (4) airline emissions were included starting in 2012; and (5) €300 million worth of allowances were set aside in the New Entrants Reserve to fund the deployment of innovative renewable energy technologies and carbon capture and storage (European Commission, 2017).

Retrospective analyses show that the EU-ETS had been severely over-allocated in the first and second trading periods, resulting in unexpectedly low carbon pricing within the auction framework. A price collapse for units of carbon at the end of Phase 1 and Phase 2 trading resulted in emission allowances falling from a peak of about €30 per metric tonne in April 2005 to a rock-bottom price of €0.10 per metric tonne in September 2007, as market participants became aware that actual EU emissions were well below the number of allowances issued by government. This over-allocation was caused by EU Member States overestimating their emissions. After recovering to a price of more than €20 per metric tonne of CO₂ at the start of Phase 2 trading, prices again fell below €7 per unit by 2012. In this instance, the price collapse was caused primarily by a combination of global economic recession (which affected worldwide economies starting in 2008), general over-allocation across the EU once again, and an abundance of cheap international offsets that industries could also access to avoid buying allowances in the EU carbon marketplace (Koch, 2014; The Climate Group, 2013; The Economist, 2013).

To prepare for Phase 3 trading, the EU introduced several reforms intended to tighten and improve the system and to salvage the EU’s flagship climate policy. The main challenge in the third trading period has been the large surplus of EU emission allowances transferred from the second to the third trading period, which continue to glut the marketplace.

Figure 4 below illustrates that this price volatility has not prevented the EU from meeting its emissions goals and EU emissions have fallen since the ETS came into existence. In 2014, GHG emissions in the EU were down by 22.9 per cent compared with 1990 levels, putting the EU on track to surpass its 2020 target, which is to reduce GHG emissions by 20 per cent by 2020 and by 40 per cent by 2030 compared with 1990 (EuroStat, 2016).
The Use of the EU ETS Revenues

According to the revised EU ETS Directive, EU member states shall determine the use of revenues generated from the auctioning of allowances; however, at least 50 per cent of auctioning revenues should be used for climate and energy related purposes including but not limited to:

1. Reducing GHG emissions
2. Developing renewable energies
3. Investing in environmentally safe capture and geological storage of CO₂
4. Shifting to low-emissions and public forms of transportation (i.e. "sustainable transport")
5. Financing research and development in energy efficiency and clean technologies

European Union member states can decide whether they allocate revenues from the auctioning of allowances directly to a specific climate action fund to support a specific program – a process known as “earmarking” – or whether they will count the auction revenues as additional income streams that support the general state budget (European Commission, 2017).

Under the Monitoring Mechanism Regulation, EU member states are requested to report annually on the amount and use of the revenues generated. However, analyses have demonstrated that reporting on ETS auctioning revenues and their use continues to suffer from deficiencies in the reporting framework and a lack of attention to detail in the preparation of reports (Velten et al., 2016). European Union member states each receive a specific share of

Figure 4: EU’s Greenhouse gas emissions: 1990- 2014 (EuroStat, 2016)
the total allowances to be auctioned mainly based on their overall ETS emissions. From 2013 to 2015, those states auctioned a combined value of almost 2 billion allowances amounting to €11.7 billion in revenues. On average, EU member states report to have spent 85 per cent of the total auctioning revenues for climate purposes over the period 2013 to 2015. As per member state reporting, the majority of the revenues used for climate action (82 per cent) were allocated to domestic actions amounting to €8,691 million. Close to 10 per cent was spent on international climate actions, amounting to €1,048 million. Another eight per cent (€808 million) has been allocated to unspecified climate related purposes (Velten et al., 2016).

As shown in Figure 5, EU auction revenues have been spent based on member states’ national priorities. Most countries have used these investments to address and improve energy efficiency and to promote the generation of renewables or the launch of sustainable transportation projects. For instance, Hungary recently invested part of its carbon pricing revenues into electric mobility projects (i.e. EV programs). France, Lithuania, and the Czech Republic have spent most of their carbon pricing revenues on energy efficiency projects. In Bulgaria, Portugal and Spain, national priorities include the development of renewable energy projects across those respective countries. The UK focuses its investments on energy efficiency projects, renewable energy generation projects, research and innovation in low-carbon systems, and financial assistance for low-income households. In Germany, most revenues generated are directed toward a specific fund, which supports a wide-range of projects including sustainable transportation technology implementation (European Environment Agency, 2016).

To help disseminate carbon revenues, the *Energy and Climate Fund* was established in 2010. All EU-ETS auctioning revenues are channeled into this fund which provides additional finance to support the implementation of Germany’s long-term climate strategy by providing incentives for investments towards low-carbon or carbon-free sources of energy, and which promotes electric mobility. The fund provides finance for energy efficiency, renewable energy, energy storage and grid technology, energetic refurbishment of buildings, national climate action, international climate and environmental action, and the development of electric mobility projects (International Energy Agency, 2017).
Budgetary earmarking for climate action within the *Energy and Climate Fund* is a big step toward transparency, as it renders national and international allocations of EU-ETS revenues easy to track. As of December 2016, eleven EU member states have earmarked their auctioning revenues by allocating the revenues to a specific support program or fund. For example, France has allocated all of its revenues (up to €590 million per year) to the *Habiter Mieux* ("live better") program managed by the National Agency of Housing for national political expenditures and social objectives. Initially, this program was designed to support measures to improve the energy efficiency of housing (Velten et al., 2016). Currently, the *Habiter Mieux* budget targets four priorities, including: (1) renovation of degraded houses, (2) promotion of energy-efficient renovations, (3) the fight against energy poverty, (4) adaptation of homes to overcome the loss of autonomy among people living with disabilities or for the aged; (5) support for distressed condominiums (The World Bank, 2015).

**Ontario Cap and Trade Mechanism**

In April 2015, the Government of Ontario announced the implementation of a new Cap and Trade system as part of its overall strategy to address climate change. The system came into effect in January 2017 under the *Climate Change Mitigation and Low-carbon Economy Act*. First, the government set a maximum limit (cap) on the total level of GHGs produced by heavy emitters, including electricity importers, facilities or natural gas distributors that emit at least 25,000 tonnes of GHGs per year as well as fuel suppliers that sell more than 200 litres of fuel per year (Government of Ontario¹, 2017). Participation in the current C&T program is not mandatory for facilities that generate between 10,000 and 25,000 tonnes of GHGs per year. However, “non-covered” entities, i.e. those that do not exceed the emissions threshold, can be affected by the C&T system through an increase in costs that are passed along from heavy-emitters or “covered” facilities (Ontario Chamber of Commerce, 2015).

Ontario set a GHG emissions cap of roughly 142 megatonnes (MT) for 2017. The emissions cap will be reduced each year from 142 MT in 2017 to 136 MT in 2018, 131 MT in 2019 and 125 MT in 2020, which is equal to the government’s target of reducing overall provincial emissions 15 per cent below 1990 levels by 2020 (Kingston Region, 2017).

The Ontario C&T system is designed to provide emitters with a mechanism by which they can trade on their ability to emit GHGs. Trading is made possible through the creation of emissions allowances. If an Ontario heavy-emitter or otherwise “covered” entity exceeds the GHG cap imposed by the government, it must buy an equal number of allowances at auction or from other companies that pollute less than their imposed GHG limit. An emission “allowance” acts as a permit to emit. One emission allowance is equivalent to one metric tonne of CO₂e, meaning that an emitter in possession of one emission allowance has permission to emit one tonne of CO₂e into the atmosphere (Government of Ontario², 2017). Emissions allowances can only be issued by the Government of Ontario and they are typically allocated in two ways: (1) for free, or (2) by auction.

Large Ontario emitters will receive allowances for free until 2020 to prevent them from moving to jurisdictions without carbon pricing, and to help reduce the cost of compliance for those emitters in the short-term. By contrast, fuel distributors and electricity importers will not receive free allowances in the short-term, meaning fuel distributors and electricity importers must begin purchasing allowances from the auction or from other companies immediately. The allowance auctions constitute the primary mechanism by which the Government of Ontario will generate “carbon revenues”. As of March 22, 2017, Ontario opened its first C&T allowances auction; the auction performed beyond expectations, selling out all currently allocated allowances based on a carbon price valued at $18.07 per unit (CBC, 2017). This first auction generated $472 million...
in new revenues for the government – revenues that must necessarily be allocated to “green” technology investments in the province.

As the emissions cap declines and fewer allowances are available, the government hopes the incentive increases for companies to invest in technologies that cut their emissions. It is predicted that quarterly auctions of carbon credits will generate approximately $1.9 billion in annual revenues for the Province each year for a total of approximately $8 billion in new revenues by the end of 2020. The government will distribute these revenues to programs focused on emissions reductions, which can and should help private businesses, public fleets, and consumers adapt to the new low-carbon economy.

Starting in 2018, Ontario plans to link its C&T system to the joint Quebec-California market so as to create a larger international market for carbon credit purchases, sales and offset opportunities. However, Ontario’s Environmental Commissioner and the Province’s Auditor General have both raised concerns recently about enabling companies to buy allowances in jurisdictions other than Ontario due to the lower prices for carbon in those regions. The concern at play is that lower carbon prices in California and Quebec will drive down the auctioned value of carbon in Ontario once the markets are linked. Additionally, because companies can buy credits outside of Ontario, an estimated $466 million in carbon revenue is expected to leave the Ontario economy over three years as Ontario companies buy credits in Quebec and California rather than in the province’s local auction. This may mean that GHGs in Ontario will also not drop as radically as expected were companies restricted to buying Ontario credits only (Financial Post, 2017).

Note that participating companies can also generate “offset credits” to meet up to eight per cent of their emission allowance requirements. Offset credits represent emissions reductions achieved through specific project-based actions that exist external to the activities regulated by the C&T system itself. These “offsets” constitute mechanisms by which companies that pollute heavily can offset their pollution and GHG emissions by supporting another organization, or project, that reduces emissions. Offset credits can be created by projects that reduce or remove one tonne of GHG emissions. Typical offset projects include tree planting initiatives, the capture and destruction of methane gas from landfills or other sites of natural gas emissions, upgrading commercial or industrial cooling systems to use refrigerants that have little or no impact on global warming, etc. (Government of Ontario, 2016). Offset projects need to be accredited by the government. There is no necessary or a priori limitation as to what can constitute an offset project, meaning there is flexibility embedded within the provincial offset marketplace to enable innovation and creative communities to generate projects that would attract private sector investments due to the GHG reduction potential of the project.

By law, Ontario C&T proceeds are directed to a GHG reduction account named the Greenhouse Gas Reduction Account (GGRA) for initiatives/projects that support the reduction of GHG emissions and fight climate change. The Climate Change Action Plan outlines how the government intends to spend these proceeds. In the Climate Change Action Plan, the Greenhouse Gas Reduction Account funding is estimated to range from $5.96 billion to $8.3 billion. The Government of Ontario announced that this funding will be used to invest in initiatives such as retrofit programs that reduce GHG emissions like solar energy systems, battery storage, building insulation, heat pumps and switching fuels with cleaner alternatives to help homeowners use less energy and save more money (MOECC, 2016).

Ontario has already committed $325 million to the Green Investment Fund to secure a low-carbon future by (1) helping homeowners use less energy and reduce energy bills through home retrofits; (2) supporting more EV charging stations across Ontario; (3) retrofitting social housing developments to boost energy efficiency; (4) helping businesses reduce emissions; (5)
funding local environmental organizations; (6) providing Indigenous communities with training, tools and infrastructure to address climate change (Government of Ontario\textsuperscript{2}, 2016).

