

AT WHAT COST?

**Asking the right questions about how to
finance climate change action in Canada**

**Simon Liem, MCRP, Class of 2019
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School of Community and Regional Planning
University of British Columbia
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CAPSTONE SUMMARY

Climate change poses a dire threat to Canadian cities. Immediate action is required to adapt urban centres to weather regimes that are becoming more extreme and unpredictable. Planners and their municipalities must change their practices in this new reality, especially with regard to planning for infrastructure. This will require a large investment into adapting urban infrastructure for climate change. Unfortunately, municipal governments are ill-equipped to face this challenge. The fiscal tools available to municipal governments are not capable of meeting the responsibilities delegated to them.

This Capstone Project argues that this lack of fiscal capacity is a self-imposed political constraint that can be lifted at any time. Canada's federal government, as the issuer of the Canadian dollar, has a unique ability to create financial resources at its discretion. This fact supersedes arguments over which level of government has the necessary capacity to spend, because the federal government has a fundamentally different ability to spend than all other levels of government.

Canada also has a history of federal-municipal collaboration that continues to the present day, providing an institutional framework for directing federal resources to local governments. Proposals, such as the Green New Deal, offer paths to utilize federal spending powers and existing federal-municipal relationships to take the necessary steps to adapting Canadian cities to climate change.

The goal of this Capstone Project is to show that there are fewer barriers to financing climate change adaptation than commonly thought. If the observations made in this report are accepted it will lead to more fruitful work of building cities that meet the needs of its citizens in this changing climate.

INTRODUCTION

Climate change requires urgent action. Cities must be leaders in this action, as this is where most people will feel the effects of climate change. In Canada, there are many barriers to progress, but a lack of financial resources or institutional capacity is not one of them. The federal government is capable of creating the financial resources needed to address climate change adaptation, and it has a long history of collaborating with municipalities in projects for the national interest. This Capstone Project describes this ability and offers ways to utilize it for the purpose of climate change adaptation.

In the most recent Intergovernmental Panel on Climate Change (IPCC) report, *Global Warming of 1.5 °C*, the authors compare the consequences of a global temperature rise of 1.5 °C above pre-industrial levels to those of a rise of 2.0 °C. The climate-related risks of the increase to 2.0 °C are more severe in most cases, with a greater range of extreme temperatures, more frequent droughts, and higher sea-level rise, among other risks (IPCC, 2018). The report highlights the urgency of limiting the rise of the global temperature to 1.5 °C, an outcome that will still bring significant changes to the climate. In its call for action, the IPCC identifies cities as crucial for addressing the climate crisis, specifically as the “frontline of adaptation” and “key to developing and reinforcing measures for reducing weather- and climate-related risks” (Allen et al., 2018, pp. 70, 51). The authors stress that in adapting to climate change, municipal governments face such obstacles as a “lack of up-to-date and locally relevant information, lack of finance and technology, social values and attitudes, and institutional constraints” (Allen et al., 2018, p. 51).

In Canada, the ability of local governments to overcome some of these obstacles is in question. An analysis of 63 Canadian municipal climate change plans found that most municipalities appeared to be unprepared for adaptation. Despite an increasing awareness of climate change, the study found that the focus of plans was mostly on mitigation with little emphasis on adaptation. Furthermore, the authors wrote, “nearly all of the plans lacked specifics about processes and protocols to actually implement the plan in practice” (Guyadeen, Thistlethwaite, & Henstra, 2018). One of the paper’s authors remarked that “Cities are the most vulnerable government to climate change in Canada but have the least resources in order to manage the problem” (Weber, 2018).

The gap between the responsibility that Canadian municipalities are burdened with and the powers needed to manage this burden presents a major impediment to

the adaptation of Canadian cities for the changing climate. Creative solutions are required.

Some issues highlighted by the IPCC—deficiencies in quality information, appropriate technology, and social awareness—are serious impediments for addressing climate change. The lack of finance and the existence of institutional constraints, however, are not the barriers to progress in the way it is commonly believed, though the belief is arguably at the root of the other deficiencies cited. Canada’s federal government, like other governments that issue a sovereign floating-exchange rate currency, has the ability to mobilize resources without financial constraint (Becklumb & Frigon, 2015; Couture & Bélisle, 2015), and it has a history of involvement in municipal affairs (Andrew & Morrison, 2002; Sancton, 2006; Taylor & Bradford, 2015; Vojnovic, 2006). While the latter point is well-accepted in urban policy research, the former is a controversial contention that draws intense scrutiny (see Ambler, 2019).

This Capstone Project examines whether the lack of finance and presence of institutional constraints to create climate change infrastructure are significant barriers within the Canadian context. It argues that:

1. Local governments do not have the ability to address the urgency of adapting to climate change;
2. Canada’s federal government, as the issuer of Canadian dollars, has the ability to create the needed financial resources for local governments to adapt to climate change;
3. As the currency issuer, the federal government is the only level of government in Canada that has the ability to mobilize the resources required; and
4. Planners, focused on place-based public policy (Taylor & Bradford, 2015), are crucial in ensuring that federal-municipal collaboration creates the appropriate and equitable development of climate change adaptation measures.

This Capstone Project consists of four sections. The first presents some of the challenges that Canadian municipalities are, and will be facing, from climate change, including a review of how planners are addressing these challenges. The second section reviews the tools that local governments, being “creatures of the provinces” (Gore, 2010), have at their disposal to prepare themselves for climate change and the effectiveness of those tools. The third section outlines the role of the federal government and Bank of Canada in money creation, and how that role is inherently different from the role of other levels of government. And the fourth section presents recommendations on how the federal government’s fiscal ability can be utilized based upon historical precedent and programs currently in place. It is also necessary that any higher-level government intervention must be combined with community and regional planning principles to ensure a successful climate change adaptation program.

The framework for evaluating the federal government’s fiscal capacity is based on the work of a number of heterodox economists who have closely examined the mechanics of money creation (Bell, 2000; Fullwiler, 2006; Lavoie, 2011), as well as historical research on the subject (Desan, 2014). These economists have been tied to calls for a “Green New Deal” in the United States (Kelton, Bernal, & Carlock, 2018; Nersisyan & Wray, 2019), which

is an ambitious program to make the United States carbon neutral “through a fair and just transition for all communities and workers” (H. R. Con. Res. 1209, 116th Cong., 2019). The core argument of this group is that a government that issues its own floating-exchange rate currency is not financially limited in its ability to spend, and it is best suited for mobilizing the resources needed to prepare for climate change. This framework for evaluating how a government can provision resources cannot address other limitations, such as the availability of resources to purchase or the bio-physical constraints of employing those resources sustainably. Those questions are outside the scope of this project.

