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LETTER FROM THE EDITORS

Dear Readers,

On behalf of the School of Policy Studies at Queen's University, it is our pleasure to present the 11th volume of the Queen's Policy Review.

When our team began working on this publication in September 2019, we did so in the midst of an election season where climate change weighed heavily on the minds of Canadian voters. We determined that producing a journal on the existential threat of climate change was a timely choice, given the grave danger our world faces. We sought to publish essays that offered substantive contributions to environmental policy.

However, in 2020, few things have gone according to plan. Seemingly overnight, the global pandemic transformed our daily lives, and the policy landscape along with it. In light of an overwhelmingly and largely grim historical moment, Canadians proved that through collective action we can fight COVID-19. The spirit of sacrifice that has fueled our response to the pandemic is a key factor to halting climate change.

In response to the pandemic, nations begun spending heavily on public health initiatives and economic recovery. Therefore, it was unsurprising to see that some nations have temporarily diverted funds away from climate resilience and renewable energy projects. Increased use of personal protective equipment such as masks, gloves, and plexiglass dividers as well as plastic food packaging coupled with improper disposal practices have resulted in an increase in pandemic related waste.

LETTER FROM THE EDITORS

The fight against COVID-19 can teach us all a great deal about resisting climate change. Over the last ten months, we have shown that we have the will, resilience and camaraderie to pull through a global crisis. For the most part, we adapted to the requirements of the so-called "new normal" with marked improvements in achieving our goals.

It is important for Canada, and the international community, to continue to invest in climate resilience infrastructure as part of economic stimulus packages and maintain commitments to net-zero emissions. Pandemic relief policies and programs can and should be designed to make Canadian communities better at facing the impacts of climate change and the stresses it brings. It is also incumbent upon us to reflect on our individual environmental and ecological practices, and work collaboratively with one another to continue to battle climate change.

The articles published in this issue discuss a range of topics surrounding climate change, each covering a unique policy challenge facing Canada and the world at large.

We are very grateful to the contributing authors for their time, effort, and patience throughout the editorial process. We hope you, our readers, enjoy reading this year's edition of the Queen's Policy Review.

Stay informed, stay involved, and stay safe.

Sincerely,
QPR 2019-20 Editorial Team

THE IMPORTANCE OF COORDINATION AND MONITORING TO SUPPORT ENVIRONMENTAL POLICY AND SUSTAINABLE LIVING: TORONTO FLOODS CASE STUDY

BY: MISHA KHORRAMSHAHI

Environmental challenges caused by either natural or unnatural disasters are undeniably of significant concern to the public. However, because these disasters, and the repercussions of the challenges they pose, are rarely felt in daily life, it is difficult for the public to prioritize sustainable living. Thus, many Canadians are only made aware of environmental challenges when they encounter disastrous environmental events. Toronto's history of flooding presents a noteworthy example to examine the challenges faced in coordinating and monitoring the support of environmental policy and sustainable living. This paper will discuss Toronto's history of devastating floods and offer conclusions on sustainable living and the barriers faced in monitoring and coordination.

Hurricane Hazel, October 1954

Since the 1950s, the City of Toronto has experienced five major floods. The flood of 1954 was a direct result of the aftermath of Hurricane Hazel. It caused more than 80 deaths and rendered 7,472 people homeless. Approximately 121 mm of rain fell in 12 hours, totaling up to 210 mm over a two-day period. The flooding was particularly severe in low lying areas of the Don and Humber Rivers, as well as the Etobicoke and Mimico Creeks. It caused unprecedented levels of infrastructural damage, with 20 bridges being destroyed or damaged beyond repair and full blocks of homes being swept away (Bonnell & Fortin, 2009). After the flood, the Ontario government established Conservation Authorities under the provincial *Conservation Authorities Act* (The Ontario Ministry of Environment, 2011) to monitor streamflow, issue warnings, and advise governments on ways to minimize flooding in addition to other flood management programs (Welsh, 2019).

The flood of 1976 lasted two days and was the result of 75 mm of rain from two large storms. It caused over 1.3 million dollars in damage (Bonnell & Fortin, 2009). Moreover, the August 19, 2005 flood recorded 153 mm of rain over 3 hours, which at the time, was only preceded by Hurricane Hazel in 1954 (Bonnell & Fortin, 2009). This flood caused $500 million in insured damage. The flood of 2013 received over 120 mm of rain, while the monthly average for Toronto was sitting at 74.4 mm (Armenakis & Nirupama, 2014). This flood was the most expensive natural disaster in Ontario's history. It incurred $940 million in damages, which were a direct cause of the severe urban flooding that was reported across the city (Mann & Wolfe, 2016). The power outages affected about 300,000 residents. Serious disruptions included flight cancellations, subway service delays, and other transportation closures, including the closure of the main train station of the city, Union Station (Bonnell & Fortin, 2009). Most public transit was unavailable until the next day, leaving 1,400 people stranded for hours on public transit because of flooded roadways, train tracks, and subway lines (Mann & Wolfe, 2016). The flood of 2018 received 72 mm of rain over Toronto, with 51 mm falling in just one hour. The

storm cost Toronto more than $80 million in insured damages (Insurance Bureau of Canada, 2018).

There are numerous factors that contribute to Toronto's well-documented flooding history. Firstly, there are many roads and rails crossing the Don River in Toronto, the low-lying nature of the infrastructure make them vulnerable to flooding, including high volume floods. Moreover, the non-confining structure of the Don Valley, which is wide but insufficiently deep, leaves the structure susceptible to overflows. Additionally, the City's decaying infrastructure and storm management systems are unable to withstand the intensity of today's storms. Such storms are exacerbated by climate change, as rising temperatures can add moisture to the air, increasing the odds of intense rainfall in certain locations (Welsh, 2019). Many of Toronto's natural creeks are also submerged in sewer pipes, which have led to a loss of natural waterways leading to Lake Ontario. This has contributed to rivers and creeks overflowing onto streets during periods of heavy rainfall. Further, the number of pipes that carry raw human sewage and stormwater are insufficient for Toronto's expanding population. (Welsh, 2019). Finally, issues involving debris, ice jams, and sedimentation also contribute to the flooding issue in Toronto.

In addition to various structural issues that have caused the floods, there is also evidence which suggests that the floods are driven by climate change and other forms of "human influence". Toronto's continued urbanization has led to a dramatic increase of hard surfaces such as concrete pavements. Because absorbent areas like forests, fields and wetlands have been paved over, excess water now feeds into Lake Ontario. Moreover, data suggests that the average temperature in Toronto has increased 1 to 1.5 degrees over the last 30 years. This data is supported by Kent Moore, a professor of physics at the University of Toronto. He suggests that snow-melting rains are the most obvious example of this phenomenon. Compared to the Toronto winters of 40 years ago, Moore claims that there are now an extra 10 days when temperatures creep above zero and that rainfall is "consistent with the view that as we warm the planet, we intensify the hydrological cycle or the rainfall cycle" (Welsh, 2019). Canada's mean annual temperatures are now double the global warming rate. This has increased by 1.7 degrees between 1948 and 2016, with higher temperatures in the north than the south, particularly in the winter. Scientists agree that Canadians can expect more wildfires, droughts, and floods as a result (Bush & Lemmen, 2019).

Sandbags keep water from flooding the land more as the Toronto Islands are threatened by rising water levels in Toronto (The Canadian Press/Nathan Denette)

While losses associated with flooding and other natural hazards in Ontario are lower than those experienced in other jurisdictions due to Ontario's prevention-first approach (Ontario Newsroom, 2019), flood-related water damage is replacing fire as the leading cause of insurance claims. In addition, flood related losses are increasing nearly every year (Hamilton, 2016). There is large flood loss potential within the Greater Toronto Area (GTA) due to its large population and development density as well as the high market values of the properties in the region. The economic loss for a modeled 200-year scenario flood for the GTA is projected at $6.4 billion and the insured loss is estimated at $2.5 billion (Green Communities Canada, 2017). Additionally, it is projected that it will cost between $14 million and $16 million to protect the Toronto Islands against future flooding (Kopun, 2019). The financial implications of protecting Ontario shorelines is overwhelming. Given the above information, it is disheartening to

learn that the Ontario government has reduced the budget for conservation authorities by 50 percent (Jones, 2019). Fortunately, the federal government has compensated for this budget cut by allocating $150 million for flood mitigation projects (CBC News, 2019).

Enacting policies to respond to climate change is critically important, however, there are many challenges associated with implementation and transitioning to a more environmentally sustainable society. First, there is an economic barrier that perceives environmental policies as double-pronged initiatives (Giddings at al., 2002). This refers to the historic trend in which some politicians tend to favour environmentally friendly policies only if they contribute to economic growth, not necessarily because the policy in question is the best policy. One such example is the federal carbon tax (Dangerfield, 2018). Policies designed to protect the environment should be considered for implementation-based efficacy, not their ability to create a revenue stream.

Water Measurement Gauge

In order for the environment to be taken seriously as its own separate issue, it requires better monitoring and evaluation systems. Improvements are required in tracking climate data and progress, as there is a clear lack of specific targets at various levels including globally, nationally, and locally. With regards to floods in Toronto, there are gaps in rainfall monitoring that create difficulties in accurately tracking and predicting the impacts of floods. During the 2018 Toronto flood, Environment Canada meteorologist Rob Kuhn was tasked with monitoring rainfall amounts. He was able to do this using two water measurement gauges on the west side of downtown Toronto. One location was at Billy Bishop Airport and the other was near Bloor Street West and St. George Street (Welsh, 2019). From images of flooded streetcars and roadways, Kuhn was able to surmise that some locations in the core of the city received an overwhelming 200mm of rain. However, there was no water gauge in that area to prove Kuhn's estimate. This speaks to one of the fundamental issues in tracking environmental disasters – the lack of adequate resources and tools to measure rainfall. The issue is that because the rain did not land near a gauge it did not get recorded and therefore did not officially count towards rainfall monitoring efforts. With insufficient data and a lack of accurate reporting tools, it makes it difficult for policymakers to prioritize environmental issues.

On a global scale, the consequences of a lack of monitoring efforts is evident in the Paris Agreement, as individual countries were left to determine their own targets and effectively police themselves (Bang et al., 2016). Monitoring and accurately recording the results of climate action will serve as evidence to support green initiatives and can be used by decision-makers to hold each other accountable. While there is substantial data by scientists and individual researchers who support climate action, efforts need to be made towards making this information digestible and readily available in the mainstream. The continued presence of social media attention on climate issues and the youth climate movements has contributed greatly to this (Mercado, 2019). More importantly, social media and the youth movement provide climate education that is easy to understand and convenient to participate in. This helps to gauge the interest of more people to use their powers to lobby the government.

Institutional barriers and the dispersion of climate responsibility are also closely related to unclear

targets. It was determined that "local actors identify the lack of precisely formulated goals, and contradictory national goals, as an important problem for coordinating the adaptation effort of different sectors" (Fünfgeld, 2015). It is difficult to have "horizontal coordination" when there are various government and non-governmental actors working on the same issue. It leads to overlap in initiatives, apprehension in sharing knowledge, and funding barriers. While centralizing environmental issues to one decision-making body can solve this, it can risk pushing out some key factors such as scientists and climate experts. Such individuals are essential to supporting policies. In addition to the lack of specialized bodies that can both analyze research results and propose possible applications, the added uncertainty of climate models can make decision-making quite difficult (Dupuis, 2011). Therefore, the creation of council bodies bringing together climate change specialists and sector analysts could be a way to better communicate climate research results to stakeholders and policymakers.