**Conclusion**

Ontario can benefit from lessons learned from the other jurisdictions to develop its future policies in ways that are mainstreamed with transit needs and aligned with transit-led solutions. A well-designed transit-led consultation process could also support transit agencies in understanding carbon pricing mechanisms and the opportunities for new revenues and technology switching that carbon pricing systems enable.

It is important to ensure such a system is fair to low-income households, which are at risk of being disproportionately affected (Bubna-Litic and Chalifour, 2012). The following are examples of opportunities and challenges that transit agencies may face in Ontario.

**Opportunities**

Ontario’s C&T program is expected to generate proceeds of approximately $1.8 to $1.9 billion each year, but the program could generate additional funding if C&T regulations were extended to include mid-emitters in the future (Government of Ontario\textsuperscript{3}, 2016). These revenues are legally tied to “green” initiatives, which includes green transit initiatives. Thus, transit could benefit significantly from investments made by the Government of Ontario into transit systems based on new C&T revenues. Similar to Quebec, carbon pricing revenues could be allocated to improvements in public transportation and investment in cleaner alternatives.

Firms that are targeted as “heavy emitters” can offset their carbon footprint by investing in carbon offsets. Offsets relate to projects that reduce GHGs or draw carbon pollution out of the atmosphere. In Ontario, the government invites and recognizes proposals for “real, additional, enforceable, verifiable, and permanent reductions” that occur outside the C&T framework (Phillips and Drolet, 2016). Transit may play an important role in the offset marketplace (i.e. by investing in electrification of buses) if the community of transit agencies could organize itself so as to proposed such projects.

**Challenges**

Cap and Trade policies will result in increases in diesel costs in the near-term future. Predictions for increased fuel prices generally focus on an initial five per cent increase in diesel fuel costs over the next year with incremental increases ensuing over the next five years. The resulting effects on transit include higher diesel costs in the short- and long-term. This may cause a challenge for those transit agencies that currently struggle to pay for operations within the existing low-priced global and domestic diesel marketplace.

The degree to which carbon pricing could or should affect transit agency decision-making is an open question that should be addressed – in the first instance – through structured consultations with the transit industry in Ontario. Such consultations should seek to inform participants about carbon pricing mechanisms at play in other jurisdictions (nationally and internationally) and also assess the degree to which transit agencies elsewhere might offer Ontario’s transit agencies lessons in “best practices” or viable options moving forward.
Low Carbon Fuel Standards

A Low Carbon Fuel Standard (LCFS) is a flexible regulation that specifies mandatory reductions in the GHG intensity of fuels sold within a jurisdiction. Existing LCFSs have been applied exclusively to transportation fuels. LCFSs define the emissions performance required of transit vehicles and allow suppliers flexibility in reaching the standard through mechanisms such as credit trading. Suppliers of alternative low-carbon fuels, which in the transportation sector include biofuels, propane, hydrogen, and electric vehicle charging, can earn credits. LCFSs not only have an immediate effect by improving the emissions intensity of fuels used, they also encourage clean innovation and accelerate the transition to cleaner fuels. Therefore, the GHG reduction potential and low cost to customers of LCFSs have increased their popularity as a tool to reduce emissions in the transportation sector (Scott, 2017).

British Columbia is the only Canadian jurisdiction with an existing LCFS (as a part of the Renewable and Low Carbon Fuel Requirements Regulation), following the lead of California and the European Union, and more recently, Oregon. However, both Ontario and the Federal Government are currently proposing LCFSs, which are referred to as a “Clean Fuel Standard” by the Government of Canada and as a “Modern Renewable Fuel Standard” by the Government of Ontario. The LCFS proposed by the Federal Government seeks to extend the policy beyond transportation fuels to include fuels used in buildings and industry as well (Scott, 2017).

California

The state of California introduced a Low Carbon Fuel Standard (LCFS) in 2009 as one of the GHG reducing strategies to achieve its 2020 goal of a 20 percent reduction in GHG emissions relative to 1990 levels. The standard was implemented on January 1, 2011 (California EPA, 2017). The LCFS is a performance-based standard that requires petroleum refiners and other fuel providers to reduce the carbon-intensity of transportation fuels by 10 percent by 2020 (Promotum, 2015). The “carbon intensity” of a fuel refers to the amount of global warming emissions produced by a given unit of fuel (Barbose, 2017). A full lifecycle analysis is used to measure the carbon-intensity of each fuel, including GHG emissions from feedstock production, transportation, refining, distribution, and end-use combustion (Promotum, 2015).

Refineries and fuel importers can comply with LCFS requirements by selling fuels that meet the carbon intensity standard, or by selling fuels over the standard, while purchasing credits generated by sellers of lower-carbon fuels, such as biodiesel or electricity (Barbose, 2017). Companies can earn LCFS “credits” in a variety of ways, due to the technology-neutral nature of the standard, including (Environment and Climate Change Canada, 2017; Promotum, 2015):

- Improving their processes
- Switching to renewable feedstocks and inputs
- Using electricity or hydrogen for transportation
- Using renewable hydrogen within refineries
- Investing in GHG reductions projects for refineries
- Implementing innovative crude production methods (i.e. solar stream or heat generation, solar or wind based electricity, and carbon capture and storage)

Each LCFS credit is equivalent to one metric ton of GHG emission reductions. Similar to the Cap and Trade system, the LCFS system follows a market-based scheme, whereby LCFS credits can be sold, banked, or utilized to help meet set requirements (Promotum, 2015). Additionally, obligations can be transferred from the fuel supplier to another party, such as from...
Common transportation fuels such as diesel and gasoline possess a higher carbon intensity than that required by the LCFS standard, which creates a constant market for cleaner non-petroleum fuel sources. The success of the LCFS program is evident with the 50 percent increase in alternative fuel use in California between 2011 and 2016, with an additional 30 percent decline in carbon intensity of these fuels over the same period. In total, the LCFS regulations within California can be accredited with 25 million tons of reduced carbon emissions (Barbose, 2017). Customers have not been negatively impacted by the LCFS. Rather, customers gained expanded availability of fuel choices and negligible price impacts such as the 0.6¢ increase to a gallon of blended gasoline in 2016. For comparison, the Cap and Trade program added approximately 9¢ per gallon (Yeh, 2017).

Oregon

Oregon’s Clean Fuel Standard was implemented in 2016 and requires a 10 percent reduction in the carbon intensity of transportation gasoline and diesel fuels by 2025 relative to 2015 levels. Since Oregon does not house any refineries, the only regulated parties are importers of gasoline and diesel. Fuel importers can comply with standards through the blending of biofuels into gas of diesel, such as ethanol, biodiesel, or renewable diesel. Importers can also provide alternative fuels such as natural gas, biogas, electricity, propane or hydrogen, or purchase credits from producers to meet standards. The requirements can be suspended or modified if the supply of suitable lower carbon fuels is insufficient to allow for regulation compliance. Oregon follows the same lifecycle analyses as those approved by California for the purposes of the Clean Fuel Standard (Environment and Climate Change Canada, 2017).

European Union

The European Union’s Fuel Quality Directive requires fuel suppliers to reduce the lifecycle GHG emissions from fuels by up to 10 percent by 2020. Six percent of the 10 is binding, two percent can be reached using carbon sequestration and storage, and the final two percent can be achieved through “Clean Development Mechanism” projects. The Fuel Quality Directive compliments the EU Renewable Energy Directive which requires that biofuels make up 10 percent (by energy content) of transportation fuels for each member country by 2020 (Environment and Climate Change Canada, 2017). The Fuel Quality Directive was enacted in 2009 but has yet to be implemented by all parties, hence little data is available on the successes of the program thus far (Scott, 2017).

British Columbia

British Columbia enacted a low carbon fuel standard in 2008, alongside a renewable fuels regulation, making it the only Canadian province with a carbon fuel standard in place. The standard is centered around a goal of reducing the carbon intensity of fuels by 10 percent by 2020 from 2010 levels. The standard covers all fuels used for transportation in British Columbia, with the exception of fuels used by aircrafts or for military operations. Similar to California, there is flexibility to delegate requirements from the fuel supplier to another party (i.e. from fuel producer to distributor) (Environment and Climate Change Canada, 2017).

Suppliers can comply with LCFS by (1) reducing overall carbon intensity of fuels they supply; (2) acquiring credits from another fuel supplier; or (3) entering into a Part 3 agreement with the
Government of British Columbia (Environment and Climate Change Canada, 2017). The compliance penalty currently sits at $200 per tonne of average GHG emissions (Scott, 2017). The average price per credit sold within 2016 was $171 (Government of British Columbia, 2017). Part 3 agreements require fuel suppliers to take actions, or influence the actions of others, that would have a reasonable possibility of reducing emissions by using lower carbon fuels, in a more timely manner than would have been otherwise achieved without these actions (Environment and Climate Change Canada, 2017). The three categories of Part 3 agreements are:

- Improve the lifecycle carbon intensity of a fuel
- Increase lower carbon fuel supply (quantity and access)
- Increase lower carbon fuel demand.

### GHG Emissions Modeling

This section is intended to facilitate corporate-level quantifying and reporting of GHG emissions from transportation or mobile sources. Mobile sources of emission refer to the fleet fuel combustion which includes two categories of emissions: (1) Direct emissions from fossil fuels combustion in vehicles and equipment; and (2) Fugitive emissions from mobile air conditioning systems. Whereas, stationary sources (or non-transport fuel combustion) of GHG emissions are activities associated with the lighting, heating and cooling of facilities, and the powering of machinery and equipment within those facilities which again consist of two categories: (1) Direct emissions from stationary fuel combustion and/or stationary air conditioning and refrigeration; and (2) Indirect emissions from purchased electricity, district energy systems, and purchased steam and hot water (B.C. Ministry of Environment, 2016).

In general, corporate transportation emissions can take the form of either direct or indirect emissions. Direct emissions refer to only those emissions that are associated with owned or controlled sources, such as company owned vehicle fleets and corporate aircraft. Indirect emissions refer to all other company-related emissions, including employee commuting, short-term vehicle rentals, purchased electricity, and upstream/downstream transportation emissions, such as those associated with material inputs or consumer use (Austrian Government, 2016).

GHG emissions from mobile combustion are most easily estimated by major transport activity, i.e., road, off-road, air, railways, and water-borne navigation. Mobile sources produce direct GHG emissions of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) from the combustion of various fuel types, as well as several other pollutants such as carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO₂), particulate matter (PM) and oxides of nitrate (NOₓ), which cause or contribute to local or regional air pollution (IPCC, 2006).

Currently, the OPTA-CUTRIC project addresses direct GHGs (CO₂, CH₄, and N₂O) from mobile sources, although indirect GHG emissions may be integrated into the calculation in the future.

For all mobile sources, there two methods to calculate GHG emissions: **fuel-based** calculations based on aggregated fuel consumption data or **distance-based** calculations based on distance traveled and distance-based emission factors. Emissions can be estimated from either the fuel consumed (represented by fuel sold) or the distance travelled by the vehicles. The first approach (fuel sold) is appropriate for CO₂ and the second (distance travelled by vehicle type and road type) is appropriate for CH₄ and N₂O. In practice, the availability of data determines which approach – fuel-based or distance-based – to take. In order to reduce the uncertainties, efforts should concentrate on the carbon content and on improving the data on fuel sold.
Another major uncertainty component is the use of transport fuel for non-road purposes (Air Canada, 2005).