While there are many more questions to be answered, if the description of the fiscal ability of the federal government is correct, it shows that certain barriers to taking action on what is an existential threat to human civilization are actually political choices. Costs can be evaluated in more meaningful terms than budget deficits and debt, which are self-imposed constraints. The question of whether we can afford action can be answered in terms of the resources available, the real benefits to the public, and how those benefits are distributed. How to pay for climate change solutions has been recognized as an understudied topic of policy literature (Peterson, 2018). This Capstone Project attempts to contribute to the discussion of this issue.

1. PLANNING FOR CLIMATE CHANGE

Canadian cities are already feeling the effects of climate change. Climate research on Canada indicates that these effects are likely to become worse. There will be acute effects on how infrastructure is maintained and built in the future. Planners must adapt their practices to account for these changes. Unfortunately, it does not appear that planners or local governments are prepared for this challenge. This is likely related to the vast amount of money required for climate change adaptation and the lack of capacity of local governments to raise those funds.

Environment and Climate Change Canada (ECCC), the federal department overseeing national environmental issues, released the *Canada's Changing Climate Report* this year (Bush & Lemmen, 2019). The report details what Canada has experienced and what it can expect to experience with regard to the changing global climate. Climate change has caused Canada's average temperature to warm twice as much as the rest of the world and will continue to warm at twice the global rate. This is in part caused by the loss of sea ice and snow in the northern regions of Canada, which has reduced the reflectivity of the surface, thereby increasing the surface retention of thermal energy (Bush et al., 2018).

While Canada's entire geography will be affected by increased global temperatures, urban areas and population centres will feel particular effects, highlighting the necessity of adapting to a new climate regime. The ECCC expects extreme weather events will be more common in Canada in the coming years, increasing the frequency and intensity of extreme rainfalls, flooding, heatwaves and cold snaps, droughts, and wildfires (Zhang et al., 2019). All of these weather phenomena have significant impacts on how planners will approach land-use, transportation, and infrastructure management. This section outlines some of these challenges and how planners will have to meet them.

Flooding

One of the greatest climate stressors on infrastructure in Canada will be from flooding. The ECCC estimates that early-summer floods of 2013 in Southern Alberta caused \$6 billion in damage and displaced 100,000 people (Zhang et al., 2019). A number of factors, including heavy sustained rainfall and poor ground conditions, caused the Bow River to reach a 60-year high. The floods washed out 1,000 kilometres of road and destroyed numerous bridges and culverts (Teufel et al., 2017). Researchers found that human-induced climate change influenced some of the conditions that led to the

floods (Teufel et al., 2017; Zhang et al., 2019).

While determining the causes of individual weather events is a difficult task because of natural weather variability, the ECCC forecasts with high confidence that extreme precipitation events will increase, and with it the incidence of urban flooding (Bonsal, Peters, Seglenieks, Rivera, & Berg, 2019).

Montreal, Toronto, Winnipeg, and Thunder Bay are other major Canadian cities that have experienced severe flooding in the past fifteen years, causing billions of dollars in damages (Ayushi Gaur, Gaur, Yamazaki, & Simonovic, 2019). Gaur et al. (2019) performed an impact assessment on the 100 most populous cities in Canada and found that up to 50 percent of Canada's flow regulation infrastructure will experience increased flooding frequencies, with the prairies and northern regions of the country seeing the largest increases.

Adaptation to flooding related to storm surges and sea-level rise will also concern planners in Canada. For example, in the Atlantic region, wave heights and the length of wave seasons will grow as sea ice is reduced (Cohen et al., 2019). In a case study of the Halifax Regional Municipality, the Insurance Bureau of Canada (2015) found that a one-in-one-hundred-year storm surge occurring in 2040 would create an additional \$29 million in expected annual damages for a high climate-change scenario, compared to a baseline scenario with low climate-change impacts. The costs represent direct and secondary impacts to buildings, infrastructure, and effects on business.

Flooding damage is directly related to the success and failure of urban planning. The location of impermeable surfaces and design of stormwater management systems will influence the damage floods cause and how quickly areas can recover (Cohen et al., 2019).

Extreme temperatures

In addition to adapting to different precipitation patterns, infrastructure must cope with new ranges of

Table 1: Extreme weather events in Canada

Extreme weather event	Estimated cost	Effects
Ontario & Quebec windstorms, 2018	\$410 million	Downed trees and power lines Extensive road closures Three deaths
Fort McMurray wildfire, 2016	\$3.5 billion	Forced evacuation of city (~85,000 people) ~2,600 homes destroyed
Toronto flood, 2013	\$940 million	Transit and roadway closures 300,000 people without power Airport closures
Calgary flood, 2013	\$6 billion	100,000 people displaced Extensive road damage Bridge collapse
Toronto flood, 2005	\$500 million	Collapse of major arterial street Damage to gas and water mains Damage to communications infrastructure
Eastern Canada icestorms, 1998	\$5.4 billion	Destruction of roads, rail, and sewage networks 20 businesses destroyed Wide-spread power outages

Source: Insurance Bureau of Canada; Boyle, Cunningham, & Dekens, 2013.

temperature extremes. Most concrete and asphalt in Canada is designed to withstand temperatures ranging from -20 °C to 30 °C (Casello & Towns, 2017, p. 281). As the climate warms in Canada, the range of temperatures will be greater than what this infrastructure is designed to withstand. Roads will wear more quickly, increasing the need for maintenance and replacement (Casello & Towns, 2017). It is expected that elevated levels of carbon in the atmosphere, coupled with warmer temperatures and higher humidity, will cause earlier-than-expected deterioration of concrete structures (Hallegatte, 2009; Stewart, Wang, & Nguyen, 2012).