Ultimately, there is no single solution to overcoming climate change. When discussing options, policymakers must keep in mind that Toronto is a city that was built for a climate that simply no longer exists. Thus, there are infrastructural and organizational changes that need to occur to allow for the city to effectively combat the impacts of a warming climate. It requires the cooperation of several elements including: framing the issue of climate change outside of the scope of the economy, accurate tracking, conveying outcomes in a digestible way, and improving institutional barriers so that scientists and policymakers can all efficiently contribute to a viable solution going forward.

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DEMOCRATIZING THE LOBBYING EFFORT IN CANADA

BY: EMILLY RENAUD

In recent years, corporate influence and lobbying practices in Canadian policymaking have become a major topic of public debate. This paper investigates whether Canada's laws and regulations on lobbying provide corporations enough space to express their opinions without imposing excessive influence on public policy outcomes. First, I briefly describe lobbying regulations in Canada and overview some current developments of the *Lobbying Act*. Next, I dive into the critiques of the *Lobbying Act,* drawing on the example of the disproportionate lobbying activities that Canada's oil and gas industry engages in.

Though oil and gas companies are huge economic drivers and stakeholders in Canada, this industry serves as an example of powerful players having unparalleled access to government officials because of their ability to pay for resources and top shelf lobbyists, but do not represent public opinion (Graham, Carroll, & Chen, 2019). Environmental groups and NGOs who do not have strong spending powers engage in significantly less lobbying even though their interests strongly reflect the 60% of Canadians who want Ottawa to invest in renewable energy sources (Uguen-Csenge, 2019). This paper argues for the implementation of tighter regulations on the sectors that engage in disproportionate lobbying activities to democratize the access to government officials and restrict overrepresentation from wealthier industries.

Lobbying in Canada

The federal *Lobbying Act* defines lobbying as: "any paid communication with a public officer about: federal policy (including amending, developing or making legislation, resolutions, regulations or programs), federal grants or other financial contributions and benefits, federal contracts, or setting up a meeting between a client and a public office holder" (Pross, 2006). The paid communication usually takes form through the hiring of a professional lobbyist/lobbying firm or an employee from a corporation or organization to represent corporate interests and influence government (Pross, 2006). Often lobbying efforts do not seek to influence broad policy issues, rather they seek to obtain project approvals, grants, licenses, or access to natural resources (Pross, 2006).

Joe Jordan, a senior associate of Bluesky Strategy Group, noted that effective lobbying seeks common ground and works with the government's agenda because advocating for policies or projects outside of a government agenda will not be successful (Abma, 2017). Furthermore, effective lobbyists have a deep understanding of the policy process and can effectively navigate government bureaucracy. (Pross, 2006).

A 2019 report by the Corporate Mapping Project observed that the fossil fuel industry began creating networks with senior government bureaucrats with the election of the Liberal Party under Justin Trudeau in 2015. This differed from the lobbying focus on Natural Resources Canada and Environment Canada during Stephen Harper's tenure as Prime Minister. (Graham, Carroll, & Chen, 2019). But with Trudeau's Liberal Party campaigning for more aggressive climate action, the

fossil fuel industry lobbying needed to move away from elected officials and towards the decision makers who outlasted election cycles in order to secure their presence and influence in government (Graham, Carroll, & Chen, 2019).

The *Lobbying Act* has undergone various changes and is subject to government review every 5 years to constantly improve the legislation and increase transparency in lobbying activities. Some of the most notable reforms in the past 20 years have included the banning of corporate donations to campaigning parties in 2004 under Jean Chrétien's Liberal government (Meslin, 2019). However, CEOs, directors, and lobbyists can still donate personally. This reform remains relevant today as corporate donations have morphed into the controversial practice of "cash for access" fundraisers, wherein wealthy donors pay to socialize with ministers and members of parliament. Former Ontario premier Kathleen Wynne, former British Columbia premier Christy Clark, and Trudeau's Liberal Party have all been publicly scrutinized for engaging in "cash for access." In fact, each party was called to implement legislation to restrict these kinds of fundraisers (Meslin 2019).

Pierre Gatton, president and CEO of the Mining Association of Canada, argues that Canada's lobbying rules are fair and robust. He compares Canada's transparent lobbying activities to the United States where its lobbying is concealed and conducted in "darkened corridors" (Riley, 2019). Gatton supports a multi-stakeholder approach to policymaking and contends that it is the best way of "doing things" for the country (Riley, 2019).

However, some politicians work to call attention to the dangers of industry influence in the government. In the aftermath of the SNC Lavalin scandal, "cash-for-access" fundraisers, and the purchase of the Trans Mountain pipeline, the NDP moved for a motion in spring of 2019 "to condemn the pervasive influence of corporate lobbyists over the federal government" (Vigliotti, 2019). This motion was supported by the Conservative Party, according to MP Garnett Genius (Vigliotti, 2019). While the Conservative Party supported restricting "unrestrained corporate welfare", where corporations such as Loblaws lobby for large government grants, Genius highlighted the importance of ensuring any new lobbying regulation not interfere with competition amongst domestic firms (Vigliotti, 2019).

When contrasted with the dangerously unregulated lobbying system in the US, *The Lobbying Act* ostensibly fosters transparent and fair lobbying in Canada. However, as mentioned by Gatton, there is strong support to further increase transparency and reform certain *Lobbying Act* regulations. Democracy Watch highlights that current ethical rules for public officials and lobbyists are not effectively enforced. Reasons brought forth include but are not limited to: "[t]he Ethics Commissioner for Cabinet ministers and MPs does not have enough legal requirements and powers to ensure the Commissioner strictly and strongly enforces the rules", and both the Ethics Commissioner and Commissioner of Lobbying are "handpicked by Cabinet ministers who can easily choose a person who will act like a lapdog instead of a watchdog" (Democracy Watch).

Lobbying in the Oil and Gas Industry

Though the oil and gas industry are one of the largest drivers of GDP growth in Canada, the vulnerability of oil prices (Page, 2020) and the rising awareness about climate change have shifted the political agendas of Canadians towards divesting

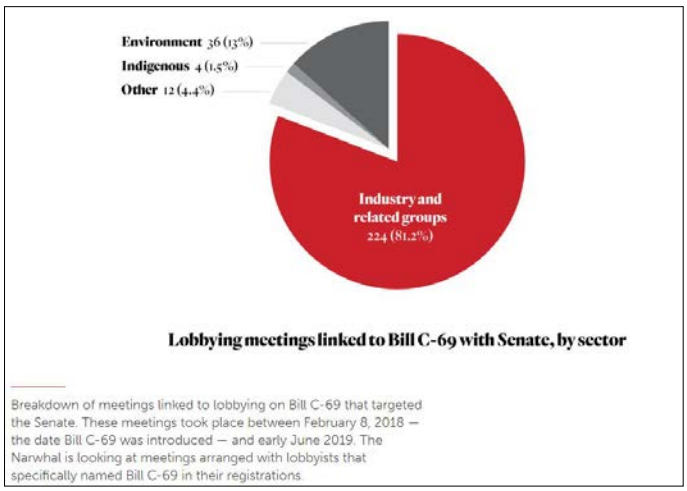
in fossil fuels and investing in renewable energy sources (Uguen-Csenge, 2019). Despite the building public resistance to fossil fuels, oil and gas lobbyists have effectively slowed Canada's transition to a more environmentally conscious approach to energy.

In the following section, I will overview lobbying from the oil and gas industries. I argue that oil and gas industries have unparalleled access to government officials via financial means to pay for resources and top tier lobbyists. Though environmental groups more accurately reflect the opinions of Canadians, they lack the resources to engage in the same level of lobbying.

Corporate Influence in Government: Analyzing the Oil and Gas Industry Lobbying in Canada

Bill C-69: An Act to enact the *Impact Assessment Act* and the *Canadian Energy Regulator Act*, aims to evaluate health, environmental, and community impacts of future infrastructure projects in order to prevent adverse effects and foster sustainability (Parliament of Canada, 2019). Bill C-69 was seen a win for environmental activists and many Indigenous communities as it would increase consultation, oil and gas industry supporters viewed this bill as infringing on future pipeline projects and investment as approvals will be more difficult to receive (Canadian Association of Petroleum Producers, 2018). These controversial bills open up "lobbying windows" which are "time periods of intensive lobbying in the lead-up to significant government decisions" (Graham, Carrol, & Chen, 2019, p. 18).

Lobbying efforts surrounding Bill C-69 were dominated by the oil and gas industries who encompassed over 80 percent of Senate lobbying, compared to environmental and Indigenous groups which only encompassed 13 percent (Riley & Cox, 2019). Groups representing industry had 224 meetings with Senate members since Bill C-69 was first introduced in February 2018, while environmental, Indigenous, and other groups only had 52 meetings in total (Riley & Cox, 2019). The oil and gas industry have the resources to massively outspend and out lobby everyone else (Riley & Cox, 2019).



According to an investigation by Sharon J. Riley and Sarah Cox (2019), these massive lobbying efforts by the oil and gas industry have paid off. Even though Bill C-69 was supported by 4 out of 5 Parties in the House of Commons, the Senate passed the Bill with 187 amendments, many of which addressed the concerns of The Canadian Association of Petroleum Producers who lobbied with 36 individual Senators on multiple occasions (Riley & Cox, 2019). The Senate typically "readily approves" legislation that is supported by a large majority of MPs, so passing a majority supported Bill which includes nearly 200 amendments is extremely uncommon (Riley & Cox, 2019).

It seems that the oil and gas industries ability to out lobby other sectors by over 65 percent has granted them influence over decision government making. For example, Senate amendments favored weaker environmental assessment laws (Riley & Cox, 2019). Gratton, president and CEO of the Mining Association of Canada, partly attributes the disproportionate lobbying to diligence in reporting (Riley, 2019). But other research into fossil fuel lobbying has highlighted huge fossil fuel lobbying efforts, even outside of the Bill C-69 lobbying window.

A report by the Corporate Mapping Project (2019) found that yearly meetings between government bureaucrats and the fossil fuel industry have increased by 84 contacts a year since Trudeau's liberal party formed government. As previously mentioned, this increase in lobbying was a key part of the fossil fuel industries strategy to stymie the efforts of the Trudeau government to enact policies that would fight climate change and reduce greenhouse gas emissions. (Graham, Carroll, & Chen, 2019). But with polls highlighting majority public support for investments in renewable energy (Uguen-Csenge, 2019); (DeCillia, 2020), and scientists arguing that action to address climate change needs to be taken within the next 2 years in order to avoid environmental devastation (McGrath, 2019); (Huges, 2019), is the increasing contact with bureaucrats due to the wealth and power of the fossil fuel industry fair?

The fossil fuel industry has an advantage as not only does the sector provide revenue for the government, but it is profit-based, allowing it to invest large sums into lobbying, advertising, and government relations. In contrast, environmental groups are often not-for-profit, relying on comparatively limited budgets largely fueled by public donations.

In the following sections, I synthesize recommendations brought forth by fossil fuel lobbying critiques to make access to government officials more democratic. These recommendations highlight unfairness in disproportionate lobbying activity because of wealth and resources.

Recommendations to Equalize the Lobbying Playing Field.

The following recommendations are not robust policy solutions or concise amendments to *the Lobbying Act.* Rather, these recommendations are frameworks upon which to enhance fairness lobbying representation.

As previously mentioned, "cash for access" fundraisers have received significant criticism for posing as an opportunity for lobbyists and CEOs to make donations to election campaigns and parties as private citizens, though with the covert goal of gaining influence in the party. Dave Meslin (2019), a journalist from *The Walrus,* has suggested strictly tax-funded election campaigns to prevent personal donations from wealthy people from large corporations who are effectively exploiting loopholes around the ban on corporate donations. He notes that the printing of ballots, election staff, renting voting stations, and most other aspects of elections are already tax-funded. If campaigns and advertising were also tax-funded and funds were equal amongst major parties, this could reduce the role of corporate influence in the political process. donations (Mesline, 2019).