Measuring GHG emissions is an important first step for improving the management of activities and operations responsible for producing those emissions and deploying mitigation strategies to reduce them. Whether or not an organization plans to go carbon neutral, measuring and managing emissions can result in cost savings, increased organizational efficiencies and better asset management. In Ontario, the mid-emitters will soon be the subject of the second iteration of the C&T system. Therefore, being proactive in measuring emissions and planning to reduce them seems vital for most transit agencies in Ontario.

**Model inputs: Fuel-based Method to Estimate GHG Emission from Mobile Sources**

Fuels used for transport purposes produce slightly different methane and nitrous oxide emissions than if the same fuels were used for stationary energy purposes. Therefore, separate emission factors are used to calculate emissions. Table 1 shows emission factors for different transportation fuels to apply where fuels are used for general transport purposes (mobile fuel combustion). Table 7 of the 2016/17 BC Best Practices Methodology for Quantifying Greenhouse Gas Emission (B.C. Ministry of Environment, 2016) and Table A6-11 of the 1990-2013 National Inventory Report by Environment Canada (part 2, page 199) provide emission factors for mobile fuel combustion sources. It is important to note that the emission factors for gasoline and diesel cars, buses, and trucks vary with emission control technology which correlates with vehicle age.

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Bio Co₂</th>
<th>Co₂</th>
<th>CH₄</th>
<th>N₂O</th>
</tr>
</thead>
<tbody>
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<td>Gasoline</td>
<td>-</td>
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<tr>
<td>Natural Gas (kg/m³)</td>
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<td>0.009</td>
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</tr>
<tr>
<td>Electricity (kg/kWh)</td>
<td>-</td>
<td>0.04</td>
<td>0.00001</td>
<td>0.000001</td>
</tr>
</tbody>
</table>

Following the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (2006) estimates of emissions from the combustion of individual fuel types are made by multiplying the quantity of fuel combusted by a **fuel-specific emission factor**. This is performed for each relevant greenhouse gas (in this case, carbon dioxide, methane and nitrous oxide). Separate calculations should be carried out for each fuel type. Total GHG emissions are calculated by summing the emissions of each fuel type and each GHG. The following formula can be used to estimate GHG emissions from the combustion of each type of fuel listed in Table 1 used for transport energy purposes.
Where:

- $Eij$ is “Emission” of gas type (j) from fuel type (i) in tonnes.
- $Qi$ is the “Quantity” of fuel type (i) combusted for transport energy purposes in Litre.
- $EFij$ is “Emission Factor” for each gas type (j) for fuel type (i) in Kilograms per Litre.

The Global Warming Potential (GWP) is an index used to convert relevant non-carbon dioxide gases to a carbon dioxide equivalent ($CO_2e$). Greenhouse gases vary in their ability to trap heat in the atmosphere (radiative forcing). The GWP of a GHG accounts for both the immediate radiative forcing due to an increase in the concentration of the gas in the atmosphere, and the lifetime of the gas. The GWP for each GHG is expressed as the ratio of its heat trapping ability relative to $CO_2$. For example, the GWP of $CO_2$ equals one while $CH_4$ has a GWP of 25, indicating that it’s radiative forcing is 25 times more than $CO_2$. In other words, releasing one tonne of $CH_4$ is equivalent to releasing 25 tonnes of $CO_2$, which can also be expressed as 25 tonnes of $CO_2e$. Table 2 below shows GWPs for different GHGs (B.C. Ministry of Environment, 2016).

<table>
<thead>
<tr>
<th>Greenhouse Gas</th>
<th>GWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>$CO_2$</td>
<td>1</td>
</tr>
<tr>
<td>$CH_4$</td>
<td>25</td>
</tr>
<tr>
<td>$N_2O$</td>
<td>298</td>
</tr>
</tbody>
</table>

GWPs are particularly important within the context of emissions reporting since international protocols require the reporting of specific GHGs and their $CO_2e$. For this reason, the calculation of GHG emissions generally involves (1) multiplying the emission factor for a GHG by an appropriate measure of consumption (activity) to produce the corresponding emissions for that GHG and then (2) multiplying those emissions by its GWP to produce the corresponding $CO_2e$ emissions:

$$CO_2e = Eij \times GWP_j$$

In the case of liquid fossil fuel blends with biofuel (e.g. ethanol or biodiesel), gasoline or diesel are combined with varying proportions of biofuels (e.g. E10, B5, B20), resulting in emission factors that are weighted averages of the biofuel and fossil fuel factors. Since international protocols require the separate reporting of biogenic emissions from combustion, the $CO_2$ emissions from the biofuel component (Bio $CO_2$) must be calculated and reported separately from those of the fossil fuel component (B.C. Ministry of Environment, 2016).

To properly address the related emissions from biofuel combusted in road transportation, biofuel-specific emission factors should be used, when activity data on biofuel use are available. According to the Intergovernmental Panel on Climate Change (IPCC) guidelines, $CO_2$ emissions from the combustion of the biogenic carbon of these fuels are treated in the agriculture sector.
and should be reported separately as an information item to avoid double counting. Biodiesel can be blended and used in many different concentrations. The most common are B5 and B20 (respectively 5% and 20% biodiesel blended with petroleum diesel). B100 (pure biodiesel) is typically used as a blendstock to produce lower blends and is rarely used as a transportation fuel. "The share of biogenic carbon in the biofuel can be acknowledged by multiplying the biodiesel emission factor by its fraction in the combusted biofuel blend" (IPCC 2006; p. 3.17).

The CO₂ released to the atmosphere during combustion of biomass is assumed to be the same quantity that had been absorbed from the atmosphere during plant growth. Because CO₂ absorption from plant growth and the emissions from combustion occur within a relatively short timeframe to one another (typically 100-200 years), there is no long-term change in atmospheric CO₂ levels (B.C. Ministry of Environment, 2016). For this reason, biomass (depending on its origin) is often considered “carbon-neutral” and the IPCC Guidelines for National Greenhouse Gas Inventories specifies the separate reporting of CO₂ emissions from biofuel combustion. To avoid over or under-reporting of CO₂ emissions, it is important to assess the biofuel origin so as to identify and separate fossil from biogenic feedstock. For example, “biodiesel made from coal methanol with animal feedstock has a non-zero fossil fuel fraction and is therefore not fully carbon neutral. Ethanol from the fermentation of agricultural products will generally be purely biogenic (carbon neutral), except in some cases, such as fossil-fuel derived methanol" (IPCC, 2006; p. 3.17).

**GHG Emission Calculation**

Fuel consumption, ridership, number of active vehicles, service area population, service area size, and vehicle kilometres data are derived from the Ontario Urban Transit Fact Book: 2015 Operating Data prepared for The Ontario Ministry of Transportation by Canadian Urban Transit Association (CUTA) to estimate each transit agency’s GHG footprint. CUTRIC will further refine its methodology by obtaining data from transit agencies to reach an optimal model to estimate the GHG footprint from both mobile and stationary sources. Table 3 indicates our primary GHG estimation for transit agencies within the OPTA network, which are sorted by their service area density

CUTRIC presents results in a manner that allows comparisons across transit agencies. For example, in addition to total quantity of emissions produced (absolute), CUTRIC developed the GHG emission modeling (relative) per ridership, per kilometre, per bus, and other ratios of emissions and energy productivity to allow for cross-agency comparative analysis.

Therefore, collaboration with transit agencies to get accurate data (e.g. fuel consumption for transportation purposes, number of buses, number of passengers moving around per year, estimates of distance traveled, etc.) is an important part of ongoing project development.

---

2 Service area density = Service area population/service area size (km²)
### Table 3: GHG Emission Calculation

<table>
<thead>
<tr>
<th>Transit Agency</th>
<th>Estimated CO\textsubscript{2}e (tonne)</th>
<th>Estimated CO\textsubscript{2}e per passenger (tonne)</th>
<th>Estimated CO\textsubscript{2}e per vehicle (tonne)</th>
<th>Estimated CO\textsubscript{2}e per total vehicle kilometres (tonne)</th>
<th>Estimated CO\textsubscript{2}e per revenue vehicle kilometres (tonne)</th>
<th>Service Area Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toronto Transit Commission</td>
<td>241,253.36</td>
<td>0.0004</td>
<td>84.83</td>
<td>0.0010</td>
<td>0.0011</td>
<td>4,472.31</td>
</tr>
<tr>
<td>Mi-Way</td>
<td>46,663.87</td>
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<td>99.92</td>
<td>0.0014</td>
<td>0.0015</td>
<td>4,263.16</td>
</tr>
<tr>
<td>Milton Transit</td>
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<td>60.95</td>
<td>0.0014</td>
<td>0.0014</td>
<td>2,386.88</td>
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<td>0.0017</td>
<td>2,296.99</td>
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<td>0.0014</td>
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<td>Estimated CO$_2$e (tonne)</td>
<td>Estimated CO$_2$e per passenger (tonne)</td>
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<td>Estimated CO$_2$e per total vehicle kilometres (tonne)</td>
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<td>Service Area Density</td>
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<tr>
<td>Bradford West Gwillimbury</td>
<td>54.86</td>
<td>0.0021</td>
<td>18.29</td>
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<td>0.00068</td>
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<td>Estimated CO$_2$e per revenue vehicle kilometres (tonne)</td>
<td>Service Area Density</td>
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<td>Estimated CO$_2$e per vehicle (tonne)</td>
<td>Estimated CO$_2$e per total vehicle kilometres (tonne)</td>
<td>Estimated CO$_2$e per revenue vehicle kilometres (tonne)</td>
<td>Service Area Density</td>
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<td>17.45</td>
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<td>0.00056</td>
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Other GHG Calculation Methodologies

There are different methodologies adapted by various organizations/jurisdictions to calculate GHG emissions. Most of them align with the IPCC guidelines. Each methodology has its own benefits and limitations. The following are some examples of deployed methodologies:

CUTA’s methodology to calculate GHG emission is based on fuel consumption metrics. CUTA has used this methodology for the calculation of GHG emissions (CO₂, CH₄, NO₂) from transit systems for the Transit Vision 2040 benchmarking, which presents the results as an aggregate for the country. CUTA’s methodology is based on reported fuel consumption and excludes other emission sources. The methodology also does not consider ridership or vehicle kilometre provided for a given volume of fuel consumption.

GHGenius is an Excel spreadsheet model used to complete lifecycle assessments (LCA) of transportation fuels and estimate emissions. The model was developed for Natural Resources Canada based on the 1998 version of Dr. Mark Delucchi’s Lifecycle Emissions Model (LEM). GHGenius analyzes emissions of many contaminants associated with the production and use of traditional and alternative transportation fuels. Life cycle emissions focus on primary greenhouse gases, criteria pollutants from combustion sources, and the energy used. GHGenius is capable of predicting emissions for past, present and future years through to 2050 and is able to perform region-specific LCAs throughout Canada. The model is capable of estimating emissions for an extensive selection of transportation fuels and a full range of transportation vehicles, spanning light duty battery-electric vehicles to heavy-duty trucks (S&T Consultants Inc., 2004).

The Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) Model was developed by the Argonne National Laboratory in the United States. The GREET model fully evaluates energy and emissions impacts of advanced vehicle technologies and new transportation fuels, throughout the entire lifecycle or from “well to wheel”. GREET was developed as a multidimensional spreadsheet model in Microsoft Excel. The GREET model can simulate data for passenger cars, light duty trucks (up to 8500 lbs), and electrical vehicles, providing information about total resource use, and GHG emissions (CO₂, CH₄ and N₂O). Additionally, the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) tool was recently developed for Clean City stakeholders to estimate petroleum use, GHG emissions, air pollutant emissions, and cost of ownership of light-duty and heavy-duty vehicles using simple spreadsheet inputs (Argonne National Laboratory, 2017).