Extreme heats can have devastating human costs. The deadliness of heatwaves was dramatically demonstrated when more than 70,000 excess deaths were attributed to a summer heat spell in Europe in 2003 (Robine et al., 2008). The Quebec heatwave in 2010 is believed to have caused 280 excess deaths and a sharp increase in hospitalizations (Bustinza, Lebel, Gosselin, Bélanger, & Chebana, 2013). These deaths and hospitalizations are largely preventable if early warning systems are in place to ensure that action can be taken to protect the most vulnerable populations, which tend to be the elderly (Lowe et al., 2016).

Minimizing the deleterious effects of extreme heat can be done through design by reducing the prevalence of urban heat islands (UHIs)—the phenomenon of elevated temperatures in urban areas compared to rural ones. Surface materials, urban design, and ecological and geographical contexts can contribute to UHIs and negative health outcomes (Abhishek Gaur, Eichenbaum, & Simonovic, 2018; Gregory, Otero, Lebedeva, & Chan, 2009). An analysis of 20 Canadian cities found that 16 have experienced an increasing UHI effect, and the trend will

continue for more than half of the cities studied (Abhishek Gaur et al., 2018).

Planning that encourages adequate reflective surfaces, sufficient vegetation, and other interventions can help mitigate the negative effects of UHIs (Gregory et al., 2009; Senbel, Lesnikowski, & Liem, n.d.).

Flooding and extreme temperatures create most acute and costly effects on infrastructure (see Table 1), but the increased probability of droughts and wildfires, changes in food production, and the availability of freshwater will also change the practices of urban planning.

Planning Readiness

How prepared are local governments in Canada for the threats that climate change pose to urban areas? The Federation of Canadian Municipalities (FCM) Canadian Infrastructure Report Card (2016) contained troubling results. Eighty percent of surveyed municipalities had no formal mechanisms for incorporating climate change into decision making processes. Only 16 percent of municipalities had formal adaptation strategies for stormwater infrastructure assets, and 15 percent reported having climate change strategies for roads and bridges (FCM 2016, p. 14). Notably, Canadian municipalities are the owners of a majority of the nation's infrastructure (Mirza & Ali, 2017), which means large portions of municipal assets have no formal plans to adapt to climate change.

Most Canadian research on climate change planning has focused on British Columbia (Baynham & Stevens, 2014; Stevens & Senbel, 2012). Its provincial government passed legislation in 2006, which mandated that official community plans have policies and targets for reducing greenhouse gas emissions. British Columbia has made

promising steps forward in incorporating climate change into planning processes, but research has shown that there has been a lack of knowledge, rigour, and scope in the planning documents (Baynham & Stevens, 2014).

In the first nation-wide study, Guyadeen et al. (2018) reviewed 63 climate change plans from the most populous Canadian municipalities to evaluate the quality of the plans. The results were encouraging in some respects, as there were improvements in almost all aspects of the plans when comparing pre-2010 planning documents to more recent ones. Most plans addressed all of the characteristics associated with plan quality. The authors, however, found serious deficiencies, including a lack of focus on adaptation strategies, weakness on stakeholder engagement, and vagueness on the implementation and monitoring of plans.

The last aspect speaks to the subject of this Capstone Project, as “[e]ffective implementation is facilitated by allocating appropriate financial resources” (Guyadeen et al., 2018, p. 4). The neglect of finance has been seen in the other levels government and has made creating

robust adaptation strategies more difficult (Craft, Howlett, Crawford, & McNutt, 2013).

This lack of preparedness follows trends in other multi-level governance systems. In a study of cities in Australia, Canada, and the United States, Jones (2011) argues that climate change planning is driven more by economic and political benefits rather than forming practical solutions to climate change adaptation. Urban policy researchers have described Canada’s government institution’s lack of coordination and policy capacity with regard to climate change as “quite bleak” (Craft & Howlett, 2013, p. 3).

Considering the vast amount of financial resources required to address the regular maintenance of infrastructure, not including what will be required for adaptation, it is unsurprising that municipalities avoid identifying specific actions in planning documents when they are incapable of pursuing them. The mismatch between municipalities’ capacities and the tasks that they are burdened with will be discussed further in the next section.

2. GLOBAL BURDEN, MUNICIPAL CAPACITY

The responsibilities and powers of municipal governments in Canada are determined by provincial legislation. Municipalities are required to manage significant infrastructure assets with a tightly limited fiscal capacity. In the context of climate change, this has left municipal governments with the responsibility of addressing a global phenomenon within regional boundaries. This mismatch sets municipalities up for failure, as they are ill-equipped to mobilize the necessary resources to adapt Canada's urban areas to climate change.

Municipalities, or local governments, in Canada are often referred to as creatures of the provinces, as they have no constitutional rights (Gore, 2010; Siegel, 2002). Sections 91 and 92 of Canada's Constitution Act of 1867 set out the division of powers between the federal and provincial governments, respectively, with municipal issues falling under Section 92. The powers that a municipality exercises are contingent on provincial legislation, placing them in what Sancton calls a "legally inferior position" of governance (2006, p. 307). Given this status of Canadian municipalities, how well endowed are local governments of urban areas to address the climate change threats discussed in the previous section? The urban policy research reviewed in this section suggests that there are serious shortfalls, especially in the matter of fiscal capacity.

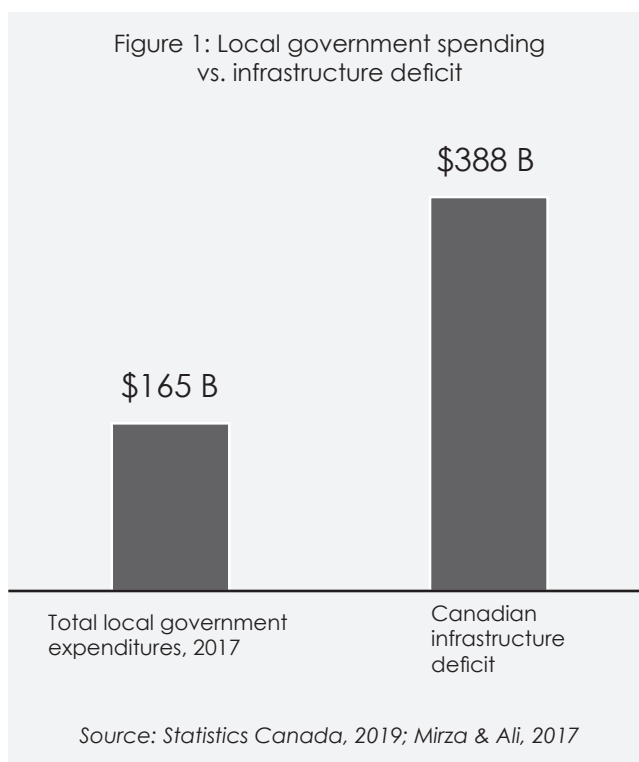
Municipal Responsibilities and Powers

With few exceptions, municipalities are required by provincial legislation to manage the roads, water and sewage systems, and land-use planning, among other responsibilities, within their boundaries (Sancton, 2006). Municipalities are bound by provincial and federal regulations related to matters within their jurisdictions, which do not necessarily come with direct support to enforce those regulations (Slack, 2006). This leaves important domains of public life that will be deeply affected by climate change under the responsibility of local governments (Craft et al., 2013).