The Corporate Mapping Project (2019) argues that not all lobbying activities are negative. However, a combination of oil and gas industry "deep state" lobbying wherein lobbyists meet with Senators and senior bureaucrats who outlast election cycles, and their resources and spending powers to gain this access "is clearly a departure from democratic practice" (Graham, Carroll, & Chen, 2019, p. 50). The Corporate Mapping Project (2019) report does not suggest that the oil and gas industry should stop lobbying. Rather, they contend that *Lobbying Act* policies should not be solely focused on increasing transparency as they should also be "proactively seeking to equalize opportunities for political influence" (Graham, Carroll, & Chen, 2019, p. 51).

Democracy Watch's recommendations mirror The Corporate Mapping Project's (2019) arguments as Democracy Watch calls for the federal government to implement a "merit-based process for government appointments and awarding contacts" (Democracywatch.com). Further, government consultations should better include citizen participation when decisions may impact communities (Democracywatch.com). The B.C. Office of the Seniors Advocate is an example of public interest and public advocacy lobbying. This office monitors senior services and issues in B.C. and meets with the provincial government to express opinions and/or recommendations. The council of advisors consists of diverse seniors with varying

needs, abilities, and experiences (seniorsadvocatebc.ca).

These recommendations highlight the unfair advantages and access that wealthy donors and corporations have due to financial resources. Equalizing the access to government officials to decrease the disproportionate representation of wealthy corporations can allow for more public interest or environmental advocacy groups to lobby and express concerns that are more representative of Canadian citizen interests.

While the oil and gas industry's desire for infrastructure, resource extraction, and pipeline development projects may not align with public opinion, the Canadian economy is heavily dependent on oil and gas prices. This industry is one of the top 4 revenue generators in Canada (Page 2020). The success and growth of this industry impacts Canadians greatly, making the oil and gas industry one of the biggest stakeholders in lobbying policy reform. Thus, it makes sense to see greater lobbying efforts for oil and gas than most other sectors. However, as indicated with the Bill C-69 lobbying window, the oil and gas lobbying efforts were disproportionately higher considering environmental and Indigenous groups were also important stakeholders in the bill.

The recommendations do not attempt to denounce lobbying from the oil and gas industry. They provide frameworks for equalizing access to government officials through merit-based approaches including allotting meetings with the government and decreasing the influence of wealthy corporations through limiting their financial powers as a means of access to Senators and senior bureaucrats. The Corporate Mapping Project (2019) argues that greater influence because of wealth, and not public interest, veers away from democratic practices. These recommendations seek to allow for more civil engagement and public interest advocacy groups to be involved in consultation and lobbying.

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FROM BLUE TO GREEN HELMETS: GUIDING INTERNATIONAL DEVELOPMENT BY SDG 17 THROUGH CLIMATE CHANGE

BY: ABOUBAKER KADDOUR

In September of 2015, the United Nations Member States unanimously adopted the 2030 agenda for sustainable development. This agenda called for global peace and prosperity through a sustainable development strategy guided by 17 goals consisting of 169 targets, known as the Sustainable Development Goals (SDG) (United Nations, n.d.-b). These goals are assumed to cover all aspects of development, ranging from poverty eradication, education, gender equality, energy access, and climate action (United Nations, n.d.-b). The 2030 agenda's predecessor, the Millennium Development Goals (MDG) consisted of 8 goals that were targeted exclusively towards developing nations, with the assistance of industrialized nations (Kawamoto & Kanie, 2020). The 2030 agenda lays out goals that are both relevant for developing and industrialized nations, however, not neglecting the role that industrialized nations play towards assisting developing nations in achieving these goals. The importance of this role is acknowledged in Goal 17 of the SDGs labeled *"Partnerships for the Goals"* (United Nations, n.d.-a). The goal calls for global partnership towards achieving the other 16 goals.

Sustainable Development Goals (SDGs).

The modern energy mix is highly fossil-fuel dependent. Our reliance on fossil fuels is a chief driver of carbon emissions, and consequently, climate change. The security and wellbeing of nations across the spectrum of economic development are threatened by climate change. However, the global south is the most vulnerable to the impact of climate change related events (Masson-Delmotte et al., 2018). Developing nations are already struggling with issues that in a "business-as-usual" environment hinder their development. The risk of climate change is not confined to natural disasters, it also threatens their path towards development (Chen & He, 2013). These nations are facing problems such as poverty, low levels of education, gender inequality, amongst other issues. Climate change poses the risk of exacerbating such issues, as these nations are expected to decrease their global warming causing greenhouse gas (GHG) emissions as a contribution to the global efforts of limiting temperature rise to 1.5ºC, or well below 2ºC compared to pre-industrial levels, as stated in the Paris agreement (Masson-Delmotte et al., 2018; UNFCCC, 2015). Since GHG emissions are the main by-product of conventional energy-use, reducing GHG emissions would mean decreasing the levels of energy consumptions, and thereby development.

Although this reduction is greatly needed on a global scale, developing nations have had minimal contribution to global warming as opposed to industrialized nations (Chen & He, 2013; ECBI, 2017). The risk of climate change mitigation, and disruptive natural events, therefore, pose a risk in all cases for these nations. The risk of slowing their development paths because of climate change mitigation, and the risk of being subjected to the disruptive events. Moreover, developing nations do not possess the financial and technological means to pursue a low-carbon development path, or

implement adaptation strategies and measures. Therefore, as affirmed by Article 9 of the Paris Agreement, it is the duty of industrialized nations to ensure that the needs of developing nations are met with respect to climate change mitigation and adaptation measures (UNFCCC, 2015).

The focus of this paper will be on the capability of industrialized nations to contribute to combating climate change through capacity building and technology transfer in developing nations. These nations lack the financial resources to adopt clean energy technologies that facilitate the shift towards sustainable development. Financial-aid alone increases the financial and economic development of nations, but has proven to negatively impact the environment in the absence of strong institutional capacity (Tamazian & Bhaskara Rao, 2010). Capacity building is the transfer of knowledge that aims to strengthen and build institutions (ECBI, 2017). Capacity building for technology transfer is the focus as it provides developing nations with the know-how on mitigating and adapting to climate change, while being able to address their domestic issues with minimal foreign interference. Considering the multiple issues that may arise from the issue mentioned above, the paper provides a broad reasoning for why industrialized nations should take this path instead of the traditional aid-based development approach.

Energy and Sustainable Development: Why Energy?

The Industrial Revolution formed a shift from 'visible' sources of energy-services such as wood and animal traction to more mechanical based energy-services sources powered by hydrocarbons (coal, oil, and gas). This caused drastic changes in the pace of development in the world and brought a new definition to the global economy. The new sources of energy have become not only exclusive to the industrial sector but have become an integral part of daily life.

Energy access has become one of the main drivers of human development. Energy use has evolved substantially over the last two centuries. Between 1820 and 1950, the global economy grew by 1% and then saw a leap into 3% between 1950 and 1973 (Carbonnier & Brugger, 2013). This growth can surely be, at least in part, attributed to the increased consumption and availability of easily transported and stored fossil-fuels, mainly coal and oil, and to a lesser extent natural gas.

Energy has been found to correlate directly to human development through the Human Development Index (HDI) (Carbonnier & Brugger, 2013). The HDI measures human development based on monetary income, health, and education. Although the correlation is not linear, some characteristics can be observed as to the level of energy consumption required to achieve a higher HDI score. The correlation of HDI and energy shows that in the case of poor nations, there is a steep score rise relative to an increase in energy consumption (Carbonnier & Brugger, 2013). Moreover, countries with more than 60% biomass (traditional) based energy consumption, which is a characteristic of many developing nations, score automatically below 0.6 on the HDI (Carbonnier & Brugger, 2013).

These numbers are unsurprising as these sources are usually inefficient and are responsible for many external factors that negatively affect human well-being. Health issues arising are more severe as people are directly subject to emissions from these sources. Moreover, the economic burden is also significant given that people usually spend large portions of their income to acquire such sources that on top of being inefficient, impact their ability to spend on other essential needs. Carbonnier & Brugger (2013) estimated that the cost of kerosene for basic lighting is estimated to be 200 times more than what grid users would have paid, considering efficiency.

Improving energy access, however, requires investments estimated in the billions of dollars. The abundance and low cost of fossil-fuels would also mean that energy access projects, especially

electrification, would mean increasing GHG emissions in a carbon constrained world. The alternatives available also pose a risk for the well-being of these nations, especially, their need for long-term sustainable development. Conventional fossil-fuel powered power plants use water for cooling, which poses water availability challenges in already water-scarce areas. Conversely, Hydropower requires significant capital investments and poses risks of flooding the livelihoods of communities and other environmental impacts. Biogas and Biomass technologies, which are considered as carbon neutral, require substantial areas of agricultural lands and therefore pose the risk of developing a food versus energy conundrum (Carbonnier & Brugger, 2013).

Solar farm in Morocco. Various solar power technologies harness energy from sunlight to generate electricity. Photo by Mohamed Atani/UN Environment

Developing Nations and Domestic Resources

With the rising global energy demand and increased access to technology, several developing nations have tapped into their fossil-fuel resources and become energy exporters (e.g. Ghana, Chad, and Uganda) (Carbonnier & Brugger, 2013). Because these countries do not possess the knowledge and infrastructure to compete with established energy exporters, they relied on Foreign Direct Investment (FDI). The pressure asserted on policy makers in developing countries by domestic situations, international oil companies and importing countries implies the natural direction of policy makers towards a liberal model that provides unrestricted access to energy sources in order to attract FDI (Carbonnier & Brugger, 2013). Such model is characterized by low corporate taxes, abandoning royalties and disregarding domestic issues surrounding the extraction of these sources (Carbonnier & Brugger, 2013). This model has provided the 'new' energy producing developing nations with an environment that would attract national and private foreign extraction industries to compete for the extraction of these resources. This is an issue for countries with low governmental regulatory capacity as the operations of these companies might not be guided by stringent environmental, human and labor rights laws. (Carbonnier & Brugger, 2013). This, however, is not the norm as many of these countries use the foreign extraction companies as means to acquire technology know-how, and follow them with nationalization of the extraction industry, especially energy extraction (Carbonnier & Brugger, 2013).

The abundance of natural resources does not guarantee a smooth transition to complete industrialization, as the process undertaken by these nations can instead lead to the transformation of these states into rentier states (O'Sullivan, 2013), which *"…are ones which use the revenues from oil and gas (and other natural resources) to construct societies beholden to and/or repressed by the ruling group"* (O'Sullivan, 2013, p. 42).

This transformation, along with increased trade might lead to further environmental degradation and an increase in GHG emissions (Cole, 2007; Tamazian & Bhaskara Rao, 2010). Even with the abundance of energy sources in some countries, the absence of a strong institutional capacity to manage development while maintaining environmental standards will lead to environmental, social, and economic policy challenges.

Shortcomings of Environmental Policy Response

Although implementing more stringent environmental regulations to mitigate environmental degradation caused by natural resource extraction may seem a viable solution, it could potentially be difficult for three reasons: firstly, many developing nations lack the institutional capacity to implement and enforce such regulations. Secondly, implementing these regulations may affect the flow of the much-needed investment in the extraction sector that many of these nations depend on, financially and for technology transfer. That is because the absence, or the weakness of these regulations provides them with the comparative advantage to attract investment (Carbonnier & Brugger, 2013). Thirdly, policies that aim to enhance environmental standards and encourage the reduction of carbon emissions might adversely impact impoverished populations as the price of energy increases (McCollum et al., 2018).