The estimates of the GHGenius and GREET methods carry limitations and uncertainties associated with life-cycle assessment modeling, perpetrated by the inconsistency of data availability and accuracy. These methods can also be time and resource intensive. Most LCA’s will not determine product performance or cost effectiveness, therefore, LCA’s should be used as only one component of the decision-making process alongside cost and performance trade-offs (O’Connor, 2011).

The Motor Vehicle Emissions Simulator (MOVES) was developed by the United States Environmental Protection Agency (EPA) to estimate emissions from mobile sources at the national, county, and project levels for criteria air pollutants, GHGs and air toxics (United States Environmental Protection Agency, 2017). Environment and Climate Change Canada is responsible for preparing an inventory of data and providing emission estimation to the United Nations. The Air Pollutant Emissions Inventory Report cites its use of the MOVES model to calculate the transit emissions estimated within the report (Environment and Climate Change Canada, 2015). Unlike the GREET and GHGenius models discussed, the MOVES model focuses primarily on combustion emissions rather than those emitted throughout the entire
The lifecycle of a given fuel. The MOVES model seems to be the most practical modelling software out of all the option discussed, due to its focus on emissions from vehicle combustion rather than attempting to calculate the emissions throughout an entire LCA, which is littered with uncertainties and decreases final metric accuracy.

CUTRIC’s methodology is an attempt to develop a robust mapping and scoring tool that includes full GHG footprint assessment of transit agencies including CO₂, CH₄, and N₂O from both mobile (combustion of fossil fuels by fleets) and stationary sources (heating, cooling and other electrical or gas-based auxiliary systems).

**OPTA Members Report Card**

A system-by-system evaluation of OPTA transit agencies has been developed to understand which transit companies are low, medium, or high emitters based on GHG emissions from mobile sources. This evaluation led to the creation of a draft Report Card documenting a relative score for each transit agency within the OPTA network. The purpose of this Report Card is to demonstrate the value of alternative fuels on GHG reductions, greater urban density on GHG reductions, and fleet optimization of services on GHG reductions.

The draft Report Card documented here will be developed into a refined tool that will help Ontario policy makers and transit agencies measure year-to-year GHG reductions (or increases) in a comparable and relative manner. The purpose of these measurements is to quantify the manner in which Ontario transit systems should qualify for Cap and Trade revenues in the future, specifically revenues to support alternative fuel/propulsion acquisitions, transit service density developments, and optimized transit technologies onboard vehicles and within fleet operations offices to advance the solutions that help to reduce GHGs and achieve Ontario’s climate change goals.

As part of this draft Report Card, CUTRIC has focused on four preliminary indicators that can be quantified based on data available in the annual transit fact book in Ontario. They include:

1. CO₂e per passenger, per revenue vehicle kilometre,
2. CO₂e per passenger, per service area density,
3. CO₂e per vehicle, per revenue vehicle kilometre,
4. CO₂e per vehicle, per service area density.

In some cases, the result of calculating each indicator was a small number that is expressed in a scientific format. For instance, 0.0000002420 is shown as 2.42E⁻⁰⁷.

The reason to present the results in two different tables is to better compare transit agencies bases on their service area density and fleet size. For this purpose transit agencies are categorized into Small, Small-Medium, Medium-Large, and Large:
It has not been possible to calculate the GHG emissions footprints for all Ontario transit agencies due to the lack of sufficient data (highlighted in red). CUTRIC has calculated current Report Card scores based on the best available aggregate information for transit agencies as of September 2017.

Table 4: Preliminary Report Card Sorted by Service Area Density

<table>
<thead>
<tr>
<th>Transit Agency (Very Small)</th>
<th>Service Area Density</th>
<th>Tonne of CO₂e per passenger per revenue vehicle kilometre</th>
<th>Relative Score</th>
<th>Tonne of CO₂e per passenger per service area density unit</th>
<th>Relative Score</th>
<th>Tonne of CO₂e per vehicle per revenue vehicle kilometre</th>
<th>Relative Score</th>
<th>Tonne of CO₂e per vehicle per service area density unit</th>
<th>Relative Score</th>
</tr>
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<tbody>
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<td>2.42E-07</td>
<td>E</td>
<td>1.68E-03</td>
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<td>5.55E-04</td>
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<td>3.862</td>
<td>E</td>
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<td>E</td>
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<td>Tonne of CO$_2$e per passenger per service area density unit</td>
<td>Relative Score</td>
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<td>Tonne of CO$_2$e per vehicle per service area density unit</td>
<td>Relative Score</td>
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<td>Transit Agency (Large)</td>
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<td>Tonne of CO&lt;sub&gt;2&lt;/sub&gt;e per passenger per revenue vehicle kilometre</td>
<td>Relative Score</td>
<td>Tonne of CO&lt;sub&gt;2&lt;/sub&gt;e per passenger per service area density unit</td>
<td>Relative Score</td>
<td>Tonne of CO&lt;sub&gt;2&lt;/sub&gt;e per vehicle per revenue vehicle kilometre</td>
<td>Relative Score</td>
<td>Tonne of CO&lt;sub&gt;2&lt;/sub&gt;e per vehicle per service area density unit</td>
<td>Relative Score</td>
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### Table 4: Preliminary Report Card Sorted by Fleet Size

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<th>Number of Active Vehicles</th>
<th>Tonne of CO₂e per passenger per revenue vehicle kilometre</th>
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<th>Tonne of CO₂e per passenger per service area density unit</th>
<th>Relative Score</th>
<th>Tonne of CO₂e per vehicle per service area density unit</th>
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<td>Relative Score</td>
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<td>Relative Score</td>
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No information in the Fact Book about: (1) Energy Consumption, and (2) Number of Active Vehicles

Tonne of CO$_2$e per passenger per revenue vehicle kilometre | Tonne of CO$_2$e per passenger per service area density unit | Tonne of CO$_2$e per vehicle per revenue vehicle kilometre | Tonne of CO$_2$e per vehicle per service area density unit |
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OPTA-CUTRIC Consultation Sessions

CUTRIC and the Ontario Public Transit Association (OPTA) hosted the first in a series of consultation sessions dedicated to carbon pricing strategies implemented by the Government of Ontario. These sessions are intended to inform transit agencies about Ontario’s carbon pricing policies, while also eliciting solutions from the transit community itself with regards to the measurement and reporting of actual carbon intensiveness within Ontario’s transit network.

The OPTA-CUTRIC consultation process also identifies opportunities for transit systems to generate new revenues within the current (and future) Cap and Trade systems in this province, as well as new revenues or cost-savings that can be generated based on allied Ontario carbon pricing policies (as embodied within the province’s 2016 Climate Change Action Plan) and upcoming low-carbon fuel standards policies, which will shape transit technologies and services in the future.

Methodology

CUTRIC consultation sessions are framed according to a structured focus-group methodology. In each session, stakeholders/participants are grouped according to the following groups:

1. Transit agencies
2. Private industry stakeholders
3. Government stakeholders
4. Other

Each group is further sub-divided to ensure no more than eight individual participants per table. Each table is tasked with responding to the general thematic concept of “Opportunities”, “Challenges” and “Solutions” vis-à-vis a particular theme. The specific themes under analysis in the OPTA-CUTRIC consultation process include the following topics.

Session 1: Ontario Cap and Trade: Overview and diesel pricing
Session 2: Transit GHG Foot-Printing: Models and methodologies
Session 3: Ontario Cap and Trade: Transit revenue qualification
Session 4: Ontario Cap and Trade: Carbon offset opportunities
Session 5: Ontario Cap and Trade: Infrastructure and operation investments
OPTA-CUTRIC Consultation Outcomes: Session #1
Ontario Cap and Trade: Overview and Diesel Pricing

The following section outlines the results emanating from focus group discussions related to Session 1: Ontario Cap and Trade: overview and diesel pricing.

Opportunities

Consultation participants identified several opportunities for the utilization of funds produced from a C&T system in Ontario. These investment opportunities can reduce the risks associated with RD&D (research, development, and demonstration) projects deployed and integrated into transit systems.

1. Proactive advocacy from transit agencies can influence future C&T regulations, while providing mutually collaborative benefits to both the government and transit agencies.
   - Advocacy can influence policies that improve ridership metrics and remove single occupancy vehicles from the roadway.
   - Effective policies are required to incentivize commuters to take public transit, necessitating both economical fare rates and timely public transit systems.
   - Effective policies are required to incentivize transit agencies to shift their internal culture to choose to fund and integrate new low-carbon technologies over the next five years.

2. Stronger enforcement of current environmentally-driven policies, such as Toronto’s Idling Control By-Law, could impel transit agencies to adopted new technologies, such as “stop-start” systems (as developed within the automotive sector for petroleum vehicles) for bus technologies going forward. The adoption of new technologies does not, however, happen overnight within transit agencies, which tend to plan only a yearly basis depending on highly structured budgets. Therefore, the transit community needs an advocate that can demonstrate the need for a Green Technology or Transit Innovation Fund to support the adoption and integration of these technologies in trial form to ensure their optimization before full procurements occurs.

3. Revenues generated from the Ontario C&T system provide a clear opportunity for RD&D projects as well as potential retrofit projects.
   - General revenues created by the Ontario government from the C&T system can be – and should be – reinvested into projects that reduce GHG emissions, including general transit service improvements given the GHG reduction outcomes associated with higher transit ridership (regardless of the propulsion system application), as well as low-carbon propulsion system projects (such as electric bus and hydrogen fuel cell electric bus trials).
   - General revenues created by Cap and Trade can also be utilized for infrastructure upgrades, such as efficiency improvements in transit garages or solar photovoltaic panels on transit infrastructure (e.g. bus shelters). These projects will reduce GHG emissions from “transit” as an “energy system” overall, while providing an economic incentive due to energy bill reductions and fee avoidance through compliance with increasingly stringent emissions and pollution monitoring by the Ministry of Transportation and/or future C&T regulations that might integrate “transit” as a “mid” or “heavy emitter” in future years.
General revenues created by C&T should be allocated towards de-risking higher-than-normal low-carbon RD&D projects within transit. A fund – such as a “Transit Technology Innovation Fund” – ought to be generated annually from C&T revenues and invested into collaborative consortium-styled projects or individual transit agency carbon reduction projects to help reduce emissions. Such funding will avoid undue burdens and short-term challenges within the regular operational funding framework and budgetary structures among transit agencies today. Appropriate projects may include data optimization technologies, testing for reliability and efficiency of new low-carbon technologies (e.g. e-buses), alternative fuel technology demonstration, ridership improvement and "smart" or automated and/or "on demand" vehicle pilot projects, etc. Funding to help decrease risk will allow for expedited testing and easier adoption of new green technologies across Ontario’s transit agencies over the next five to 10 years.

Additional C&T related revenues might be created through innovative carbon offset projects, and the sale of allowances to carbon intensive industries. This is foreseeable if transit agencies were to integrate renewable energy sources with stationery energy storage tools (such as stationary batteries, flywheels or hydrogen storage) at garages and/or on routes, as well as fleets of mobile energy storage in the form of electric buses, connected through “smart grid” or “smart infrastructure” communications tools. These types of setups would render transit agencies “renewable energy producers”. Cap and Trade policy makers need to recognize this innovative possibility – and others – within the transit domain, which to date has not been a sector identified by the Government of Ontario as a location for advanced carbon reduction innovation.

Challenges
Consultation participants identified several challenges ahead associated with the C&T system itself, as well as the integration of low-carbon technologies meant to avoid the penalties associated with carbon pricing in fuel costs.