With respect to infrastructure, local governments are charged with maintaining large amounts of capital assets, which takes significant resources. Spending on transportation and environmental infrastructure made up 73 percent of all capital expenditures in Ontario in 2014, with less than 20 percent of funding coming from other levels of government. The largest funding sources were from development charges and borrowing (Slack & Tassonyi, 2017, p. 27).

Overall, Canadian municipalities own nearly 57 percent of all infrastructure in the country (FCM 2016, p. 6), but only collect 8 percent of all tax revenues in Canada (Mirza & Ali, 2017, p. 542). Canada's infrastructure deficit, the difference between available funding for infrastructure and the estimated amount needed for its repair and maintenance, has been calculated as up to \$388 billion (Mirza & Ali, 2017). The total of all municipal expenditures, including operating and capital expenses, across Canada amounted to less than \$165 billion in 2017 (Statistics Canada, 2019) (See Figure 1). Local governments would have to increase expenditures by a significant amount to close the infrastructure deficit.

Figure 1: Local government spending vs. infrastructure deficit



The revenue raising options available to local governments to do this normally comprise property taxes, user fees, and grants from higher levels of government (Sancton, 2006). Cities are generally not allowed to run deficits for operating budgets, though they can issue debt for capital expenditures with the permission of the province. Siegel (2002) argues that grants from upper levels of governments exist in explicit recognition of the fact that municipalities' other revenue sources are insufficient for financing their assigned operations.

This system has resulted in relative fiscal conservatism for municipalities and a degradation of infrastructure across the country, with few governments raising property taxes or issuing debt to the degree needed to keep up with the maintenance of their capital assets (Mirza & Ali, 2017; Slack, 2006). Peterson (2018) writes that typical municipal financial tools are almost certainly inadequate for addressing climate change. The limited fiscal toolbox also constrains municipal decision making in other manners. Cities in need of increased revenues from property taxes can be pressured to intensify development for the sake of expanding its assessment base and not necessarily for good urban design (Siegel, 2002; Vojnovic, 2006). For climate change planning, this means municipalities often consider the goals for adaptation and mitigation in

service of the economic necessities (Jones, 2011).

This creates a conflict between what is expected of municipalities and what they are empowered to do. Taylor and Bradford argue that the constitutional status of Canadian municipalities has historically made them policy extensions of provincial governments, resulting in a "legacy of legal and fiscal dependence on upper-level governments" (Taylor & Bradford, 2015, p. 194). At times when cities are politically willing to address climate change, it can sometimes be thwarted by provincial priorities.

It is irrational to leave municipalities without significant support from higher-levels of government for the task of adapting to climate change, given that it is widely recognized that they are ill-equipped to handle the responsibilities already delegated to them. While some public policy analysts believe that it is rare for local, or even provincial, needs to intersect with the national interest (Boadway & Kitchen, 2019), the resiliency of cities, as population and economic centres, to climate change is clearly a national issue.

Considering the country-wide implications of this topic, it is natural that the federal government take a lead role in addressing it, not only for political reasons but also for technical reasons, which will be discussed in the following section.

3. FEDERAL FISCAL POWER

Questions regarding which level of government has the capacity to spend on public services are ill-conceived. Federal spending works in a fundamentally different manner than spending at other levels of government. The provinces' capacity to spend is limited by the amount of taxes it is able to raise and debt it is able to sell. Local governments operate within those same bounds as "creatures of the province." The federal government, as the issuer of the Canadian dollar, is instead limited by the availability of goods to purchase. Given the difference not only in capacity but ability, the federal government is best suited for provisioning public goods for climate change adaptation.

Legal scholarship over federal spending power is a subject of vigorous debate, as the issue is not explicitly addressed in Canada's constitution. Opponents of federal spending in provincial jurisdictions have called the practice a "direct contradiction to the intentions of Canada's founding fathers" (Kellock & LeRoy, 2007, p. 24), which were to establish a balance of governmental powers between the provinces and federal government. Peter Hogg, the author of the standard text for Canadian constitutional law, believes that the federal government "may spend or lend its funds to any government or institution or individual it chooses, for any purpose it chooses..." (Hogg, 2012, Chapter 6.8(a)).

While this discussion revolves mostly around the right of one government to spend money in another's jurisdiction, none of the literature reviewed examines the role of the federal government in money creation or its ownership of the central bank, the Bank of Canada. This distinction between a currency issuer (in this case, the federal government) and the currency users, which include provincial and municipal governments, is important to understanding why the federal government has a fundamentally different role in spending than other levels of government. This section of the Capstone reviews economic scholarship, with a focus on the school of modern monetary theory, on this subject and its implications for provisioning resources for the public purpose.

Money Creation and the Currency Issuer

The Library of Parliament published a paper entitled *How the Bank of Canada Creates Money for the Federal Government: Operational and Legal Aspects* (Becklumb & Frigon, 2015). The text illustrates the Bank of Canada's role in issuing federal debt. When the federal government borrows by issuing debt, it coordinates with Bank of Canada to decide how much will be purchased by the Bank at a non-competitive rate. The implications of how an actor, the Canadian government in this case, borrows its own currency from an entity it owns is important:

Figure 2: Federal money creation

Balance Sheet	Asset	Liability
Bank of Canada	New Government of Canada securities purchased	New deposit from the Government of Canada
Government of Canada	New deposit at the Bank of Canada	New Government of Canada securities issued

"This chart illustrates the impact on the balance sheets of the Bank of Canada and Government of Canada when the Government of Canada issues new securities and these are purchased directly by the Bank of Canada."