Environmental regulations, such as emissions standards and carbon prices both domestically and globally, have been known to increase low-carbon technology transfer (Glachant & Dechezleprêtre, 2017). However, these environmental policies may negatively affect foreign investors in developing nations, as these policies alone may not provide a great enough incentive for foreign investors, and therefore, should be paired with market-based approaches (Verdolini & Bosetti, 2017).

Developing nations face a dilemma- while introducing environmental regulation with market-based policies would encourage clean energy technology transfer, it might decrease the effectiveness of the very environmental regulations in place. This is true for energy producing developing nations facing pressure to provide the suitable market conditions for natural resource extraction investors (Carbonnier & Brugger, 2013). Therefore, within the context of climate change, technology transfer provides a clear chance for developing nations to pursue a sustainable development path. This path would only be possible with the strengthening of domestic institutions so that these organizations would have sufficient capacity to address such dilemmas (Chen & He, 2013; Tamazian & Bhaskara Rao, 2010; Verdolini & Bosetti, 2017).

Sustainable Development Goals and Energy

The 2030 agenda for sustainable development, as mentioned above, aims to complete what the Millennium Development Goals (MDGs) missed (United Nations, 2015). The MDGs targeted the social aspects of development, rather than the economic and environmental facets (WHO, n.d.). The MDGs only mentions environmental sustainability as one goal. Moreover, the SDGs were developed so that they would be integrated and interlinked in a sense that, the achievement of one SDG would contribute to the achievement of the other (United Nations, 2015). The SDGs complete the MDGs on environmental and energy issues by introducing six goals that can be interlinked with energy, while SDG 7 directly calls for affordable and clean energy access (United Nations, n.d.-b). Linking the SDGs to energy as the main driver of development shown in section 2, shows that there are direct correlations:

- SDG 8: Decent Work and Economic Growth
- SDG 9: Industry, Innovation and Infrastructure
- SDG 11: Sustainable Cities and Communities
- SDG 12: Responsible Consumption and Production
- SDG 13: Climate Action

The level of linkage, however, may change from each goal depending on multiple factors (example see (McCollum et al., 2018)). The availability of the interlinkages of energy with multiple SDGs, implies that most efforts aimed at enhancing energy access (SDG 7) would have results that would also

contribute to the achievement of other SDGs (McCollum et al., 2018).

Progress in energy and SDG 7 contributes to all other SDGs. Figure source: IRENA REthinking Energy Report.

SDG 17: Partnership for Goals:

The call for a global partnership towards achieving development goals is not novel. It was proposed in the MDG agenda and was reaffirmed later in the 2030 SDG agenda (United Nations, 2015; WHO, n.d.). The resolution called for international cooperation in achieving the goals with special emphasis on the needs of the *"poorest and the most vulnerable"* (United Nations, 2015, p. 2). This call is targeted towards industrialized nations to effectively 'partner' with developing nations towards achieving sustainable development. Within the context of energy and climate change, this partnership should *"…reaffirm that every State has, and shall freely exercise, full permanent sovereignty over all its wealth, natural resources and economic activity."* (United Nations, 2015, p. 6). SDG 17 consists of 19 targets that also serve as indicators for its implementation. The targets and indicators cover the areas of: Finance, Technology, Capacity-Building, Trade and Systematic issues (United Nations, n.d.-a). the focus here is on targets 17.7; technology transfer, and 17.9; capacity-building (United Nations, n.d.-a).

- SDG 17.7: "Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed" (United Nations, n.d.-a).

- *SDG 17.9: "Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation"* (United Nations, n.d.-a)

The above-mentioned targets within the context of climate change raise multiple issues that this paper tries to address. First, traditional foreign aid has been plagued with a lack of effectiveness. This ineffectiveness is mainly due to the possible aid dependence that aid-recipient countries may face (Asongu, 2015). It is also linked to the poor governance that is one of the effects of aid-dependence as opposed to local tax revenues (Asongu, 2015). This loop of ineffectiveness, and other issues, can be solved by working towards capacity building in order for these nations to develop their own development strategies with respect to their domestic contexts (Chen & He, 2013; Ika & Donnelly, 2017; Kim, 2018; McCollum et al., 2018; Olawuyi, 2018). Second, working simultaneously with capacity building, technology transfer is of particular interest in the context of combating climate change as mentioned above; *"…environmentally sound technologies to developing countries on favourable terms…"* (United Nations, n.d.-a).

Technology transfer would not only allow developing nations to take mitigation and adaptation

measures, but it would also increase their innovative capacity with respect to domestic challenges. This would also link back to the importance of capacity building, as one major challenge with technology innovation in developing nations is the lack of capacity at the early adoption stage (Olawuyi, 2018; Olhoff, 2015; Suzuki, 2015).

Capacity Building and Climate Change

Capacity building refers to efforts that target institutional and human resource strengthening and development (ECBI, 2017). This concept emerged in the 1950s owing to the argument that different nations develop differently due to the varying quality of their governing institutions, especially economical capacities (ECBI, 2017). Since then, however, capacity building has evolved from an economic development concept to encompass most areas of development including infrastructure, social, economic, security etc. (Ika & Donnelly, 2017). Moreover, capacity building became a resort for development projects as a way to limit interference, especially foreign, by encouraging domestic leadership (ECBI, 2017).

Capacity building projects differ from other development projects in that they focus on increasing the capability of institutions or humans in enhancing the process rather than delivering a certain service or good (Ika & Donnelly, 2017). It can be in the form of providing expert knowledge, training personnel in a certain facility, or training public servants with the aim of enhancing organizational capacity within an institution. The ambiguity of the theoretical background for capacity building is reflected in its implementation as well (ECBI, 2017). The open-ended approach towards capacity building by both donor and recipient organizations and governments results in multiple challenges towards the effectiveness of capacity building programs (ECBI, 2017).

Project-based interventions that are usually applied for capacity building projects such as workshops, and training make it challenging to measure the success of such projects. On the donor side, these projects and programs are outsourced to consulting firms that carry-on the program and leave (ECBI, 2017). These supply-side approaches are usually incentivized by short-term out-put based results (ECBI, 2017). On the recipient side, a lack of transparency and accountability that can arise from lack of effective communication due to the ambiguity of the concept and outcomes of these programs makes the effectiveness of these programs un-quantifiable (ECBI, 2017). Capacity building projects are mostly successful when they are demand-driven and are offered with a facilitative rather than a decisive approach (ECBI, 2017). This enables the recipients of the programs to acquire the best knowledge that is deemed relevant with respect to local challenges. This is because capacity building is a time-consuming process that requires the capacity to be built within (ECBI, 2017).

Capacity Building 'Tailored' for Climate Change

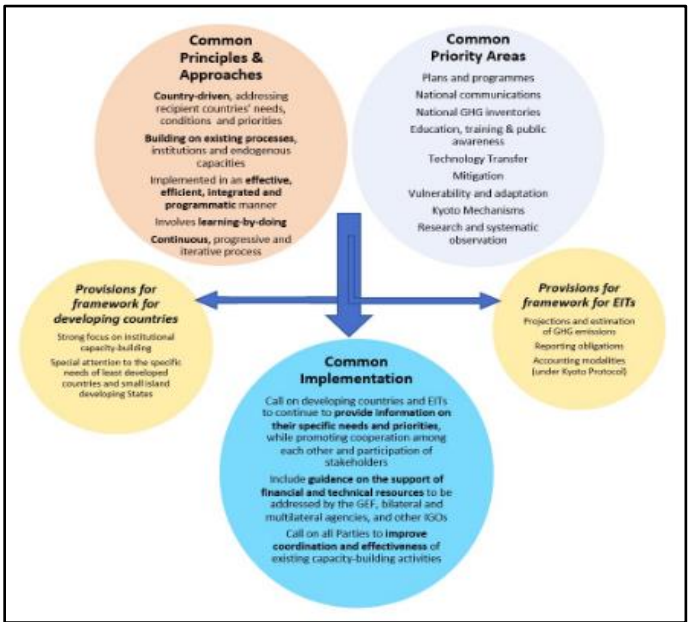
Capacity building has been long observed as an important aspect of development as demonstrated through various international treaties and conferences. This was and is still acknowledged in the context of climate change. The United Nations Framework Convention on Climate Change (UNFCCC),1992; the Kyoto Protocol,1997; the Paris Agreement,2015 are the major agreements governing global climate change action. These agreements have not only acknowledged the effectiveness of capacity building in combating climate change, but also asserted its important by making it an integral part of the treaties throughout the years (UNFCCC, 2019a).

The UNFCCC, adopted in 1992, first mentioned capacity building conceptually by dedicating Article 6 for promoting education, training, awareness, and access to climate change related information for both professionals and the general public (ECBI, 2017). When adopting the Kyoto Protocol in 1997, the convention re-affirmed the calls towards capacity building in Article 10 of the protocol by calling for increasing and strengthening research and institutional capacity in developing countries (ECBI, 2017). In 2001 as an outcome of the Conference of

Parties 7 (COP7), the Marrakesh Accords were adopted, and launched two frameworks called capacity building in developing nations (UNFCCC, 2019a). The Capacity-building Frameworks (CBF) included two decisions of adoption: one targeted at developing nations; 2/CP.7 and the other targeted at nations in transition; 3/CP.7 (UNFCCC, 2001, 2019a).

The CBF provides high-level general guidelines on how to engage in climate change related capacity building. The CBF defined the levels of capacity-building operations on three levels: Systematic, Institutional, and Individual (UNFCCC, 2019a). The systematic level targets the overall interactions between institutions and individuals through establishing the enabling environments for these interactions through economic and regulatory policies; the institutional level targets the institutions' performance and capability, ability to adapt to change and institutional cooperation; the individual level targets the knowledge and skills of individuals (UNFCCC, 2019a). This process is guided by several guidelines, with two worth mentioning; one falls within the common principle and approaches area and one within the common priorities' area of the CBF (UNFCCC, 2019a): Capacity Building should be designed as per the recipient country's needs and priorities and Technology Transfer as a common priority of the CBF.

Both guidelines align well with much of the findings mentioned above. Moreover, the Subsidiary Body for Implementation (SBI) is responsible for the periodical review of the CBF and monitoring climate change capacity building activities reported under the CBF (UNFCCC, 2019b). The SBI met three times in 2004, 2011, and 2016. The meetings resulted in pointing out gaps and needs towards making the CBF more comprehensive (ECBI, 2017). The second (2011) and third review (2016) called for, among other issues, "*…increasing country-driven coordination of capacity-building activities…"* and *"the need for enhanced support from developed countries for capacity-building actions in developing countries"*, respectively (UNFCCC, 2019b).



UNFCCC Capacity Building Framework outlining Technology Transfer within the common priority areas.

Technology Transfer and Climate Change

Technology transfer is a *"…broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change"* (IPCC, 2000, p. 3). As economies become more globally integrated, and with climate change looming ahead, low and zero carbon technology transfer gained more importance, especially for developing countries. These countries are expected to participate in the combating of climate change; however, they do not possess the innovative capacity to produce technologies of their own, hence they rely on the transfer of technology from industrialized nations. Developing nations also need these technologies to ensure that their development paths are more sustainable than those taken by industrialized nations, hence, they need to feed their rising demand for energy using low-carbon and zero carbon technologies. Finally, climate change related events are set to hit developing countries with more severity (Masson-Delmotte et al., 2018). Thus, they

will need adaptation technologies on top of production technologies (Olhoff, 2015).

Technology transfer as defined above, can be divided into three different sections, namely know-how transfer, experience transfer, and equipment transfer. These characteristics of technology transfer can be linked to three transfer barriers. The first is the lack of technological capacity that allows developing nations to operate and adopt new technologies, or the *know-how* (Suzuki, 2015).