1. The inherent politicization of the Cap and Trade system raised some concerns and uncertainties for consultation participants. A frequently identified challenge was a lack of understanding of the industry-specific regulations. There is a need for improved educational efforts and clarity of information.

   o The decision criteria for allocation of C&T revenue is as-of-yet undetermined and is a source of concern regarding politically motivated investment decisions, rather than evidence-based investment decisions. Over the long-term, the uncertainty associated with fund allocations can result in delayed project initiations due to fears associated with inadequate financial resources and the avoidance of risks.

2. Regulations under the C&T regime do not distinguish between public and private sectors. This creates an unbalanced challenge for public transit entities. No supporting mechanism or accreditation has been created to incentivize transit agencies to increase ridership, because increasing ridership will consume more fossil fuels currently, which means transit agencies are penalized (through carbon pricing) for increasing their ridership, even though increased ridership decreases GHGs overall.

3. Current regulations are not supportive of higher risk technology integration, because the regulation prices carbon but does not guarantee investment into green technologies that reduce carbon (within transit, at least). This leads to the inadequate development of a
robust supply chain composed of manufacturers and suppliers that can serve the (near) future need for low-carbon technologies, i.e. new green vehicles.

4. The transportation industry itself faces challenges in adhering to the requirements of a C&T system. Business decisions are inherently risk averse with exacerbated risks of high capital, operating, and maintenance costs of fleet operations.
   - There is a perception that new technologies within the transportation industry are over-promised and under-delivered. Agencies are hesitant to take on high-risk and high-cost projects related to low carbon technologies, as a result.
   - Discussed risks are compounded for SMEs with limited resources and conflicting priorities. Smaller organizations, such as municipalities, are often not able to dedicate resources to innovative transportation projects due to these limitations.
   - Parties at the consultation do not believe there is a first mover advantage. As the C&T system evolves and revenues increase more funds will become available for project investment. Agencies will also have a better understanding of the type of projects that are successfully granted funds, providing a stronger incentive to hold off on projects until more funds and information become available.

5. Transit vehicles have long life spans and are unconducive to quick turnaround times in terms of technology revamping or integration. Depending on allowance allocations beyond 2020, the current C&T regulation may provide a very tight timeline for transit agencies to vastly improve the GHG efficiencies of their fleets and operations, and even less time for transit agencies to aggregate in order to offer the government new offset project options.
   - New technologies involve a learning curve for operating employees. Inadequate staffing of current technicians on staff – who will be expected to become competent with new low-emission technologies or advanced mobility/on-demand services in the future – will exacerbate the challenges already faced in addressing GHG reductions in the short-term.
   - The current limited demand for new technologies has limited the available supply of technologies nationally. This creates restrictions and monopolies within the current low-GHG/low-carbon technology supply chain, which increases both costs and timelines for transit procurements and integration efforts.

6. The additional costs associated with carbon pricing may result in fare increases in several communities, on the basis that municipal transit agencies in particular have no other budgetary options at hand to cut costs or find revenue elsewhere.

7. One of the largest difficulties surrounding the implementation of a C&T system is adequate education into the specific and complicated regulations. The Ontario government has yet to release carbon emission caps, allowances, and floor prices beyond 2020. This provides for a great deal of uncertainty for future planning, increasing an already high level of confusion within the transit industry. Ontarians in general have presented questions about how the C&T system will affect their daily commute and public transportation. The government is encouraged to better educate Ontarians overall regarding the C&T system and how it will influence their daily routines.
Solutions

1. Stakeholders indicated that governmental support is a necessary aid for the adoption of a C&T system. Stronger collaborative and communicative efforts are required between transit agencies and all levels of government.

   o More specifically, the need for stronger advocacy at the council level is recognized as a need going forward – transit agencies and advocacy groups (including OPTA and/or CUTRIC) need to present information to Councils regarding the nature and implications of C&T and the nature and implications of new low-carbon technology adoption. Education of municipal Councils is key.

   o Stakeholders have a desire for a standard to be set for C&T regulations vis-à-vis transit investments and revenue allocations to ensure the criteria do not change as different political parties come into power. Varying regulations would create uncertainty and hinder high risk project development and innovation efforts. A more assured and consistent funding regime will provide freedom for transit agencies to focus on GHG reduction initiatives without preventative economic concerns.

2. The creation of a specific Cap and Trade/Carbon Pricing Taskforce focused on “Technology Adoption” could expedite the development, testing, and uptake of relevant technologies. A specific mechanism for the funding of new technology adoption would also provide an assured project investment stream for transit agencies. The taskforce and mechanism should be created jointly by the government and transit agencies.

3. More thorough and widespread government-initiated educational outreach sessions should be created for both the public and private sectors, and especially at the municipal level. These sessions should provide clear outlines for the C&T system, as well as better methods for convincing Ontarians overall that green initiatives are valuable to the economy rather than simply a matter of obligatory compliance. An increased general understanding of green initiative will lead to a more proactive and innovative approach at the transit level within communities, rather than simply reactionary compliance-driven approaches.

4. The transit industry should create internal information gathering sessions with manufacturers and suppliers to generate knowledge about developing technologies that support emissions reductions. Organizations such as CUTRIC should take a leadership role in ensuring information of this nature is, indeed, shared regularly with transit agencies in Ontario.

5. Clearly demarcated funding is required to mitigate and manage the risks associated with pilot and integration projects related to low-carbon/GHG-reduction efforts. As well, additional funds are required to refurbish, rebuild, or modernize existing infrastructure.

   o Data analysis projects are crucial within this segment as well, although they are typically defined as “indirect” GHG reduction projects. Big Data analysis projects also require funding within transit, so that transit agencies can shift towards GHG reduction technologies based on empirical evidence rather than manufacturer promises.
Summary Comments

Consultation participants concluded that a Cap and Trade program in Ontario has the potential to provide revenue opportunities that will benefit research, innovation and development efforts in the transportation industry leading to target GHG reductions. However, there are still barriers standing in the way of opportunities. Uncertainty about the future and the politicization of the program has led consultation participants to be hesitant to adopt innovative and emission reducing solutions. Transit agencies require open communication, support, and acknowledgement from the government going forward in order to de-risk some of the innovative solutions being promoted by the industry and clarify the concerns surrounding the program.
OPTA-CUTRIC Consultation Outcomes: Session #2
Transit GHG Foot-Printing: Models and Methodologies

The following section outlines the results emanating from focus group discussions related to Session 2: Transit GHG foot-printing: models and methodologies.

This session sought to elicit solutions from the transit community regarding the data collection and analysis methodologies best-suited to determine how Ontario transit systems could best tackle greenhouse gas emissions (GHGs). The session also explored the degree to which a high-level “GHG Report Card” for transit systems – which would document GHG performance on a comparative system-by-system basis – would help in this effort.

Methodology

In each session, stakeholders/participants were grouped according to the following groups:

1. Transit agencies (large, medium, small)
2. Government stakeholders
3. Other

Each table is tasked with responding to the general thematic concept of “Opportunities”, “Challenges” and “Solutions” vis-à-vis the Session #2 theme of “Transit GHG Foot-printing: models and methodologies.”

Opportunities

Focus group participants identified several opportunities regarding GHG data collection, standardized GHG performance metrics (for comparative analysis across transit agencies), and the generation of a systematic province-wide “GHG Report Card” that could be annually updated to indicate carbon emissions intensity per system (per rider, per km of service, and per vehicle, for example), as well as real GHG reductions over time as transit systems grow ridership, transition to newer lower-carbon technologies, and optimize fleets services to deliver similar or more services with less energy.

Participants highlighted the following specific “opportunities” related to GHG monitoring within and among transit agencies.

1. A formal reporting methodology and score card will contain specific and relative measures that will allow transit agencies to easily spot inefficiencies within their systems, leading to better internal decision-making regarding GHG reduction plans for the future.

2. A more standardized reporting process will create consistent emissions reporting mechanisms across jurisdictions, leading to more accurate and fair performance comparisons across transit systems, including (for example) comparisons by route, per rider, per kilometre travelled (revenue and non-revenue kilometres) and by vehicle technology type.
   - Internal and external GHG auditing procedures will need to be developed and incorporated to ensure the accuracy of reported statistics.
   - GHG auditing processes will improve discrepancies due to non-standardized accounting measures, currently existent within transit statistics and as manifest in the MTO/CUTA Fact Book.

3. A robust GHG Report Card could be used as leverage when transit agencies lobby the provincial and/or federal government for funding for technology innovation or
infrastructure expansion in the future, by providing quantified GHG data to justify funding requests.

- A transit agency that receives positive or high-ranking scoring positioning (say, an “A” on an “A” to “F” scale) may be viewed as having taken proactive measures to reduce emissions by delivering optimized services, increasing ridership or by converting vehicle technologies. These proactive measures should be positively rewarded with funding to enable further successful transformations within the system and municipal or regional community.

- By comparison, a transit agency that receives a relatively negative or low-ranking scoring positioning (say, a “D” or “F” on an “A” to “F” scale) would be better positioned to analyze the challenges associated with GHG reduction efforts within its local community by being able to compare its GHG metrics to other transit agencies performing at a higher ranking level. For example, a low-ranking might not indicate a lack of agency-level desire to reduce emissions, so much as a lack of personnel to carry out complex projects, a lack of municipal political leadership welcoming of GHG-reducing initiatives in transit, a lack of ridership due to poor urban design choices that extend beyond the transit system’s control, or a lack of funding and financing to support optimization or technology solutions that would reduce emissions. Low-rankings or poor scores could serve as a catalyst for identifying the real blocks to emissions reductions within transit, and would therefore serve as a mechanism for targeting government funding from Cap and Trade revenues to the most effective counter-measures on a system-by-system basis (avoiding the “one size fits all” mentality that does not acknowledge municipal uniqueness or local political or design contexts).

4. A robust GHG Report Card could be used to insist upon the streamlining of land-use planning and transportation planning processes within municipalities. By reporting GHG metrics, transit agencies can lead the effort to bridge existing gaps that often exist between transportation planning and land use planning objectives.

- Publication of negative or poor GHG Report Card metrics could incentivize strong and swift actions by municipalities to improve metrics, thereby hastening efforts to improve transportation systems from a systems-level analytical position.

- GHG Report Cards would strengthen municipal-transit collaborative efforts to encourage proactive “transit oriented” planning in new communities or old communities that are being revived or rebuilt.

5. GHG Report Cards could and should encourage provincial governments to create funding portals specific to GHG reduction technology trials (i.e. innovation and commercialization trials in partnership with manufacturers) over the next five years to support large scale, robust, and fleet-wide clean technology integration, including electric and hydrogen fuel cell vehicle integration, “right sized” vehicle pods/shuttle integration, and “smart” systems technologies adoption, including semi-automated vehicles for optimized delivery of vehicle services.

6. The long lifecycles associated with transit vehicles is not conducive to quick turnover solutions; therefore, hoping for a swift transition to zero-emissions vehicles is not realistic in most systems unless funding for piloting, integration trials, and urban/energy planning studies is liberated. GHG Report Card data provides immediate and evident empirical data demonstrating the need (and funding requirements) for these types of trials and integration efforts.
It is important that GHG Report Cards are properly narrated and shared with municipal councils and public audiences. Transit agencies can take a lead in shaping the narrative to ensure the outcomes of GHG Report Cards can always be used as positive marketing pieces, rather than negative indications of environmental under-performance.

- Transit agencies can and should be leaders in promoting clean technologies and clean transit achievements more generally. GHG Report Cards could help to publicize the value of transit and drive forward ridership efforts, where transit is viewed as a core ally in municipal efforts to control and reduce GHGs over time.