Source: Becklumb & Frigon, 2015.

"Since the Bank of Canada is a Crown corporation wholly owned by the federal government, the Bank's purchase of newly issued securities from the federal government can be considered an *internal transaction* [emphasis added]. By recording new and equal amounts on the asset and liability sides of its balance sheet, the Bank of Canada creates money through a few keystrokes. The federal government can spend the newly created bank deposits in the Canadian economy if it wishes" (Becklumb & Frigon, 2015, p. 2) (See Figure 2).

This transaction occurs independently of tax receipts or private actors' purchasing federal debt. The Bank of Canada, as the creditor, never needs to be paid back as it is the source of Canadian dollars and a Crown corporation owned and wholly controlled by the federal government. Two Bank of Canada analysts explain further: "The Bank is the only entity that can fully eliminate banker risk for Canadian-dollar transactions, since it can create Canadian-dollar liquidity *as required* [emphasis added] (and therefore can always meet its Canadian-dollar obligations) and cannot be declared bankrupt or insolvent" (Couture & Bélisle, 2015, p. 38).

This framework for understanding central bank operations and the fiscal sovereignty of currency issuers has regained prominence in recent decades. The school of macroeconomics known as modern monetary theory (MMT) has closely examined the mechanics of money creation. The scholarship has roots going back to the early 20th century (Bell, 2000), notably in a paper entitled "Taxes for Revenue are Obsolete," by a Chairman of the Federal Reserve Bank of New York (Ruml, 1946). MMT places emphasis on the creation of money and fiscal balances between the public and private sectors. MMT economists demonstrate that the debt of a sovereign currency issuer is the amount of money it has spent into the economy that it has yet to tax out of the economy. In terms of accounting identities, where one actor's liability is necessarily another actor's asset, all public debt is exactly balanced in private assets.

The matters of public debt and currency are under federal jurisdiction, as indicated by Section 91 of the Canadian constitution, which gives the federal government a relationship to taxing and spending distinct from that of a province's. Provincial and municipal governments, which have no legal ability to issue currency, must rely on taxes and other sources of revenue in order to spend. This limitation is similar to states in the United States, or members of the Euro, neither of which have control over the issuance of currency. For issuers of currency, the act of spending has no dependency on raising revenue through the private debt market or collecting taxes, as it has a monopoly on the creation of its own currency.¹

Desan (2014), in her legal history of money, details how taxes have been what drives the value to a currency in monetary societies. "Money" is invented when a community, acting through a stakeholder, denominates in a homogeneous way the disparate contributions received

from members, and recognizes them as a medium and mode of payment" (Desan, 2014, p. 24). When this "stakeholder" imposes a tax on its community members denominated in its own currency, and those members trust that the money will be accepted as payment for taxes, the money gains fiscal value for the exchange of goods and services among the community members. By creating money and paying for goods and services with that money before taxing it back, a stakeholder achieves the goal of mobilizing resources for whatever purpose it desires, whether that be raising an army or preparing for climate change. What is most important to emphasize is that, legally, the spending of money by the issuer of the currency must precede the taxing of that money.

For modern economies with floating exchange-rate currencies, such as Canada's, taxes serve additional functions, but they are not a "source of revenue" for the currency-issuing government, which is likewise for the issuance of public debt, as illustrated by Becklumb and Frigon (2015). How the federal government manages taxes and public debt has policy implications, mostly related to the management of central bank reserves (See Bell, 2000; and Fullwiler, 2006 for detailed discussions; and Lavoie, 2005 for the Canadian case), but taxing and debt are not inherent limitations on federal spending.

While this description of Canada's monetary system, which is applicable to most other economies with floating exchange-rate currencies, demonstrates that there is no financial restraint on public spending by the federal government, it does not mean that no restraints exist. If there is a lack of skilled labourers to perform work or a shortage of goods, no amount of government spending will create those resources. Overspending also comes with fears of creating inflation. Though in recent years with many central banks' setting interest rates near and below zero without significant inflation, it has become apparent that common theories of inflation have weak empirical bases (Fullwiler, 2006, p. 5; Tarullo, 2017).

The recognition of how federal spending operates in the real world reorients views of federal-provincial relations, because it reveals that there are fundamental differences not only in capacity for spending but also in ability. It also supports the view that the federal government is the government best suited for provisioning public goods. Fortunately, Canada has a history, sometimes checkered, of the federal government using its powers for such a purpose.

1 One of the early proponents of modern monetary theory in writing on the United States likened this process to a score keeper's distribution of points to players: "The federal government doesn't ever 'have' or 'not have' any dollars. It's just like the stadium, which doesn't 'have' or 'not have' a hoard of points to give out. When it comes to the dollar, our government, working through its Federal agencies, the Federal Reserve Bank and the U.S. Treasury Department, is the score keeper" (Mosler, 2010, p. 16).

4. FOLLOWING EXISTING PATHS

Several federal programs that direct money to municipalities for climate change action already exist. The availability of money for these programs is not in question. Because there is no causal relationship between the collection of taxes or issuance of debt and the ability of the federal government to spend, any lack of financial resources is ultimately a policy choice. Increasing the funding to existing programs could happen at the federal government's discretion. Advocacy for this approach to allocating financial resources will open possibilities for creating policies better suited to the urgency of addressing climate change.

The federal government's involvement with municipalities has waxed and waned over the past century, with mixed evaluations and fierce debate. The governing national parties periodically enter into partnerships with cities for the purpose of pursuing national goals, which may sometimes conflict with provincial ones. Provinces are often protective of their legislation and policies, of which municipalities are subject. Any perceived interference with them can create tension between the two levels of government (Dewing, Young, & Tolley, 2006). The recent announcement in 2019 by the national Liberal government for \$2.2 billion for municipal infrastructure was portrayed as an antagonistic move against conservative premiers, for example (Press, 2019).

Some have characterized these federal interventions into city affairs as a "history of failure" (Dewing et al., 2006), while others have attributed the degradation of public services to the withdrawal of the federal government from urban issues, sometimes described as the "downloading" of responsibilities (Sancton, 2006; Siegel, 2002; Taylor & Bradford, 2015).