Adopting new technologies relies heavily on the existence of relevant knowledge of similar technologies (Olawuyi, 2018). Since these technologies are already not available domestically. This also speaks to the country-driven approach of foreign aid. Depending on the level of development of certain nations, technology development might be effective or not. Foreign technology aid paired with technological assistance is more effective in developing nations with high levels of development than low levels (Kim, 2018). This is mainly because developing nations with high levels of developments have already acquired some knowledge with respect to adoption, so they would not require much technical assistance.

The second barrier is that developing nations lack the financial capacity to adopt these technologies (Suzuki, 2015). The flow of technologies usually happens from industrialized nations to developing ones. These technologies are often costlier than locally produced technologies, or in the case of energy, locally extracted natural resources such as fossil-fuels are cheaper than imported technologies. Moreover, the high initial capital required for low and zero carbon technologies is hindered by the low financial capacity of local investors (Suzuki, 2015).

The third barrier is institutional capacity. Developing countries lack the capacity to enforce climate policies that are supposed to enhance their technology adoption (Olawuyi, 2018). Technology adoption, however, is also pushed back by cultural norms that, if not addressed correctly through stake-holder engagement, and may result in major pushbacks (Olawuyi, 2018). The lack of governmental and regulatory capacity also gives low incentives for private investments (Kim, 2018). On the same note, trade barriers that are defined by a lack of regulations on the intellectual property rights forms a major barrier for developing nations (Glachant & Dechezleprêtre, 2017; Kim, 2018; Olawuyi, 2018; Verdolini & Bosetti, 2017). This stems from the fear that technologies will be abused in the absence of external enforcement mechanisms.

With increasing global economic integration, more nations are adopting clean energy technologies to respond to climate change and promote sustainable development. The laggardness of some developing nations compared to others cannot always be attributed to the ineffectiveness of international efforts of technology transfer (Olawuyi, 2018). Rather, they are inherent in the lack of enabling environments for these technologies to be transferred. It is important to note that developing nations and private institutions that work towards technology transfer should also consider limits to 'traditional' technology transfer mechanisms and try to develop new strategies that would facilitate transfer, notwithstanding mitigating the risks associated with high-investments and intellectual property rights.

The 'Green' Helmet

This section will summarize and conclude the findings of this paper by *Defining a new energy based international development strategy.* SDGs are the new realm that provide comprehensive indicators on global human well-being. In terms of international interaction towards the SDGs, SDG17: Partnership for Goals, provides 19 targets and indicators that are aimed at providing a guideline towards a successful partnership on implementing SDGs. The claim is that energy is central to the SDGs, by naturally being central to development. Energy provides the basis for the ability to carry on the activities of modern life. Climate change, however, is threatening these activities. While energy is essential to development, it might also

pose negative effects in the context of climate change. Therefore, an 'energy-centric' approach towards the SDG would have to be climate friendly.

SDG 17.7: Capacity building and 17.9: Technology Transfer address two-main issues that are hindering the progress of developing nations towards achieving climate change mitigation and adaptation measures, and therefore threatening the implementation, or for the time being, the progress towards SDGs. Indicators 17.7 and 17.9, like all other SDG indicators, are inter-related. Meaning that challenges to one may be present in the other, and the solution provided by one is also provided by the other. Indicator 17.9 calls for technology transfer to combat climate change. This transfer is met with institutional and financial barriers. Indicator 17.7 calls for capacity building and cooperation that would enhance the institutional and financial conditions that address the barriers met by 17.9. Meanwhile, capacity building in a climate change threatened world is also faced with technological barriers that may decrease efficient solutions.

So, what is the solution? Although there is no 'one-size fits all' approach, looking at SDGs in a holistic and integral way provides the guideline for progress towards a solution. This holistic approach, in the context of 17.7 and 17.9, would be to provide the know-how and expertise along with the financial and technological means to industrialized countries based on their needs. McCollum et al. (2018), provide an example on how the climate action in China and India can be achieved by targeting SDG3: Improving air quality and bettering human health. Since that issue is a main concern for policy makers in both countries, they might be better incentivized to reduce emissions and thus contribute to their emission reduction pledges, then if they would regard it solely from SDG13: Climate action.

The time for mitigating climate change is almost over, and the adaptation phase is already occurring. To achieve true and comprehensive mitigation and adaptation measures, industrialized nations should start to view international development from the SDG based 'Partnership' lens. This partnership would surely give developing nations the ability to adequately address barriers and implement effective measures towards accomplishing sustainable development, while combating climate change.

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CANADIAN INTERPROVINCIAL ELECTRICITY TRADE: INTERTIED BY GEOGRAPHY, LAW, AND INTERNATIONAL EXPORTS

BY: ELISABETTA KERR

Both a resource-rich and trade-dependent country, Canada is well-positioned to address its national climate change goals through a cohesive energy policy. As electricity is becoming the common currency for energy, there is an opportunity to amalgamate provincial energy policies and goals into a national plan. However, the National Energy Plan's (NEP) legacy suggests otherwise. Though the NEP was enacted 40 years ago, the disparate energy politics and policies among provinces has made it difficult to foster a national sense of electricity stewardship. Given provincial jurisdiction over resources and energy generation and the distribution of those resources, the geography of electricity discourages east-west transmission in favour of north-south. The economic benefits and logistical ease of exporting electricity to the United States (US) complicates a national approach to interprovincial electricity policies, regulations, and trade.

This essay will consider how the distribution of natural resources and the nature of provincial jurisdiction favour international electricity trade over interprovincial trade. First, it will consider the landscape of electricity in Canada and its impact on trade – its value, how it is regulated, and how it is distributed. Next, it will examine the relationship between interprovincial trade and international electricity trade with the US, and how provincial energy jurisdiction discourages east-west transmission. Finally, it will lay out the main challenges of encouraging cooperation between provinces as the imperative for electrification becomes ever stronger.

Electricity Generation and Transmission in Canada

Electricity in Canada is valuable economically, financially, and environmentally. The distribution of natural resources is unequal across provinces, so there is significant variation in the methods used to generate electricity. In 2018, Canada produced 647.7 terawatt hours (TW.h) of electricity. 61% of this came from hydro sources, 6% from wind and solar, and the rest from natural gas, coal, coke, uranium, and petroleum (Canada Energy Regulator, "Provincial and Territorial Energy Profiles – Canada"). $20 billion is invested annually in the sector, making electricity a highly valuable industry (Canada, House of Commons, December 2017, 3). Beyond the private sector's involvement, provincial governments have a direct mandate and responsibility to supply energy for citizens (Senate of Canada, Standing Committee on Energy, the Environment and Natural Resources, Appendix 5, August 2013).

A photo of electricity poles and wind turbines

The spread of Canada's renewable hydroelectric resources alternates with non-renewable coal, oil, and natural gas. In theory, the federation should be well-equipped to communally share electricity generation depending on peak time periods and seasonal variations. In practice, however, the development of these resources and the provincial policies supporting them have fostered a greater interest in self-sufficiency. Electricity development in Canada was influenced in many jurisdictions by a social agenda, meaning that public ownership of

electrical utilities is still the case in most provinces. However, in other jurisdictions, there is significant private sector representation. When coupled with disparate geography and resources, this inward-facing structure discourages interprovincial trade (C.D. Howe Institute, "Power Sharing: Developing Inter-Provincial Electricity Trade," July 2010, 6). Provinces have been able to be virtually self-reliant, and so without the federal government's involvement in a national electricity trading scheme, they have found more benefit in selling their electricity to the US than in trading with one another.

In order to obtain a full sense of the impact of provincial electricity generation in Canada, it is imperative to look beyond national statistics. In addition to varied sources of electricity generation, there is diversity in the regulatory and market structures for electricity. The structure of the organizations that oversee generation, transmission, and distribution of electricity has a significant impact on how utilities in different provinces interact. Utilities can be both publicly and privately owned. Alberta and Ontario have deregulated wholesale electricity markets, where pricing is determined by supply and demand forces (Canada Energy Regulator, "Provincial and Territorial Energy Profiles – Canada"). Alberta has fully privatized markets, while other provinces utilize vertically integrated Crown corporations with central planning. Unlike the US, Canada does not have a national regulator to integrate Canadian electricity markets or facilitate interprovincial trade through harmonized rules (House of Commons, "Strategic Electricity Interties," 22). The absence of a federal presence to coordinate provincial regulations and policies has been overshadowed by American open access tariffs for electricity trade. Some have suggested that there are fewer barriers to exporting electricity to the US than to other provinces, especially where transmission rights are commodified rather than treated as public amenities (C.D. Howe Institute, "Power Sharing," 11).

The difficulty of navigating this patchwork system is due to the absence of a national electricity strategy. A 2017 report by the House of Commons' Standing Committee on Natural Resources investigated "Strategic Electricity Interties." The Committee concluded that inconsistent policies and regulatory issues between jurisdictions are a significant obstacle to developing better electricity connections. In the continued absence of such a policy, it is easier for provinces to sell their electricity to the US than it is to send it east or west within Canada. Since generation and transmission is organized provincially, provinces must navigate opposing or conflicting policies when trading electricity.

Electricity Crossing Borders

Electricity exports are directly connected to the distribution of and authority over resources. Provincial jurisdiction dictates that governments have enough electricity generation capacity to satisfy in-province demand (Senate of Canada, Standing Committee on Energy, the Environment and Natural Resources, Appendix 5). This, along with the uneven distribution of natural resources, gave rise to wide disparities in the energy sources used for generating electricity. The type of electricity generated plays a major role in the rate that users pay, as does the structure of the market – whether they are market-based or set by electricity regulators. Canadian consumers pay some of the lowest energy prices in North America, with electricity being the cheapest in Quebec, Manitoba, and British Columbia. It is no coincidence that these provinces are also the largest exporters of electricity. Hydro is the cheapest method of producing electricity, and reservoirs can be shut off when there is an absence of demand to ensure that there is no waste (Natural Resources Canada, "About Electricity").

More importantly for electricity trading, price also varies based on the cost of transmission and local distribution. The distribution of cheaper electricity-generating resources located near the American border promotes trading with the US rather than

interprovincially. The size of utilities providers also plays a role in how much energy can be exported. The larger the hydro utilities, the larger the surplus that can be sent to market, and the larger the system of cooperation (C.D. Howe Institute, "Power Sharing," 7). The largest exporters are provincial Crown corporations that also generate energy (Canada Energy Regulator, "Market Snapshot: Of nearly 50 companies that export electricity, three account for more than half of all exports in 2019"). Exports are managed by the Canada Energy Regulator, which regulates energy trade but is not a policy-making body (Canada Energy Regulator, "The New Canada Energy Regulator"). The structure of provincial electricity utilities and the type of resources available plays a significant role in incentivizing electricity exports. But, when other provinces have their own infrastructure to sustain their population, there is no immediate reason to import electricity.

A photo of power transmission lines.

Electricity crosses international boundaries more frequently than provincial boundaries. Canada exported 7% of the electricity it generated (48.5 TW.h) to the US through 34 major active international transmission lines in 2018 (Natural Resources Canada, "Electricity Facts," July 2020). Canada is a net exporter of electricity in its trade with the US because each province's generating capacity is typically greater than its energy requirements (Canada Energy Regulator). The net value of international electricity exports was $2.5B in 2019 (Canada Energy Regulator, "Electricity Annual Trade Summary – 2019.") All electricity exports went to the US, mostly through the border provinces of Quebec, Ontario, Manitoba, and British Columbia. Save Ontario, these provinces are leading hydro generators, interspersed with fossil and nuclear-fueled generating capabilities. Quebec alone accounted for 44% of electricity exports in 2019 (Canada Energy Regulator, "Market Snapshot…"). Because hydro provinces have installed capacity that exceeds peak demand, they inherently produce more electricity than is needed, allowing them to export.