- Negative results related GHG Report Cards can be used by transit agencies to help educate the public regarding the complexities and uniqueness of public transit fleets when compared to personal vehicles.

**Challenges**

Consultation participants identified several challenges expected in developing a robust reporting and scoring methodology that accurately captures diversity across regions of Ontario, presents results that allow for fair and accurate comparisons between transit systems, retains accuracy through auditing processes, and ensures a deep understanding of metrics within all transit systems such that GHG metrics can be practically and efficiently applied to decrease emissions across municipal “mobility” systems.

Participants highlighted the following specific “challenges” related to GHG monitoring within and among transit agencies.

1. Publically available GHG Report Cards may lead to a general misinterpretation of results, or unintended interpretations that view transit systems as highly polluting. These interpretations might be manipulated to contend that personal electric vehicle (EV) acquisition and use is superior for GHG reductions overall compared to carbon-based transit system – a belief that might lead to decreased ridership and degradations of the transit system energy efficiency, while negatively contributing to congestion, over time.

   - Malicious interpreters might conclude that GHG Report Cards demonstrate a need to reduce the size of transit agencies within some municipalities, i.e. if the agency is deemed to be “polluting” and energy inefficient overall.

   - Poor performance by a given transit system may lead to unproductive shaming of that system, especially if negative metrics are derived from inherent system inefficiencies within a given region (i.e. obligatory routes in low density areas with very low ridership). Results from the GHG Report Cards must be framed properly to ensure any given transit system is not unfairly shamed based on non-contextual interpretations of report card outcomes.

   - Ironically, well-performing transit systems may find it difficult to lobby for funding to support GHG-reduction projects, as the Province may choose to preferentially allocate funds to less efficient agencies to target the worst polluters. This outcome would stagnate progress among the most innovative transit systems, and it would stymie their ability to continue pursuing emissions efficiencies as leaders in their GHG Report Card system.

2. The breadth and complexity of data required to report and derive desired metrics is challenging and requires financial resources and personnel skills at transit agencies which might not be available in all circumstances. The large diversity amongst and between transit systems and regions across the Province must be reflected in chosen metrics of GHG intensity. Relevant variables in these cases include the size of fleet, the
topography of routes, general road conditions, population density overall, the age of fleet vehicles, fuel type used, typical congestion measures, etc.

- Standard data – or standardized reporting of these data – are difficult to obtain currently as differing regions and transit agencies cite statistics in variable ways, sometimes to the detriment (currently) of data accuracy and comparability.

- Standardizing the data collection process might require partnerships between OPTA, CUTRIC and CUTA going forward as there will need to be a clear division of responsibilities related to future GHG data collection, including the processing and transparency of the data collection processes.

- Data collection at the transit agency can be a timely and expensive endeavour; expectations and responsibilities must be carefully managed going forward (as part of this project and beyond) to ensure accurate, transparent and comparable data maintenance and upkeep.

- A robust and sound neutral auditing system must be established to provide unbiased third-party validation of reported GHG metrics at the transit agency level.

3. Personnel at transit agencies might mis-interpret the results of a GHG Report Card if they are not properly trained or integrated into the measurement process (and its intended outcomes) prior to publication of the results.

- Smaller agencies may be inadequately equipped with personnel capable of understanding and interpreting large and complex data sets, presenting a challenge at the local system level, and demonstrating the need for collaboration between large transit systems (such as the TTC) which can dedicate staff hours to these efforts, and small transit agencies, which likely cannot.

- Full and robust GHG Report Card data must arise (and be collected) at the vehicle level, rather than general fuel consumption aggregate figures and annual averages. Vehicle-level real-time GHG monitoring requires accurate and ubiquitous technologies, which not all systems can afford today.

- The introduction of on-demand services will compound the complexity associated with aggregating and comparing transit system GHG metrics by introducing new tracking and data collection requirements for non-bus, non-train, non-streetcar vehicles (such as pods, shuttles, and cars used as “shared” mobility devices).

4. Publication of GHG Report Cards may induce parochial competition between transit agencies in Ontario, which would have negative consequences for the provincial transit industry overall. For example, operational decisions may be made to improve reporting scores but result in decreased service offering or degraded quality of service for transit customers in low-density communities. Systems with high density may compete for scarce dollars with systems in low-density areas, by being able to demonstrate high GHG Report Card rankings.

- Knowledge-sharing and collaborative efforts are pertinent to ensure that reported metrics are productive, rather than a burden and waste of time resulting in an effort and labour expenditure that does not accurately inform future plans.

- The transit industry as a whole must work together to develop and interpret GHG Report Card “grades” prior to and following their publication. Transit systems with lower scores should use the opportunity to learn from agencies that are performing well; conversely, systems with high scores should be willing to play a
mentorship role and share knowledge with systems that are struggling to demonstrate system-wide efficiencies.

5. The reaction of municipal councils to the release of GHG Report Cards is uncertain. Municipal councillors might not accept the notion that allocating resources to produce GHG Report Card which may negatively reflect upon their community is a laudable choice to make without first understanding the funding implications associated with the scores and rankings.

Solutions

Consultation participants identified several solutions that correspond the challenges identified above regarding the nature, breadth and standardization associated with GHG data within the transit industry.

Participants highlighted the following specific “solutions” related to GHG monitoring within and among transit agencies.

1. Municipal politicians require educational support so they may fully understand the necessity of transit and transportation investments into GHG-reducing transit plans and technology projects. Municipal politicians require help in understanding the value of the triple bottom line through infrastructure upgrades, improved systems efficiencies, reduced GHG emissions, and advanced technology integration in support of low-carbon “smart” mobility.
   - A sound business case needs to be created to justify allocating resources towards generation of report cards and the broader value that investments in transportation systems emission reductions projects will have within a region.
   - Imminent integration of on-demand smart mobility will displace people out of transit and into higher numbers of single-occupancy vehicles causing increased congestion. Early investments in smart technologies can work in favour of public transit systems by offering complimentary services to improve system efficiencies and convenience (i.e. first-mile last-mile solutions).

2. The GHG Report Card methodology ultimately adopted should undergo rigorous review and multiple iterations by industry experts and peers to ensure sound logic, consistency, practicality, and feasibility of the final Reported.
   - All transit agencies should be encouraged to attend methodological development and consultation sessions (run by OPTA and CUTRIC) so that considerations across all Ontario regions can be integrated into the process.
   - The inclusion of all transit agencies provincially will lead to the development of a robust and ubiquitous system that can be applied by any transit system across the Province.
   - Internal and external auditing requirements need to be established to certify accurate data collection and reporting methods continue to exist beyond the life of the current project.
   - The methodologies established should be proactive regarding future technologies such as electrified vehicles/buses, autonomous and connected vehicles, and shared mobility services to ensure these new technologies can be smoothly added into the reporting model in the future.
3. Transit systems need to equip themselves with adequate personnel and expertise to capture, synthesize, analyze and report required metrics, as determined by participants in the current OPTA-CUTRIC project.
   - Outside expertise may need to be hired to fill knowledge gaps within certain systems. Collaborative efforts between transit agencies might also serve to fill these knowledge gaps and could lead to new skills acquisition for existing personnel.

**Supplementary Query 1:** Should municipal councils be obligated to create an Emissions Reduction Strategy (or Climate Change Action Plan) before GHG Report Cards are published?

Focus groups responded as follows.

1. **YES,** municipalities should be obligated to create Emissions Reduction Strategies prior to the publication of the GHG Report Card.
   - An established plan will create consistency within an ever-changing political landscape, thereby securing long-term political buy-in that supports low-carbon and advanced technology adoption regardless of municipal or provincial election outcomes in any given year.
   - A Council-approved obligatory Emissions Reduction Strategy should have some required elements that are consistent across all jurisdictions, while still allowing for customization of other elements based on specific municipal needs. One such required “common” element should be the inclusion of a transportation-specific sub-section created in collaboration with the local transit system.

2. **NO,** municipalities should not be obligated to create Emissions Reduction Strategies prior to the publication of the GHG Report Card. Alternatively, municipal councils should utilize the report card as an incentive to create an Emissions Reduction Strategy. Transit systems could use the report cards to incent municipal councils to create an Emissions Reduction Strategy that addresses public transportation emission reductions as alluded to within reporting scores.
   - Some municipalities have emissions reduction strategies in place already that **do not include transit,** but which focus instead on non-transit fleet vehicles within the municipality. Obligating an Emissions Reduction Strategy does not necessarily provide benefit to public transit systems.
   - Small- and medium-sized municipalities may require a “how-to” guide or a framework to follow in advance of creating their own Emissions Reduction Strategy. Larger municipalities could play a meaningful and robust mentorship role with smaller municipalities to help reduce the costs associated with hiring an external consultant to create such plans, which are frequently large, complex and nuanced in nature.
   - There is uncertainty as to which entity would issue an obligatory directive for municipalities to create Emissions Reduction Strategies in any case.
   - There is a lack of clarity as to which jurisdiction (provincial or municipal) or which municipal department would control assets associated with an Emissions Reduction Strategy; therefore, a municipal plan of action in this regard may not be effective in actuality if the municipality does not actually control resources to effectuate it.
Supplementary Query 2: Should the private sector be granted access to the methodologies and processes underpinning the GHG Report Card project between OPTA and CUTRIC? If yes, then to what extent should access be granted throughout the process?

Focus groups responded as follows.

1. **[Private sector stakeholders]**
   
   **YES**, the private sector should be granted access to the methodologies and processes.
   
   - The private sector requires a dynamic understanding of priorities within the transportation industry to develop relevant products and solutions within the marketplace.
   
   - Excluding the private sector would eliminate the ability of private enterprise to inject its expertise and knowledge in the process, thereby removing a potentially advantageous stakeholder that could aid in navigating the complexities of GHG reporting in general.
   
   - A caveat associated with private sector involvement in this project might be an expression by private stakeholders of the joint understanding of the sensitivities associated with the data collection process at hand, and a firm agreement to not use methodologies and data against transit agencies by exploiting areas of weakness.

2. **[Transit system stakeholders]**
   
   **NO**, immediate access to the methodologies and processes should not be granted to the private sector.
   
   - Interim sessions associated with the methodological generation, refinement and final vetting of the GHG Report Card should follow a staged approach whereby private sector interests are only granted access once general metric and methodologies have been established and agreed to by participating transit agencies, based on a full assessment of the nature of data to be collected and the implications of that data collection and publication.
   
   - The private sector should not be granted access to upcoming CUTRIC-OPTA consultation sessions until transit agencies become sufficiently comfortable with the data being obtained and derived.
   
   - Transit agencies must develop an internal confidence in the process to accurately defend weaknesses within a given system before private interests are able to view those weaknesses.
   
   - The private sector could be granted access once suitable comfort levels have been achieved within the methodological processes among transit agencies.
   
   - The involvement of private sector interests should be guided by the interests of the transit and transportation sector.
   
   - Two different final reports should be generated - one for internal sharing with transit and transportation agencies invested in the process (i.e. participants), and one for private and general public audiences. The private sector should only receive access to a high-level descriptions of methodologies while transportation agencies would receive an in-depth methodological depiction of all calculations,
including challenging assumptions or data realities that would need to be identified within the data collection and assessment process.

Supplementary Query 3: Should Metrolinx play a leadership role in the development of a GHG Report Card methodology for municipal transit agencies?

Focus groups responded as follows.

1. Metrolinx does not currently possess the operational experience or the personnel and expertise required to lead the generation of GHG Report Cards for municipal transit agencies. Theoretically, Metrolinx could be a governing body for such a project, but it lacks the required skills at this time. A culture shift is needed within the organization before it possesses suitable expertise to lead this initiative.
   - Metrolinx does not speak for the municipal transit industry per se.
   - Metrolinx does not touch all municipal transit systems across Ontario, as this does not fall within their mandate, which creates gaps in their ability to create a methodology robust enough to represent all systems across the Province.