Both sides of the argument tend to assume that this is a political battle between two relatively equal levels of government. Aside from jurisdictional issues, the question is often conceived as matter of which government has, and should have, the capacity to tax and spend. As the previous section demonstrated, this misses a fundamental difference between federal and provincial government, which is that not only are their differences in capacity but also differences in ability.

This section gives a brief overview of past and current federal-municipal ventures and argues that the needed institutional arrangements are already established for addressing climate change with federally driven fiscal policy. This policy, however, needs to be informed by place-based planning to ensure that any action is appropriate for the unique needs of different populations and geographies.

Canada's federal-municipal history

One of the most studied aspects of federal-municipal relations in Canada is in the realm of housing. In 1919, prime minister Robert Borden's Unionist Party invested \$25 million to support the construction of homes in an attempt to address the lack of affordable housing for veterans of World War I, which was Canada's first federal housing initiative. The government noted that housing was properly "within the jurisdiction of the provinces and municipalities," but the shortage of housing was seen as a national issue (Gordon, 1985, p. 33).

War again spurred the federal government into housing after World War II in 1946 with the founding of the Canada Mortgage and Housing Corporation (CMHC), a federal Crown corporation, and with amendments to the National Housing Act in 1949 (Dewing et al., 2006; Hulchanski, 2004). The CMHC's focus in its first decades was on providing favourable loans to stimulate construction and encourage home ownership. This was aided by federal-provincial partnerships, which saw the federal government contributing up to 75 percent of costs for the acquisition of land and creation of municipal services (Dewing et al., 2006).

This sporadic federal involvement was successful in subsidizing the real estate market and making homeownership obtainable for many Canadians. It also resulted in the dubious effects of "urban renewal," which created car dependence, displacement, and housing segregation.

In the 1990s, the federal government withdrew completely from housing issues, leaving a small legacy of successful public housing initiatives completed through the 1970s (Hulchanski, 2004). The withdrawal arguably birthed problems in homelessness, housing affordability, and household debt, which persist until today (Walks, 2015).

The creation of public infrastructure has also been an area of successful federal intervention into municipal jurisdictions, which has most often been justified as creating

economic stimulus (Craft et al., 2013; Siegel, 2002). The first of such programs was the Municipal Development and Loan program created in 1938, which focused on financing job creation through municipal infrastructure projects, such as sewage and water treatment facilities (Bojorquez, Champagne, & Vaillancourt, 2009). Another was the Municipal Development and Loan program in 1963. This program provided funding for the Toronto transit system to the amount of \$7.4 million in grants and \$22.1 million in subsidized loans (Frakena, 1982).

In the 1990s, the Federal Infrastructure Program directed billions of dollars to municipalities to build and upgrade infrastructure for the purpose of creating jobs. The funding was popular among the municipalities that took part but was ultimately short-lived, ending in 1998 (Mirza & Ali, 2017).

All of these programs have tended towards short lifespans. There have been few efforts in establishing a formal institutional framework to connect municipalities to the federal government. In 1971, the Trudeau government appointed a Minister of State for Urban Affairs, who was charged with coordinating policy between the federal government and municipalities. Cities gave strong support for the ministry, but a lack of funds and uncertainty of the constitutional-jurisdictional issues meant that the ministry was temporary. Provincial governments also refused to cooperate with federal initiatives, even rejecting funding in some cases (Dewing et al., 2006; Taylor & Bradford, 2015). The interest in municipal affairs of the 1970s receded with Brian Mulroney's Conservative government, which was less interested in inserting itself into provincial matters (Vojnovic, 2006).

The Liberal government of Paul Martin established a Ministry of State for Infrastructure and Communities in conjunction with the "New Deal for Cities and Communities" program in 2005, which sought to increase fiscal transfers to municipalities and create tri-level governmental partnerships to address urban issues (Craft et al., 2013; Taylor & Bradford, 2015). That prime minister Martin was responsible for the renewed focus highlights how political expediency drives these issues in Canada. He was the finance minister that made the decision to rid the federal government of any responsibility for social housing, essentially continuing Conservative Party policy from the previous government (Hulchanski, 2004). Martin's efforts for stronger federal-municipal relationships were likewise scaled back with Stephen Harper's government.

This history shows that the coordination of local and national policy is not as wicked a problem as it seems, but that the biggest obstacle to its success may be finding sustained political will. During the last debate over Canadian constitutional reforms, there were attempts to introduce more clarity over federal spending to ensure that it only be used for issues concerning national objectives (Hulchanski, 2004). Because the reforms were voted down, it is unknown what effect they would have had on intergovernmental relations. Formalizing such language,

however, would strengthen the argument that the effects of climate change felt by urban areas are of distinct national interest and require federal intervention.

Building on existing place-based policy

Since the early 2000s, a number of programs have existed for municipalities to access federal funding for issues that are seen as being in the national interest, some of which already provide a policy and institutional framework for financing climate change infrastructure. Taylor and Bradford's (2015) review of Canadian federal urban policy show that while these programs tend to be modest in scope, they have shown place-based policy backed by higher levels of government to be effective in a number of areas, such as infrastructure, immigration policy, and homelessness.

There have been recent direct federal-municipal partnerships with cities. In the early 2000s, a number of municipalities, alongside a host of local and provincial actors, entered into Urban Development Agreements with the Liberal government to address problems related to poverty. The policies that arose from the agreements were guided by a national framework that was flexible enough to suit the particular needs of the local governments (Bradford, 2005). The Vancouver Agreement received wide acclaim for its ingenuity in developing horizontal relationships between all levels of government and participating stakeholders. The agreement ended in 2005 with some success (Mason, 2007), though any lasting effects have been overshadowed by Vancouver's worsening overdose, homelessness, and housing crises.

The Urban Development Agreements required broad collaboration across three levels of government and myriad public institutions and non-governmental organizations. Community advisory boards, multi-stakeholder agreements, and intergovernmental intermediaries are some of the regular features that have helped coordinate broad national goals with the local actors who possess the intimate knowledge needed to make effective policy.

Today, there is a small movement back towards a national urban agenda. The Liberal government of Justin Trudeau is moving towards closer relationships with municipalities, creating a national housing policy and re-establishing the Ministry for Infrastructure of Communities. The ministry is responsible for Infrastructure Canada, the federal department charged with pursuing infrastructure policy in the national interest.