Enhancing interprovincial trade requires two key elements: infrastructure and an opportunity for mutual benefit. It is difficult to get transmission lines constructed when it appears that only one side will benefit, because the costs of construction are often borne by both sides. There are two important cases of mutually beneficial electricity transfers that would be difficult to replicate in other jurisdictions because of how resources are distributed. Connecting systems in Ontario and Quebec, as well as Alberta and British Columbia, make similar use of on- and off-peak electricity transmission. Inexpensive surplus electricity is imported at off-peak hours and exported back during peak demand times. This is framed as a reciprocally beneficial scenario, where peak-hours imports are cheaper than what it would cost to generate electricity at peak demand times (House of Commons, "Strategic Electricity Interties," 10). This arrangement also accounts for variable renewable electricity by trading surplus renewable generation when output is high, and importing electricity when output is low. This way, resources can be used as energy storage reservoirs for neighbouring systems, limiting the waste of electricity while avoiding capital cost investments to construct additional infrastructure to meet peak demand (Ibid.).

By sharing energy as peak demand moves from east to west across time zones, interprovincial electricity trade can alleviate large-scale logistical and financial complications of providing enough electricity at peak times. It can also balance seasonal

variability of generation capacity, improve reliability and emergency response, and control costs by deferring investment in generation (Ibid., 17). In the case of Prince Edward Island and Nova Scotia, the former cannot be self-sufficient and relies on the latter for the bulk of its electricity. This more regional approach in Atlantic Canada, along with development of the Maritime Link, helps harmonize efficiencies and promote interconnections as a critical resource (Ibid., 18). However, this strategy is being used in some jurisdictions (mostly in B.C.) to import American electricity because of the greater capacity to transfer electricity along north-south lines. American prices are often higher, but provinces will import from the US when domestic supply is limited, when importing from other provinces is constrained, or at off-peak hours when American prices are cheaper (Canada Energy Regulator, "Electricity Annual Trade Summary – 2018").

However, there are scenarios, both real and hypothetical, that do not lend themselves to interprovincial trade being mutually beneficial. For instance, all output at the Churchill Falls hydro facility in Labrador is sold to Quebec, which is the largest electricity exporter in the country (Natural Resources Canada, "About Electricity"). There have been problems constructing infrastructure between Manitoba and Saskatchewan, where hydro-generated electricity would help Saskatchewan reduce its greenhouse gas emissions. However, there are concerns that Manitoba ratepayers would have to bear the cost of helping Saskatchewan achieve its climate change targets (House of Commons, "Strategic Electricity Interties," 13). This view seems to overshadow national climate change goals in favour of provincial goals. For this approach to work, there must be an overarching framework to support a cohesive approach.

Governments can create incentive programs and update policies to promote interprovincial trade, but the question of physical transmission distance is a difficult problem to overcome. In general, the distances between Canadian generation and American demand regions are shorter than the distances between several provinces. Areas of high demand lie across international borders from regions that produce surplus energy, such as the production of hydroelectricity in Quebec that is exported to New England and New York State. Across Canadian terrain, there is the additional challenge and transmission costs incurred by mountain ranges, the Great Lakes, and sparsely inhabited areas. This tends to be why electricity flows along north-south transmission routes, rather than east-west (Canada Energy Regulator, "Electricity Annual Trade Summary – 2018"). Geography is a central obstacle in hindering east-west transmission, especially when the benefits of undertaking expensive projects are unclear to some provinces.

Despite these challenges, the federal government could have an important place in providing incentives and national electricity policies. However, electricity policy is almost entirely a provincial responsibility. History has demonstrated that the federal government's interference in provincial energy and resource jurisdiction is unwelcome (The Canadian Encyclopedia, "National Energy Program," April 2016). Federal redistributive programs like equalization transfer payments tend to be controversial, and the asymmetric benefits of electricity trading may draw a polarized response from provinces. The geographic spread of Canadian provinces from east to west should be able to account for shifts in peak hours across time zones. However, there are important barriers that inhibit the formation of what seems like a national unity project: provincial energy policies, infrastructure, the nature of utilities, and jurisdiction.

In the absence of prolific interprovincial electricity trade, there is some importing of American electricity to help avoid the cost of building additional generation capacity infrastructure in Canada (Canada Energy Regulator, "Electricity Annual Trade Summary – 2018"). It is not inherently problematic for provinces to import American electricity, but there is potential to

achieve energy reliability, national self-sufficiency, and climate change goals through a unified interprovincial approach to electricity trade. For example, Ontario and Quebec actively trade, which allows them to buy and sell surplus electricity. This effectively increases their overall grid reliability and allows them to generate more with renewable sources. This arrangement offers the flexibility to sell electricity at off-peak times, when there is a surplus, and buy it back at peak times when it is needed (Canada Energy Regulator, "Market Snapshot…"). Though it is a great example of an ideal interprovincial energy trading arrangement, many other Canadian jurisdictions do not share the same benefits of proximity and renewable resources for generation and transmission.

Down the Line

It may seem counterintuitive to emphasize the imperative for interprovincial trade while acknowledging provincial self-sufficiency in electricity generation. However, the benefits of enhanced interconnections could help to economize electricity production, achieve climate change goals, and improve international electricity exports. With increasing public concern about the effects of climate change, there has been a change in attitude in favour of electricity generated through renewable sources (C.D. Howe Institute, "Power Sharing," 5). Increasing electrification will continue to be critical in meeting Canada's national climate goals. It will be imperative to facilitate connections between provinces with excess clean electricity and those that rely primarily on fossil fuels for energy generation.

Some experts argue that enhanced interprovincial transmission would also benefit international trade. The House Standing Committee on Natural Resources proposed that increasing interprovincial transmission lines might help provinces trade more electricity with the US (House of Commons, "Strategic Electricity Interties," 8). The 2017 report reasoned that east-west interconnections could provide provinces with more ways to access American markets if they are less reliant on in-province electricity generation (Ibid). Especially as the US continues to demand low-emission electricity to meet domestic goals, provinces face an opportunity to capitalize on clean electricity and create additional value for its exports, while still supporting climate change goals (House of Commons, "Strategic Electricity Interties," 19). Though there are limited projections of the added economic value of this opportunity, this is a convincing argument for enhancing both interprovincial and international electricity trading (Ibid.).

The issue of interprovincial trade is not only about having physical structures in place to generate or transmit electricity. It is part of the larger problem of creating congruent policies and attitudes. This is the true challenge for politicians, policymakers, and industry. Energy market reform is currently being driven by climate change policies at the federal, provincial, and territorial levels (Ibid., 2). However, the patchwork nature of competitive markets and monopoly utilities complicates the task of unifying provincial transmission policies into something that might be workable across all jurisdictions. Herein lies the paradoxical nature of establishing an interprovincial approach to electricity trade. The federal government cannot intervene without challenge, and the provinces do not all face equal opportunity or motivation to convene on the issue themselves.

Given the complexity of the problem, it is unsurprising that the federal government has made little progress in facilitating interprovincial electricity trade. The Government of Canada published a response to the Standing Committee on Natural Resource's report in March 2018 (Canada). The response agreed with the key recommendations of the report, recognizing the need to accommodate widespread electrification and improve transmissions between jurisdictions. The federal government also announced several national programs investing billions of dollars in green infrastructure over the next decade. This includes the Regional Electricity Cooperation and Strategic Infrastructure Initiative (Ibid.). Though this

infrastructure is obviously needed, the recommendations omitted any major policy or regulatory changes that might be adopted to support these objectives. The federal government can only do so much to encourage provincial interties. Aside from offering funding, it is largely the responsibility of the provinces to work together to sufficiently coordinate policies and regulations.

Scholarly analyses, think-tank pieces, and government publications all assess interprovincial electricity trade from different perspectives. The most complicated aspect of the issue is that it must be viewed both holistically and in parts. Interprovincial trade seems to be in tension with international trade, a situation in which province's individual economic and energy interests supersede the potential for the whole. However, the crux of the issue lies beyond just economics – it is environmental policy, regionalism, energy policy, federalism, law, and finance. With developing climate change policies, a unified approach to electricity trade among provinces is critical. With evidence of the mutual benefit for achieving energy security and climate change goals, the main obstacles remain government jurisdiction over resources and policies. Part logistics and part political will, the future of electricity trade may simply continue to be dominated by finance and economics without a harmonized approach to interprovincial cooperation.

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THE GLOBAL FUTURE OF NUCLEAR ENERGY

BY: ADAM HARRIS-KOBLIN

Nuclear power can be a valuable tool in global efforts to reduce climate change. Despite the promise of this technology, some nations are gravitating away from it. This paper will examine the recent dwindling of nuclear energy and discuss its potential future. First, it will summarize the challenges nuclear energy faces in competing with other energy sources. Second, it will discuss how negative perceptions of nuclear energy endanger its future. Finally, it will discuss the emergence of new technologies and their potential to trigger a resurgence in nuclear energy.

A central challenge facing nuclear energy is the decreasing costs of other forms of energy. In the United States, which produces approximately 30 percent of the world's nuclear-generated electricity, several plants have closed because of the declining prices of natural gas, with roughly 35% of nuclear plants at risk of shuttering because of an inability to compete with the price of natural gas (World Nuclear Association, May 2020; Silverstein, May 2019). For example, Exelon Generation, which owned the now-closed Three Mile Island nuclear plant shut operations at the facility after their request for state aid was denied (Fortin, May 2019).

Three Mile Island Nuclear Power Plant

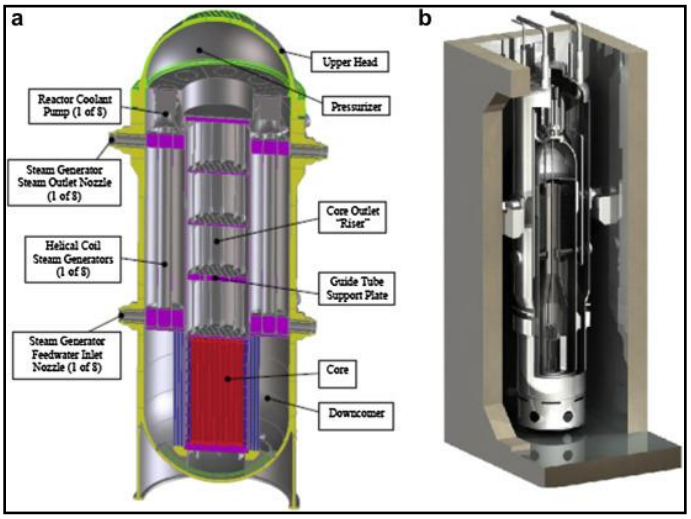
In 2016, New York State began a subsidies program for nuclear plants, delivering $965 million of aid to three of the state's nuclear plants in a two-year span (Walton, August 2016). In contrast, wind power in the US receives robust subsidization from the federal government, receiving $23 per megawatt-hour in Federal Production Tax Credits for wind farms in 2016 (Penafiel, July 2016). Further, the prices of batteries for storing energy, once a major hurdle in the renewable movement, decreased by 85% from 2010 to 2018 (Wade, September 2019). The costs of solar and wind electricity generation have fallen greatly, decreasing by 88% and 69% respectively since 2009, while the cost of nuclear energy has increased by approximately 23% (Forbes Magazine, May 2019).

The global commitment to renewables has also damaged the prospects for nuclear energy. France, which secures 72% of its electricity from nuclear energy, has promised to reduce this figure to 50% by 2035 and to increase its wind power electricity levels by 300% by 2030 (Phys.org, November 2018). Competing energy sources are becoming cheaper, subsidies are scarce, and governments are reducing nuclear usage. Most construction of nuclear plants is taking place in China and Eastern Europe, but many of these projects have been plagued by delays (Plumer, August 2014).