2. GO Transit could and should participate as a transit provider given its superior operational experience.
   - There is a greater degree of comfort in working with GO Transit and the Toronto Transit Commission (TTC) – as major system operators – as future leaders in GHG Report Card management since they provide services similar to those that transit system participants in this project must deliver on a daily basis.

Summary Comments

Consultation participants concluded the collection and reportage of transit systems GHG emissions can create several important benefits. Those benefits include the creation of a standardized and comparable data set for fair and accurate GHG emissions comparisons. The GHG Report Card could be leveraged as a tool in lobby efforts tied to funding opportunities.

Challenges were identified with relation to the perception of data, unintended consequences resulting from uncontextualized data interpretations by municipal councils and news media, potential funding competition between and amongst transit agencies, and misguided attempts to lower emission numbers (i.e. through reduction of services) without addressing the root problem of energy inefficiency in a system.

Solutions to these challenges include the careful dissemination and in-depth education of political colleagues at the municipal level, and the generation of standardized emissions data sets that will allow for positive outcomes associated with GHG Report Cards – specifically, the generation of new funding opportunities from Cap and Trade revenues in the future for projects dedicated to the lowering of GHG emissions in transit.
OPTA-CUTRIC Consultation Outcomes: Session #3
Ontario Cap and Trade: Transit Revenue Qualification

The following section outlines the results from focus group discussions related to Session 3: Ontario Cap and Trade: Transit revenue qualification.

Methodology

In each session, stakeholders/participants were grouped according to the following groups:

1. Transit agencies (large, medium, small)
2. Government stakeholders
3. Other

Each table is tasked with responding to the general thematic concepts of “Opportunities”, “Challenges” and “Solutions” vis-à-vis the theme for Session #3, namely “Ontario Cap and Trade: Transit revenue qualification”.

Consultation participants were queried for their opinions on how Ontario Cap and Trade generated funds should be allocated to transit projects, including the percentage of funds that should be reserved for transit projects. The consultation outputs below are intended to serve as recommendations to the Minister of the Environment and Climate Change (MOECC) and the Minister of Transportation (MTO) going forward.

Query 1: Assuming Cap and Trade revenues generated approximately $500M in new revenues per market auction (i.e. approximately $2 billion in new revenues per annum), what portion of those direct funds should be dedicated to “Municipal Transit” (not Metrolinx services) in the pursuit of GHG emissions reduction technologies and services development?

Consultation participants were asked to identify a baseline percentage of funds that should be allocated to transit-specific GHG-reduction projects from Cap and Trade revenues. This assessment process includes considerations of future declines in gas tax revenues that will result from electrification and reduced individual passenger car usage in the future.

1. Potentially, a baseline of 10 per cent of Cap and Trade funds could be dedicated to municipal transit agencies per annum given the relevance of transit to wider sectors of the economy, including job growth and economic development, urban design and density, and climate action.

2. Municipal transit agencies should potentially qualify for up to 20 per cent or more of Cap and Trade funds per annum, given that investments in public transit projects not only reduce direct GHG emissions from transit vehicles, but also increase ridership, improve social quality of life in communities, remove GHG-emitting personal vehicles, and serve health benefits to cities.

3. Potentially, a portion of Cap and Trade funds could be dedicated to transit projects on the basis of the industry’s contribution to GHG emissions, though this might underrepresent the cost and needs for transitioning to cleaner technologies.

4. In sum, the GHG reductions combined with economic productivity, job growth, health outcomes, achieved through improved public transit systems should be accounted for when allocating funds, but funds should be allocated to municipal transit agencies from Cap and Trade revenues in some manner going forward.
Transit system projects are incredibly expensive; price assessments for proposed projects need to include both the cost of acquiring new vehicles, as well as necessary infrastructure upgrades to support new vehicular technologies (i.e. charging stations for electric buses), and new maintenance services.

Supplementary Query 1: Identify the justification for pre-determined and dedicated transit funding.

Participants were asked to provide justifications for transit agencies to receive pre-determined and dedicated Cap and Trade funding.

1. A primary justification for dedicated transit funding from Cap and Trade revenues is the two-fold emission reductions that transit creates. The switch to cleaner propulsion systems for transit systems directly reduces GHG emissions and improves air quality, while the expansion and optimization of transit services in general (diesel-based or otherwise) drive up density, reduce passenger car travel and reduce congestion (and unproductive, energy intensive mobility options prominent today). One dollar of Cap and Trade investment into transit has a multiplier effect in GHG reductions across the municipal and provincial economy.

2. Transit vehicles are expensive throughout their entire lifecycle, including high upfront costs, ongoing maintenance costs, and long lifespans of vehicles. Transit agencies do not have the ability to increase revenues or generate funds to purchase new and more efficient vehicles without financial assistance.
   - New Cap and Trade funding could be used to acquire new transit vehicles.
   - Additional funding above and beyond that would require its own justification based on the nature of the project and the amount of funds requested.
   - A transparent methodology could be established to determine which projects boast the highest GHG reduction merit and highest return on investments per unit of GHG reduced.

3. Funds should not be delivered as a baseline handout value to each transit agency regardless of innovation intention. Rather, funds should be allocated based on an innovation needs basis determined by the nature and justification of each individual project proposed.

4. A “mobile billboard” could be created for the advertisement of cleaner mobility systems on public transit vehicles, which would help government raise awareness that transit agencies are improving the sustainability of their operations and providing better services due to carbon pricing in the form of the Cap and Trade system. This creates an educational opportunity for government over the long-term, which is relevant given the poor social comprehension of Cap and Trade program.

Supplementary Query 2: Identify a typical project that would be funded from transit dedicated revenues.

Participants were asked to provide an example of a typical “Cap and Trade” fundable project that could serve the mandate and goals associated with climate action policies in Ontario. Projects exemplars included the following possibilities:

1. Renewable energy sources and energy storage system installations to reduce and mitigate energy demands by transit facilities and operations (e.g. garages, depots, bus shelters, etc.).
2. Renewable natural gas (RNG) is a cleaner fuel alternative to gasoline, but RNG technologies are relatively new and still require pilot projects to test functionality and feasibility. A series of RNG / CNG (compressed natural gas) vehicle applications for transit services, especially highway-based routes, would provide GHG reduction opportunities for transit buses.

3. Signal prioritization software development projects and technology integration can radically improve transit services, including on-time scheduling, passenger satisfaction, and fuel reduction from optimized drive cycles. The integration of these types of software solutions today cost approximately $500,000 – $2M, which is outside of the budget of most transit agencies.

4. Scaling up existing GHG-reduction projects-in-the-pipeline would constitute low-hanging fruit for GHG reductions. For example, The CUTRIC Pan-Canadian Electric Bus Demonstration and Integration Trial (Phase I) could be enlarged into Phase II and Phase III to achieve more than 100 electric buses in service within the next three years. This would require Cap and Trade investment to achieve, but – beneficially – the technical planning and economic analysis work that is a prerequisite for these projects is already underway, and these projects are “ready to launch” or “nearly ready to launch”.

Supplementary Query 3: Would an expanded MOECC-managed “Municipal Green Fund” be appropriate for the types of projects identified above? If not, which ministry should manage these funds?

Participants agreed that one ministry must take the lead on transit innovation. Challengingly, the Ministry of Transportation has not yet taken this lead on municipal transit agency leadership; rather, “innovation” tends to rest with the Ministry of Economic Development & Growth (MEDG), which has no mandate to support transit-based innovation. The disconnect between MEDG and MTO on “innovation” specifically, combined with external advocacy by the Ministry of Environment and Climate Change (MOECC) on GHG-reduction initiatives, complicates the situation from a transit perspective. No one ministry owns this file, and transit has not been properly advocated for from within government circles as Cap and Trade initiatives have unfolded over the past 12 months.

Given its history in leading and managing transit agencies, participants generally agreed the responsibility for disseminating GHG-reducing innovation funds to transit agencies in the future (based on project assessments) should be led by the Ministry of Transportation (MTO), but to be able to play this role the MTO must grow its innovation capacities – capacities that it currently does not possess in the transit innovation sphere. One way to do this, which may create long-term benefits for transit innovation is to integrate “innovation teams” at MEDG into an MTO “transit innovation” assessment team.

Participants were concerned the MTO is not in a position to transform itself rapidly enough to adopt an innovation culture that effectively shapes the integration of today’s cutting edge GHG-reducing technologies across Ontario communities – large, medium and small. For example, the MTO today does not have a team dedicated to high-risk technology innovation in transit, but “innovation” that is “disruptive” is necessarily higher risk compared to products and services that are traditionally procured.

Supplementary Query 4: What type of technical competencies or skilled personnel would the lead ministry require to accurately approve projects and delegate funds?

Consultation participants cited concerns that personnel within the MTO, MEDG and MOECC do not possess the technical expertise required to accurately assess transit innovation projects or
compile metrics of relevance for submitted projects. Some competencies the MTO must work to integrate into its operations going forward include:

1. A multi-ministerial task force (composed of Transportation, Economic Development & Growth, Energy and Environment) that develops acumen and skill vis-à-vis the technological hurdles, costs, and integration risks facing large systems, medium sized systems, and small systems in Ontario as they approach advanced technological capabilities.

2. This task force would need to integrate public servants with technical, engineering, economic and energy analysis competencies to perform accurate, fair and comprehensive project funding assessments.

3. Small transit agencies do not have the resources or personnel to maintain ongoing government relations with multiple ministries. It is of particular importance for smaller agencies to have one overarching ministry to work that possesses or serves as a portal to the required in-house transit expertise.

Query 2: Assuming carbon offsets are awarded to projects that demonstrate GHG reductions (projects that would not likely have occurred without associated carbon pricing schemes), to what extent do opportunities exist for generating new revenues through carbon offset projects for, among, and by Ontario transit?

To address opportunities within the Ontario Cap and Trade scheme post-2020, participants were asked to brainstorm potential practical carbon offset projects that could – in aggregate form across several transit agencies – provide carbon credits to agencies.

Supplementary Query 1: Identify the top two real estate opportunities for GHG reductions (i.e. rooftop solar panels, wind mill installations, energy storage systems, etc.).

Transit agencies possess minimal real estate assets. Assets are limited to municipally-owned garages, primarily. A carbon offset project that involves solar panel installations at these facilities would not provide any direct benefit or carbon offset monetary value to transit systems on an individual basis; such projects would, instead, benefit the municipality which may or may not choose to filter funds into transit (as opposed to other competing municipal needs).

Transit agencies could still leverage these facilities to generate potential carbon offset credits on the basis that in generating “green” energy, transit benefits from concomitant revenue generation through the carbon credit marketplace.

1. Solar photovoltaic (PV) systems installed on rooftops of transit shelters and stops with complimentary energy storage systems could serve as carbon offsets if aggregated across an entire transit fleet or multiple transit agencies:
   - Bus stop terminals in some smaller transit agencies
   - Bus shelters
   - Roofing overtop of commuter parking lots at transit stations
Supplementary Query 2: Would it be plausible for transit agencies to partner with one another to aggregate GHG reductions as a singular carbon offset?

Participants acknowledged aggregating carbon credits across transit agencies in Ontario would be possible but challenging to achieve in practice. Such aggregation would require in-depth coordination between transit agencies and municipalities and clearly structured revenue dispersal mechanisms.

Municipalities would need to be involved in project funding allocation decisions as a result because they are inseparably involved in transit agency affairs.