From 2002 to 2016, Infrastructure Canada contributed \$21 billion in grants for infrastructure (See Table 2) and \$23.5 billion in cost sharing. The largest source of financing, which amounted to \$18.8 billion, was given through the Gas Tax Fund (Slack & Tassonyi, 2017, p. 41). The Liberal Paul Martin government established the program as part of the New Deal for Cities and Communities, making it a permanent source of funding of \$2 billion per year for municipal infrastructure development. The program is a transfer payment, flowing through the provinces,

Table 2: Infrastructure Canada transfer programs 2002 - 2016

Program	Description	Approved (\$ millions)
Gas Tax Fund	Ongoing fund for municipal infrastructure providing \$2 billion annually indexed at 2% per year	\$18,770
Provincial-Territorial Base Fund	Up to 50% for provinces (75% for territories) to address core infrastructure priorities; used to build or renew infrastructure in most Building Canada Fund eligible priorities	\$2,301
Public Transit Fund (closed)	Funding allocated on a per capita basis	\$400
Total funding		\$21,471

Source: Slack & Tassonyi, 2017

that municipalities use for environmentally sustainable infrastructure. Unlike many other federal programs, the Gas Tax Fund has no requirement for contributions from other levels of government (Adams, 2012).

Another significant source of municipal infrastructure funding comes through the Federation of Canadian Municipalities (FCM). The FCM is a longstanding national advocacy group with more than 2,000 member municipalities. It partners with the federal government on a number of initiatives, including the Gas Tax Fund and the Green Municipal Fund (GMF). The GMF encourages innovative and sustainable approaches to brownfield development and transportation, energy, waste, and water systems. The FCM administers the fund, which is financed through federal grants. The GMF is considerably smaller than the Gas Tax Fund, providing \$756 million to municipalities from its establishment in 2000 to 2015 (Office of the Auditor General of Canada, 2016).

The federal government also supports municipal infrastructure through federal-provincial joint programs, such as the CleanBC Communities fund, which will provide up to \$63 million for green infrastructure projects in British Columbia. The federal government will contribute up to 40 percent of a project's costs with the requirement that contributions come from the province and recipient municipality. The program focuses primarily on greenhouse gas mitigation, with less emphasis on climate change adaptation (Province of British Columbia, 2018).

All of these programs have funded projects ranging from upgrading existing infrastructure, such as replacing thousands of street lights with high-efficiency light bulbs (Association of Municipalities Ontario, 2018), to creating innovative low-carbon power utilities, such as a district energy system that uses waste sewage heat to warm a neighbourhood (Lee, 2015). Many of these ventures require high upfront investments, which are not expected to yield the short-term economic benefits that local governments would need to justify the spending. Federal money allows municipalities take these risks that are otherwise unfeasible, given their limited revenue-raising abilities.

The policy and institutional framework for funding these climate change initiatives is already in place, or has been in recent history. Each of the programs have procedures and requirements according to the policy goal being sought. What is needed to focus these programs is a policy that marries what exists with an intensification of resources aimed at the explicit purpose of addressing climate change. This intensification can happen at any time at the federal government's discretion. While many of the current programs are described as being funded by certain taxes, no federal spending has a causal relationship to tax receipts or issuing debt, as the previous section detailed. Recognizing this aspect of federal finance will open possibilities to policy prescriptions that are better suited for the task at hand.

Green New Deal

Calls for a Global Green New Deal appeared in the wake of the 2008 global financial crisis. The fragility of the world's economy was revealed when the global finance sector needed to be propped up with government intervention into the banking system. The G20 countries would commit \$2.5 trillion towards recovery after the collapse. Some saw the crisis as an opportunity to reorder the world economy to better account for climate change. The United Nations Environment Programme began to support research into a Global Green New Deal, named for the programs of United States president Franklin D. Roosevelt, whose New Deal comprised a host of political reforms and public works projects after the great depression.

The Global Green New Deal was similarly aimed at building something new after the failure of the dominant economic system, which not only affected bankers but also brought on crises in food systems and energy supply. The proposal argued that any attempts to recover from the economic crisis had to also address the tasks of reducing carbon dependency, protecting ecosystems, and alleviating poverty. Without addressing those three issues, any recovery would be short-term and unsustainable, it was argued (Barbier, 2010).

The term Green New Deal has gained more attention since the release of the most recent IPCC report. Activism in the United States¹ has garnered much attention, but the United Kingdom and Canada have also adopted similar language. A number of groups in Canada have broad plans under the name Green New Deal (Saint-Arnaud, 2019). The Canadian proposals differ in details from other countries' plans but have similar goals in achieving a drastic cut in carbon emissions by 2030, which will become a 100 percent cut by 2050, in line with the IPCC recommendations. All of the proposals put emphasis on providing for an equitable transition to a carbon-free economy based in a social justice framework. In Canada, demands for recognition of indigenous peoples' self-determination play a significant role in all of the activism (Council of Canadians, 2019; Green New Deal Canada, n.d.; Our Time, n.d.; The Leap, n.d.).

None of the plans have estimates of what costs will be incurred in implementing a Green New Deal. The most detailed information on financing the transition is from the Council of Canadians, which focuses on modifying and reforming municipal taxing practices (Council of Canadians, 2019, p. 16). Because there are no rigorous estimates of what a transition to a carbon-free economy would be, it is difficult to evaluate the ability of tax reforms to redirect resources to the effort. Given that the current infrastructure deficit is more than double all annual municipal expenditures, as discussed above, this method will most likely need significant support from other levels of government.

In the United States, where the advocacy is most active, there has been more scrutiny of the potential costs of a Green New Deal. A conservative think tank estimated the costs of a 10-year program to be upwards of \$94 trillion dollars, which is more than four times the United States gross domestic product (Holtz-Eakin, Bosch, Gitis, Goldbeck, & Rossetti, 2019).

Nersisyan and Wray (2019), two MMT economists, have attempted a more nuanced approach to understanding the costs of transitioning to a carbon-free economy in their *How to Pay for the Green New Deal?*, which takes the framework created by John Maynard Keynes in his treatise *How to Pay for the War?* Keynes did not attempt to estimate how much money would be needed to finance World War II, instead the amount of resources needed for the task. War-making often incurs significant public-spending, large-deficits, and quick reorientations of a national economy. Similar to Keynes, Nersisyan and Wray argue that the question should not be viewed as one of financial affordability, "Rather, the problem will be inflation if sufficient resources cannot be diverted to the [Green New Deal]" (2019, p. 1).