Nevertheless, nuclear energy remains a compelling alternative to other forms of energy, especially in areas that lack abundant supplies of natural gas and other fossil fuels or require greater generating stability than can be provided by renewables alone. Successfully competing with the falling costs of renewables and gas plants could determine the future of nuclear energy.

As mentioned, negative perceptions of nuclear energy challenge its potential for growth. Following the Fukushima nuclear disaster, Germany, facing

overwhelming opposition to nuclear energy -- a sentiment which also partially stems from damage wrought by the Chernobyl disaster -- announced plans to phase out nuclear power completely by 2022 (Bittner, January 2020). Notably, the Fukushima disaster occurred because of an earthquake-generated tsunami and a vulnerable location, not a universal flaw in nuclear technology. German nuclear energy was mostly replaced by fossil fuels, which led to a 5% increase in national carbon emissions and a social cost of 12 billion USD annually (Oberhaus, January 2020). In the US, just 47% of the public believe nuclear energy is safe (Reinhart, April 2018), yet American coal power plants are responsible for the death of 7,500 people annually, while the Chernobyl disaster -- a generational calamity -- killed 4,000 (Stockton, June 2017). Nuclear energy is wrongly perceived as dangerous, and this misguided view is shaping energy policy. These undue fears have the potential to severely hamper nuclear growth in the future.



Small modular reactor

Small Modular Reactors (SMR's) are a growing alternative to traditional, large scale nuclear plants that are significantly simpler, smaller, and are composed of standardized parts (Roberts, July 2018). SMR's generate 300 and below megawatts, compared to 800 megawatts by traditionally sized plants. Because of their small size, they can be more easily deployed close to industrial sites or in areas in need of increased electricity generation, and additional SMR's can be installed to meet demand shifts (Conca, February 2015).

Ontario, Saskatchewan, and New Brunswick are proposing to cooperate on SMRs and the technology is being discussed as a potential tool to lower carbon emissions associated with extraction operations in Alberta's oil sands (Donnelly, December 2019). However, it may be years before this technology becomes commercially viable (Bensadoun, January 2020). Another potential alternative to traditional nuclear plants is micro-reactors, nuclear reactors that produce between 1 and 20 megawatts and are small enough to fit on a truck. They are easily installed, require little oversight for operation and employ modern safety systems to avoid meltdown or malfunction. They are extremely mobile, and can provide emergency electricity to areas of need, like those devastated by natural disasters (*Energy.gov*, October 2018).

China and Russia are currently pursuing floating nuclear plants, which could supply electricity to remote islands, oil platforms, human-made islands, and other coastal areas. Supporters of these plants argue that they are safer than traditional plants, as they could rely on the water they are floating on for cooling in case of malfunction. Critics note that during a nuclear meltdown on one of these vessels, winds could spread radioactivity to other areas (Forsythe, April 2016; Kramer, August 2018). SMR's and micro-reactors may represent a major piece of the future of nuclear energy, with nations gravitating away from the traditional, expensive, and potentially risker large plants. Micro-reactors could become a cornerstone of remote electricity generation if they can become cheap enough to price out renewables and fossil fuels.

In conclusion, the global future of nuclear power is somewhat uncertain. Most nuclear development is taking place in Europe and Asia; it seems that North America is moving away from traditional plants but may embrace new nuclear energy technology.

Falling costs of other energy sources have rendered nuclear energy uncompetitive in certain areas. Nuclear energy does have the potential to be a key component of the energy mix required to resist climate change, as demonstrated by France. Reducing costs of nuclear energy and easing public misgivings will be key to its rejuvenation. In the short-term, nuclear plants may require significant government aid to remain operational, but given the dire predicament of climate change, the cost of aid is undoubtedly justified. If traditional plants continue to close, nuclear energy may become a niche product, especially in North America. SMR's and micro-reactors could become major facets of mobile and remote energy generation. Floating plants may play a role in the future energy mix, but safety concerns, and their inherent limitations as a water-based product severely limit their potential.

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THE SHORT-LIVED EFFECT OF PESTICIDE BANS ON RESIDENTIAL PESTICIDE AND FERTILIZER USE IN CANADA

BY: LISA Y. SEILER

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The effects of fertilizers and pesticides on the environment are widely recognized. Nitrogen, one of the main components of fertilizers, causes toxic algae blooms through run-off into bodies of water. Nitrous oxide is an extremely powerful greenhouse gas, contributing to climate change. The toxic effects of pesticides have long caused concern. Enlisting homeowners in the environmental battle, various jurisdictions in Canada have enacted restrictions on the use of pesticides for cosmetic purposes on residential lawns. Using data from Statistics Canada's Households and the Environment Survey from 2005 to 2015, a period when most of the regulations were implemented, I test the results of those restrictions on residential lawn care practices. The data revealed that cosmetic pesticide restrictions initially reduced the use of lawn chemicals and increased the use of organic alternatives. However, after a short period of time, lawn chemical use has crept back up. The message for policymakers is that the effect of the legislation is short-lived, and renewed efforts need to be undertaken to address the problem of continuing environmental destruction.

In 1991, the town of Hudson, Quebec enacted a bylaw restricting the use of pesticides for cosmetic or aesthetic purposes and was the first municipality in Canada to do so. When this law was challenged and brought before the Supreme Court of Canada *(114957 Canada Ltée (Spraytech, Société d'arrosage) v. Hudson (Town))*, justifications in favour of the law included the health and environmental consequences of urban pesticide use, recognizing that their impact extends beyond the site of application (Canadian Environmental Law Association, 2000). The Supreme Court upheld the bylaw in 2001, which paved the way for cosmetic pesticide bans across the country (CBC News, 2001). At last count, over 180 municipalities and most provinces in Canada have enacted pesticide restrictions (British Columbia Landscape & Nursery Association (BCLNA), 2019). Despite these restrictions, people have learned how to effectively skirt the regulations.

A pesticide applicator spraying a residential lawn Photo: iStockPhoto

Bans on chemical pesticides have been generally accompanied by public awareness campaigns promoting the use of alternative, less harmful lawn care products, not only for pest control but also to encourage healthy lawn growth. In Toronto, Ontario, for example:

[a] pre-bylaw education program promot[ed] natural lawn and garden care methods such as aerating the lawn, leaving grass clippings on the lawn, spreading organic fertilizers like compost, and applying mulch in garden beds and around trees, which can prevent pest problems and minimize the need for pesticides and chemical fertilizers. (Cole et al., 2011)

Thus, it follows that cosmetic pesticide restrictions would not only cause a reduction in chemical

pesticide use, but also a reduction in the use of chemical fertilizers and an increase in the use of organic or natural pesticides and fertilizers. In this paper, I use the term 'lawn chemicals' to refer to chemical fertilizers and pesticides, 'organic products' to refer to organic or natural pesticides and fertilizers, and 'lawn care products' as a general term.

This paper looks at province-by-province data between 2005 and 2015 to determine the effect of these regulations on the use of lawn chemicals by Canadian households. Recent recognition of nitrous oxide as a potent greenhouse gas and contributor to climate change increases the urgency of this review (United Nations Environment Programme, 2019).

Specifically, using data from Statistics Canada's biennial Households and the Environment Survey (HES), I test the hypotheses that pesticide restrictions result in reduced lawn chemical use and increased use of organic alternatives. I analyze the data on a province by province basis over the period of 2005 to 2015, when most of the pesticide restrictions were coming into effect. I find that these hypotheses are generally supported by the empirical evidence, but that the use of chemical products has been on the increase again after the initial compliant drop. This suggests that the effect of legislation wears off over time.

The hypothesis that both chemical fertilizer and pesticide use would decrease because of the bans is borne out in the evidence. As the first province in the country to ban cosmetic pesticides, Quebec exhibits the least chemical use and the most organic fertilizer use of any province. At the other end of the spectrum, the prairie provinces had few bans and are the only region where chemical products use is higher than organic options. It should be noted that chemical production is a large part of the economy of those provinces.

On an overall basis, there has been a noticeable rise in recent lawn chemical use after an earlier drop. This phenomenon is primarily attributable to the most populous province of Ontario, with a large drop in 2009 and a rebound starting in 2013, but a number of other provinces also have shown a drop immediately after their restrictions were enacted, followed by a rise. The decrease in lawn chemical use is accompanied by a smaller and less consistent rise in the use of organic products. Organic pesticide use has seen a recent decline. Quebec, with legislation predating this study, shows low but rising lawn chemical use throughout the period. The increase in lawn chemical use and the lack of increase in organic alternatives suggests that a renewed push is needed if a shift or reduction in lawn care product use is to be accomplished. That push could come in the form of stronger regulations, increased communication, or new alternatives.

This study is not an exhaustive review of lawn chemical regulations but is intended to give an indication of the most notable pieces of legislation and their effects on household lawn care. There are limitations as well in extrapolating limited survey data to the entire population of Canada.

A photo of a sign informing the public of pesticide use on the lawn.

History of Pesticide Regulation in Canada

The town of Hudson took an activist stance in the 1990s against chemical pesticides, acting as the test case for the rest of Canada (BCLNA, 2019) After the approval of the Hudson bylaw, the Province of Quebec moved to swiftly restrict pesticide use, with

a ban on use on municipal and provincial properties in 2002, followed by a usage ban on all lawns by 2005. Ontario was next with a more extensive pesticide ban taking effect on April 22, 2009. Other provinces later followed suit: New Brunswick in the fall of 2009, Prince Edward Island in 2010, Nova Scotia (taking effect in April 2012) and Newfoundland and Labrador in 2011 (taking effect in May 2012), and Manitoba in 2014. Prince Edward Island updated their legislation again in 2017. Provinces west of Manitoba have not yet enacted pesticide restrictions provincially.

On the municipal level, following Hudson, the City of Halifax, Nova Scotia enacted a pesticide bylaw in 2000, with a full ban on pesticide applications on "outdoor trees, shrubs, flowers, other ornamental plants and turf on the part of a property used for residential purposes or on property of the municipality" taking effect in 2003 (Halifax Regional Municipality, 2000). Halifax is by far the largest city in the Atlantic provinces. In fact, its census metropolitan area comprises over forty percent of Nova Scotia's population and over fifteen percent of the total population of the four Atlantic provinces (Statistics Canada, 2018). Thus, the influence of this legislation on the region is significant.

The City of Toronto, Ontario's largest city, had its own pesticide bylaw, which was phased in over the period from 2004 to 2007 (Cole et al., 2011). Enforcement of the Toronto bylaw did not apply to residential users until September 2007. The provincial legislation followed less than two years later.

Although there are no provincial restrictions in British Columbia, over forty municipalities in that province have their own pesticide bylaws, enacted throughout the period from 2003 to 2012 (BCLNA, 2019). In Alberta, the City of Calgary has had only voluntary pesticide restrictions (City of Calgary, 2017), while the City of Edmonton enacted an herbicide bylaw in June 2015.

Pesticides are regulated by all branches of the government. The regulation of the products themselves is a federal matter, coming under Health Canada's Pest Management Regulatory Agency (PMRA) and the *Pest Control Products Act* (PCPA). Following approval of the Hudson bylaw, the federal government updated the PCPA in 2002. Provinces are responsible for regulating transportation, storage, sale, disposal, and use, as well as training and certification of applicators. Provincial regulations may be more restrictive than the PCPA, but provinces may not approve products that have not been approved under the PCPA. Provinces may allow municipalities to enact bylaws further restricting the use, but not the sale, of pesticides. Most restrictions on use apply only to the cosmetic use of pesticides, that is, non-essential use.