Municipalities also possess other assets that would need to be considered when aggregating outside of their jurisdiction.

Supplementary Query 3: Identify the top two challenges for capitalizing and monetizing carbon offset opportunities (i.e. political, architectural, personnel/technical, etc.).

Challenges for capitalizing and monetizing carbon offset opportunities include high upfront capital costs, lack of technical knowledge, lack of GHG modelling data for variously proposed projects (such as transit shelter solar electrification), and local political challenges emanating from municipal councilors that still do not value or foresee the need to address climate change action through transit innovation.

1. The initial investment costs for building new infrastructure and/or upgrading the strength of old infrastructure to support additions may prove to be too great, even if there is a willingness from transit agencies and municipal councilors to move forward.
   - Financial struggles are exacerbated in smaller communities where the necessary funds may not be available in any form.
   - A potential solution could be the creation of zero-interest financing for carbon offset projects.
   - Even if financial resources are acquired, GHG reduction benefits of major construction projects must be compared against high costs and service interruptions. Large-scale carbon offset projects may simply not provide a net benefit when all components are considered and taken into account.

2. Technical knowledge is required to quantify the GHG emission reductions associated with potential projects.
   - Municipal councilors and smaller transit agencies often lack personnel with a deep understanding of GHG emissions and Cap and Trade regimes.
   - In order to quantify GHG reductions, a benchmark profile will need to be calculated to determine current system emissions - a task likely requiring outside technical capabilities (such as CUTRIC’s consortium research skills).

3. Small systems do not own their own property. Therefore, they possess little authority to implement change outside of lobbying councilors regarding the general importance of these projects. And given municipal ownership of most properties that could serve as sites of carbon offset installations, carbon offset benefits may end up filtering back into the general municipal budget and bypass the transit agency altogether, thereby disincentivizing the timely and laborious lobbying efforts required to create the projects in the first instance.
Supplementary Query 4: What type of support would transit agencies need on staff to help plan, design, and launch these types of offset projects?

Necessary collaboration with municipalities requires consideration of municipal timelines, including planning around election cycles and understanding the multi-staged approach to councilors outreach efforts.

1. Participants cited that CUTRIC could be used to help create a template to send out to councilors of different jurisdictions explaining the objectives, scope, and importance of transit carbon offset projects within each municipality. CUTRIC could also be asked to lobby to councilors on behalf of transit agencies.

2. Transit agencies may not have the internal expertise required to devise a technical proposal for council, rendering the need for outside personnel to help disseminate the technicalities of project proposals and development.

Conclusion

The importance of public transit systems cannot not be overstated, yet public transit has been underrepresented both in ministry priorities and funding. Transit needs to be recognized as a long-term priority for its ability to decrease the use of personal vehicles, thereby decreasing congestion, reducing GHG emissions, improving commuter transit efficiency, and providing many secondary widespread benefits.

The Province of Ontario needs to integrate transit innovation into its future Cap and Trade planning processes by upgrading available capital and operation funding for new technologies, as well as investing in R&D and pilot projects capable of moving transit business forward in the low carbon economy.

It must be understood that transit innovations and upgrades will come at a steep price point in the short-term.

Transit agencies are not financially equipped to fund projects on their own and require ongoing and strong support from municipalities. Funding that is granted to municipalities with transit agendas in mind must be specified as such to avoid a miscommunication where the province assumes transit has received funding, but council has invested these funds elsewhere.

The timelines for funding and realistic project development goals must coincide; determining realistic project timelines will require the consultation of transit systems and manufacturers of goods involved in the project.
OPTA-CUTRIC Consultation Outcomes: Session #4
Ontario Cap and Trade: Funding Requests & Revenue Opportunities

The following section outlines the results from focus group discussions related to Session 4: Ontario Cap and Trade: Funding Requests & Revenue Opportunities.

Methodology

In each session, stakeholders/participants were grouped according to the following groups:

1. Transit agencies (large, medium, small)
2. Government stakeholders
3. Other

Each table is tasked with responding to two questions.

Consultation participants were queried for their opinion on how to achieve Provincial support for the allocation of revenues from Ontario’s Cap and Trade scheme for transit applications. Support from Municipal councils on this initiative is pertinent to success, and participants were further queried about the best processes for achieving Municipal and Regional support in advance of lobbying for Provincial support. The report outcomes and funding requests should be integrated into OPTA’s Pre-Budget Submissions, with a deadline of January 2018 for OPTA approval. The consultation outputs below are intended to serve as recommendations to the Ministry of the Environment and Climate Change (MOECC), Ministry of Transportation (MTO) and Ministry of Energy going forward.

Query 1: What are the mechanisms for reporting to municipal councils with regards to the emissions report card for Ontario transit systems? Are any formal council approvals or resolutions required for this process?

Consultation participants were asked for recommendations regarding the mechanisms by which OPTA (i.e. OPTA Members) and CUTRIC ought to communicate the outcomes of the GHG emissions report card produced by virtue of this study, and also the mechanisms by which they ought to lobby for provincial Cap & Trade funding dedicated to transit-oriented innovation that supports GHG reductions, as judged from a municipal and/or regional perspective.

1. Transit agencies should designate an OPTA-CUTRIC representative that will speak on behalf of their organization with regards to the GHG emissions report card and subsequent Cap and Trade funding requests for transit innovation.

   o This representative should be a General Manager, Director, or Commissioner of the transit system, as these individuals would receive information first and have the authority to make decisions best suited for their individual organizations. The representative could help to pave the pathway forward for governance engagement within the municipality or region in question.

   o The representative would be responsible for determining the levels of municipal and/or regional engagement required for each transit organization involved in the study and/or in the Cap and Trade lobbying process; the representative would also be responsible for helping to determine whether a formal council resolution is required prior to funding requests.

2. A preliminary meeting between CUTRIC research staff, OPTA executives, and transit representatives (as noted above) who are designated to represent their transit agency in
subsequent communications matters related to the GHG report card and Cap and Trade funding efforts is needed to establish a framework for understanding the nature of the CUTRIC-OPTA GHG report card findings prior to formal municipal and/or regional outreach efforts commencing.

- This meeting could establish a pathway forward for communications of the GHG report card outcomes for OPTA Members in general.

3. Transit representatives will likely determine that the level of municipal engagement required to inform and educate municipal councilors and/or city staff will vary on a municipality basis. Some municipalities will require education and outreach to sub-committees of council or departmental teams ahead of Council presentations.

- OPTA/CUTRIC’s communication of the outcomes of the GHG emissions report card for Ontario transit agencies, as well as the request for provincial funding from Cap and Trade revenues, will need to generate municipal “buy in” at an early stage.

- The intended outcome of municipal outreach efforts should be to receive approval for provincial Cap and Trade funding requests for the transit community and to ensure that municipalities are enabled, rather than hindered, by virtue of this funding process.

- Requests for provincial funding from Cap and Trade revenues for transit applications specifically would likely need to originate from within municipalities rather than from transit agencies directly; at a minimum, such requests will likely require a partnership between the entities to ensure coordinated messaging and community buy-in.

- Councils may provide additional leverage and pressure to help liberate funding provincially, compared to transit agencies acting and lobbying alone at the provincial level.

- Council approval, if not explicitly required, should be avoided to not waste time approaching each individual municipality.

- In general, outreach efforts should be targeted toward municipal councilors or individuals within the municipality who are leaders in (or at least knowledgeable of) local sustainability initiatives.

- Municipal support will be of increased relevance within “champion” communities which wish to make their transit systems an example of what can be achieved in emissions reductions; therefore, municipalities with existing GHG emissions reductions targets or Sustainability Plans would be ideal candidates for initial outreach efforts as the outcomes of the GHG emissions report card produced by virtue of this study could be used to demonstrate actionable steps in the pursuit of local emissions reduction targets.

4. The extent of regional outreach requirements varies between regions, as well. Some regions may only require an awareness of the OPTA processes at play, i.e. if there is no tie between the transit system and the region (e.g. as is the case with Milton Transit). By comparison, other regions may require multiple levels of committee outreach to support internal reporting needs, e.g. Transit Executive Committees, Municipal Committees, and/or Regional Councils (e.g. Durham Region).

- In some cases, regional councilors may sit on city councils, and they may be able to relay messages discussed at the municipal level to the regional level without
any additional outreach or educational efforts on the part of the transit system required.

5. CUTRIC-OPTA could formulate a template for a Council resolution that would provide appropriate language for any Council seeking to vote in favour of supporting provincial lobby efforts to obtain Cap and Trade funding for “Green Transit and New Mobility” funds.

Query 2: Assuming municipalities approve resolutions to support the outcomes of the GHG emissions report card and Cap and Trade funding requests (provincially), what are the most appropriate outreach efforts OPTA Members envision regarding the Ministry of Transportation, Ministry of the Environment and Climate Change, and Ministry of Energy?

Consultation participants were asked to provide their opinions as to the most effective processes possible to help initiate outreach efforts with ministers and bureaucrats, where such outreach efforts could include OPTA and CUTRIC executives exclusively, or a multitude of transit agency representatives, and where such outreach efforts could occur over a series of individual meetings with ministers, or via a single symposium with ministry staff, etc.

1. Direct contact with Members of Provincial Parliament (MPPs) and Ministers has demonstrated value in expediting the process of funding approval and project awareness in the past.
   - Provincial MPPs and Ministers should be targeted directly for education and outreach purposes so they receive adequate introductions and overviews of the GHG report card methodology, outcomes and allied funding requests. This type of targeted outreach will help streamline funding requests made to the Ministry of Finance, as part of Budget 2018 or Budget 2019.
   - Federal MPs have shown an active interest in the goals and objectives of transit agencies at CATA Transit Awareness Days. It may be of benefit to copy this process at the provincial level with the intention of achieving meaningful educational outreach regarding the needs and intentions of transit systems, large and small, across Ontario. OPTA-CUTRIC Transit Awareness Day could be arranged at Queens Park in advance of the 2018 Ontario budget submission in Q1 2018 to influence MPPs to include transit innovation funding from Cap and Trade revenues within the Budget. The timeline of such an event may be logistically challenging, but is exemplary of the scale of outreach efforts required.
   - Appealing to MPPs and electoral candidates on the critical importance of transit within local constituencies as part of pre-electoral processes may be equally important, given the uncertainty of upcoming electoral outcomes.

2. The timing the provincial lobbying efforts is critical; the fact an Ontario general election is scheduled for Q2 2018 means that short-term lobbying efforts at political ministerial as well as bureaucratic departmental levels is required to achieve long-term goals, which extend past the term of the current government.

3. OPTA-CUTRIC should leverage advocacy pathways developed with complementary groups, such as the Big City Mayors’ Caucus or the Association of Municipalities of Ontario (AMO).
Relevant personnel within municipalities should be targeted, such as Municipal Chief Resiliency Officers in Toronto, and other similar sustainability positions existent within most municipalities.

Community energy planning representatives should also be targeted, as they provide crucial systems-level planning support that enables long-term fuel switching and transit-energy systems planning efforts; this may include municipal utility representatives that could offer collaborative support to accommodate increased electricity requirements on the grid from electrification, for example.

4. Objective and targets outlined in the Climate Change Action Plan could be used as leverage points to pressure the government to follow through on commitments to low-carbon transportation already made in 2016.

OPTA-CUTRIC, and transit agency representatives, could form a task force composed of three to five individuals who take on the championship job of lobbying Assistant Deputy Ministers across relevant ministries in Ontario on a consistent and strategic basis over the course of 2018 to achieve Cap and Trade funding for a “Green Transit & New Mobility Fund”.
Works Cited