This approach accounts for the costs and savings from redirecting resources from one part of the economy to another. If the rise in expenditures on one good matches the drop in expenditures on another, this represents a net change of zero to economic activity. As an example, a large component of the United States' Green New Deal is a

transition from the country's notoriously expensive private health care system to a universal public system. Most proposals for this transition estimate overall savings, with a significant portion coming from lower administrative costs. This may mean that government expenditures will rise but the savings in private expenditures will create a net reduction in total spending. Some of those savings represent salaries of administrative workers who would be left without employment if a universal healthcare system were implemented. That is money that will not be spent in the economy, which may actually have a deflationary effect (Nersisyan & Wray, 2019, pp. 24–31).

A similar effect may occur from scaling back the fossil fuel industry in Canada, which could be offset by higher public investment in green energy production. At a national scale, examining capacities in terms of how resources—whether it be labour, technology, or raw materials—will be employed and released, will give a better answer to the feasibility of implementing a Green New Deal. Obviously, it may well be the case that there will be a shortage of resources for the task. Nersisyan and Wray, like Keynes, believe in such cases that taxes, induced savings programs, and other measures could defer private economic activity in a manner that could ensure a sustainable provision of resources for the transition.

Nersisyan and Wray model negligible inflation effects to the economy based on relatively high estimates of the costs of the transition. Ultimately, the approach is a macroeconomic one, which cannot account for how different localities differ in resource capacity. The approach, however, paves the way for local planners to take up these tasks with less pressure on financial implementation than necessary.

Public-Private Pitfalls

Thus far, this Capstone Project has focused on the public finance of climate change action. This policy must be driven by federal fiscal authority, because municipal and provincial governments' ability to spend is bound by tax receipts and debt markets in ways that the federal government's ability is not.

The current Liberal government has, however, shown reluctance at fully backing publicly owned and led infrastructure development. It has pushed a common alternative to public initiatives—public-private partnerships.

The Canada Infrastructure Bank was one of the government's major initiatives, which was designed to attract "private investment to help more infrastructure projects get built" (Sohi, 2017). As shown in the section on federal money creation, the premise that the federal government needs private investment is mistaken. Further, private actors must structure their investments around financial returns, which will often be in opposition to goals related to climate change actions.

As an example, the City of Vancouver attempted to engage with a local energy provider to convert a natural gas-powered utility to a low-carbon fuel source. A publicly-funded study commissioned by the private utility revealed

that the conversion was financially feasible, that is to say that the utility would remain profitable. The company, however, ultimately refused to proceed with the conversion. While profitability would have been maintained, the return on investment with the low-carbon fuel source was not high enough to justify the investment. The City of Vancouver's policy goal was thwarted because the utility was unwilling to deviate from its profit motive to obtain a better climate-

change outcome. The utility remains the largest single emitter of greenhouse gases in Vancouver today (Liem, n.d.).

Pursuing such public-private partnerships agreements is likely to be wrought with such failures, because the partnerships must be subordinate to the private actors' financial goals and market factors before the public goal. This approach also neglects useable tools that are already available to governments seeking to prepare for climate change.

CONCLUSION

The first section of this Capstone Project reviewed some of the challenges that Canadian cities are facing from climate change, and evaluated the preparedness of municipalities to meet those challenges, revealing serious shortcomings. The second section demonstrated that the fiscal tools granted to municipalities are likely insufficient for mobilizing the needed resources to adapt to climate change. The third section outlined the process of money creation in Canada, and the federal government's role in the process, arguing that the federal government is the only institution in Canada with the ability to adequately provision the needed resources for the task at hand. And the fourth section demonstrated that there is a historical precedent for this type of action and that existing programs could be adapted to utilize the federal authority over money creation.

The goal of this Capstone Project was to address the most recent IPCC report's statement on how the lack of finance and presence of institutional constraints for cities is an impediment to climate change adaptation, and to show that these are not inherent problems within Canada. The obstacle of finding the money to pay for climate change actions is largely a self-imposed one. If resources are available to use, the federal government, as the issuer of the Canadian dollar, always has the money to pay for them. And Canada has an established institutional framework that could support a robust climate change adaptation program.

Reasserting the role of the federal government in the provision of public goods through its financial tools represents a challenge to orthodoxy about who should pay for infrastructure, and it is replete with political obstacles, the most obvious being that provinces wish to retain power over what is constitutionally their own. Arguments over jurisdiction, however, will continue even with recognition of the federal government's role as the currency issuer. Re-examining funding sources will not necessarily challenge jurisdictional arrangements, as the existing federal funding

programs exist without significant conflict. The necessity for a change of perspective should not be enough reason to avoid the pursuit of the recommendations here.

The closer federal-municipal relationship suggested in this Capstone will also raise questions about responsible infrastructure policy. Public policy scholars generally hold that accountability for decision-making is strongest when the government building the infrastructure is the same one responsible for raising the revenue (Boadway & Kitchen, 2019; Slack & Tassonyi, 2017). A lifting of fiscal restraints could spur hasty decisions over what to build and how much. This view, however, is rarely spoken of in the context of climate change and environmental sustainability, which present a set of arguably more objective restraints. Rather than first asking "How will we pay for it?" local planners will need to question whether plans meet the needs of a city and its most vulnerable populations. Are the necessary labour and physical resources to adapt to climate change even available? And can cities achieve a just and sustainable transition to a carbon neutral economy? Even with an expanded view of fiscal capacity, the answers to these questions are uncertain and bring with them other types of accountability.

Perhaps the only benefit to the urgency of climate change is that as the situation becomes more dire, radical solutions will become more politically viable. This Capstone Project has given some direction to how this may happen through already existing programs and institutional arrangements.

The real barrier to climate change adaptation is one of a moribund political consciousness, which MMT economists offer advice to overcome: "Once we understand that money is a legal and social tool, no longer beholden to the false scarcity of the gold standard, we can focus on what matters most: the best use of natural and human resources to meet current social needs and to sustainably increase our productive capacity to improve living standards for future generations" (Kelton et al., 2018).

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**Simon Liem, MCRP, Class of 2019
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University of British Columbia
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