Canadian Fertilizer Industry

The Canadian fertilizer industry produces "nitrogen, phosphate, potash and sulphur fertilizers… contributing over $23 billion annually and 76,000 jobs" to Canada's economy (Fertilizer Canada, 2019). Of those jobs, over half are in Alberta and Saskatchewan with 21,000 and 20,000, and another 6,000 jobs are in Manitoba. The remainder are mainly in Ontario and Quebec. Thus, the economic impact of the industry is greatest in the three prairie provinces. Canada is the third largest producer of the primary fertilizers (nitrogen, phosphorus, and potassium) in the world and the number one producer of potash fertilizer globally.

The industry organization known as Fertilizer Canada acknowledges the impact of fertilizers on climate change due to the emission of nitrous oxide (a greenhouse gas), and on water quality due to excess nutrient run-off and leaching into water sources. As a solution, the organization has recently been working with provincial governments to promote a nutrient stewardship program as an industry standard for the agricultural sector. Fertilizer products are regulated by the Canadian Food Inspection Agency under the *Fertilizers Act* and Regulations. No regulations exist for residential fertilizer use.

Effect of Residential Lawn Chemical Use

Lawns are the largest irrigated crop in the United States. While the agricultural sector uses more chemicals in absolute terms, the rate of application of residential lawn chemicals is generally higher than in the agricultural sector (Blaine et al., 2012). Overfertilization by homeowners can be a problem (Martini et al., 2015). The excess nutrients can cause pollution of local waterways through stormwater run-off, and lead to toxic algae blooms and dead zones in lakes and oceans. Pesticides can cause human health concerns and the loss of beneficial wildlife, such as pollinators.

In addition to water quality problems, the production of chemicals contributes to global climate change. "The major warming effect is via increased emissions of nitrous oxide (N_2O), a greenhouse gas that is 300 times more potent than CO_2" (Townsend et al., 2012). Human interference with the global circulation of nitrogen and phosphorus, two components of fertilizer, has reached critical levels, affecting both the climate and global food security (Figure 1). Reducing residential use of chemical fertilizers and pesticides will not solve these problems but should be part of the potential solutions.

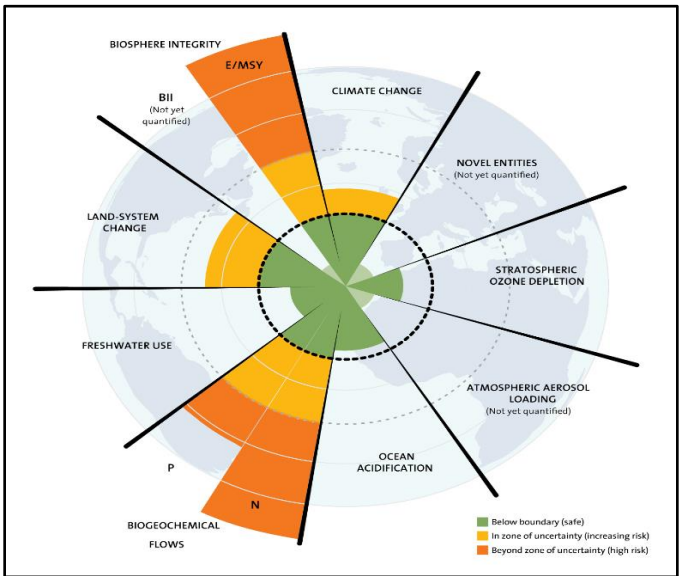

Figure 1: Planetary boundaries. P=phosphorus, N=nitrogen Source: Stockholm Resilience Centre (credit: J. Lokrantz/Azote based on Steffen et al. 2015)

However, the effect of shifting to organic products has not been well-received by all. For instance, many find dandelions unsightly and organic products ineffective at controlling them (Global News, 2019).

Behaviour Research

An increase of research into residential lawn chemical use, particularly fertilizers, has been undertaken in the United States in response to water quality concerns. These studies are generally surveying residents' behaviour or attitudes within a city or small geographic region, in order to inform local policy initiatives. The main finding in each of these studies is that neighbourhood norms and social interactions are a strong determinant of continued use of lawn chemicals despite their negative effects.

A New England study found that there is a willingness to adopt more environmentally-friendly lawn care practices if public education addresses perceived barriers, such as cost and appearance (Eisenhauer et al., 2016). A lack of discretionary time also leads to greater lawn chemical use, since, for example, hand weeding is much more time-consuming than applying chemicals (Templeton et al., 1999). The very visible nature of lawns leaves them vulnerable to social influences. Such influences, however, could be negative or positive, depending on local attitudes toward the environment (Brick et al., 2017).

Norms can be descriptive, indicating what is commonly done, or injunctive, indicating what ought to be done (Abrahamse and Steg, 2013). If using chemical pesticides becomes common, even though they are banned, that descriptive norm can loosen the injunctive norm against using them. A study of smoking in Quebec over approximately the same time period as this paper addresses this rebound issue (O'Loughlin et al., 2013). Researchers surveyed students over time to determine the effect of the provincial smoking ban on smoking by staff members, finding that there was an initial compliance but then an increase in

smoking. The conclusion is that the effect of legislation diminishes over time.

In a comparative survey of attitudes toward pesticide use in Calgary and Halifax, Hirsch and Baxter (2009) found that pesticide use in Calgary, where voluntary restrictions were in effect, was much higher than in Halifax, with mandatory restrictions. It is acknowledged that "to the extent that chemical pesticides contain petroleum by-products, there is a greater degree of attachment to the chemical pesticide industry in Calgary than in Halifax" (Hirsch and Baxter, 2009, p. 471). In both cities, neighbourhood norms, such as maintaining a weed-free lawn, carried more weight for many than the health risks of pesticide use. Injunctive norms, such as mandatory restrictions, relieve individual residents of the need to justify refraining from pesticide use.

Norms spread through social networks or diffusion (Abrahamse and Steg, 2013). Thus, the enactment of pesticide restrictions in Halifax, as a major centre for Atlantic Canada, could lead to a decrease in lawn chemical use throughout the region.

Methodology and Data

The source of the data for this study is the biennial Households and the Environment Survey (HES) undertaken by Statistics Canada. The purpose of the HES is to measure selected household behaviours that have an impact on the environment (Statistics Canada, 2016). This Canada-wide survey is undertaken in conjunction with the Canadian Community Health Survey (CCHS), which uses a multistage stratified cluster design. Data is collected using a computer-assisted telephone interviewing (CATI) system. The HES typically has a survey size of 14,000 to 22,000 households, with a response rate of over seventy percent.

The HES was first undertaken in 1991 and 1994 and was restarted in early 2006, addressing behaviour in the previous calendar year (2005). The surveys from 2007 onward were conducted starting in the fall of the year of the survey, addressing behaviour in the previous twelve-month period. This study covers all public-use master files (PUMF) to date: six cycles of the HES, from 2005 to 2015.

The sample for each dataset is limited to those households that have a lawn and are not living in an apartment. The 2006 HES split housing type into single detached, apartment, and other. Other years were split into apartment and other. Presence of a lawn was a survey question in all iterations. The option of not having a lawn also appeared in the fertilizer use question in the 2006 HES, possibly due to asking the questions in a different order. Those without a lawn were eliminated.

The dependent variables for this study are dichotomous variables indicating whether the household applied chemical or organic fertilizers or pesticides (see Table 1). The wording of the applicable questions was consistent for the 2007 to 2015 iterations of the HES. A series of four questions asked whether: 1) chemical fertilizers, 2) organic fertilizers, 3) chemical pesticides, or 4) organic pesticides were applied to the lawn or garden in the previous twelve months. Organic choices were not included in the 2006 HES, but that data seems to mostly consistent with the 2007 data for chemical fertilizer and pesticide use, so those results are included in this study.

Two major independent variables are used in this study: province and year. Province is a categorical variable resident in each dataset. The HES includes all ten provinces but excludes the territories. Due to the use of descriptive statistics only, year was addressed by simply obtaining the descriptive statistics from each dataset separately. Percentage of households, rather than absolute numbers, are used to ensure comparability. Weights contained in the databases are applied, to reflect the Canadian population.

	2005	2007	2009	2011	2013	2015
DEPENDENT VARIABLES*						
Uses chemical fertilizer	34.49%	28.35%	22.50%	21.50%	25.20%	27.83%
Uses organic fertilizer		35.78%	37.82%	36.95%	37.04%	37.86%
Uses chemical pesticide	31.90%	26.09%	15.12%	15.38%	19.20%	19.31%
Uses organic pesticide		12.23%	14.72%	15.23%	15.89%	14.10%
INDEPENDENT VARIABLES						
Province						
Newfoundland and Labrador	1.98%	1.85%	1.80%	1.86%	1.97%	2.04%
Prince Edward Island	0.52%	0.50%	0.48%	0.54%	0.54%	0.48%
Nova Scotia	3.38%	3.52%	3.58%	3.07%	3.39%	3.23%
New Brunswick	2.88%	2.82%	2.80%	2.64%	2.69%	2.59%
Quebec	22.17%	21.98%	22.46%	22.99%	22.45%	23.08%
Ontario	38.32%	38.39%	38.15%	37.22%	36.82%	38.51%
Manitoba	3.84%	3.84%	3.63%	3.33%	3.86%	3.63%
Saskatchewan	3.52%	3.32%	3.26%	3.08%	3.17%	3.29%
Alberta	10.97%	11.52%	11.05%	12.49%	12.63%	12.08%
British Columbia	12.42%	12.26%	12.79%	12.78%	12.48%	11.06%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Year n	21,052	17,166	11,649	11,543	17,382	11,413

* % of households with lawns not living in apartments; could be overlap between categories

Table 1: Descriptive univariate statistics, weighted HES PUMF data

Findings

The graph of fertilizer and pesticide use across Canada (Figure 2) shows a decline in the use of chemical products between 2005 and 2009, bottoming out in 2009, and then gradually increasing again. The 2005 data may be somewhat inflated because the survey questions did not distinguish between chemical and organic products. Growth in the use of organic products coincides with the decrease in chemical use but has been stalled since 2009.

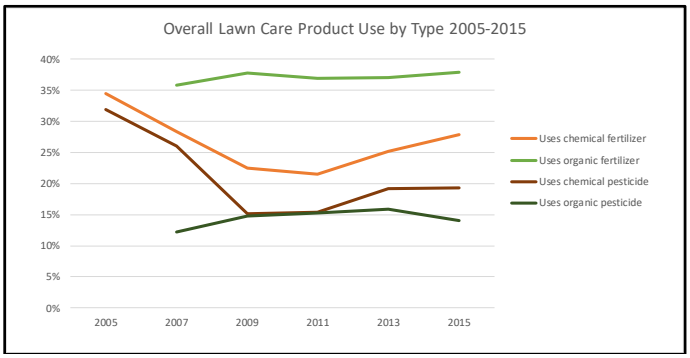

Figure 2: Percentage of Canadian households with a lawn using lawn care products, weighted HES PUMF data

Figure 3 shows provincial differences in the use of lawn chemicals and the popularity of the different types of products, as well as the specific effects of provincial legislation. The most notable regional difference is that the three prairie provinces – Alberta, Saskatchewan, and Manitoba – are the only provinces where both types of chemical product use (brown lines) are higher than organic alternatives (green lines). These provinces are all chemical producing provinces. Quebec demonstrates the reverse of this: it is the only province where both types of organic products are more popular than the chemical versions. Another general finding is that fertilizers (the lighter coloured lines) are used more than pesticides (the darker lines), except in Manitoba and for a short period in Saskatchewan and Prince Edward Island (PEI), all of which are largely agricultural provinces. We turn now to a province by province analysis of the effects of legislation.

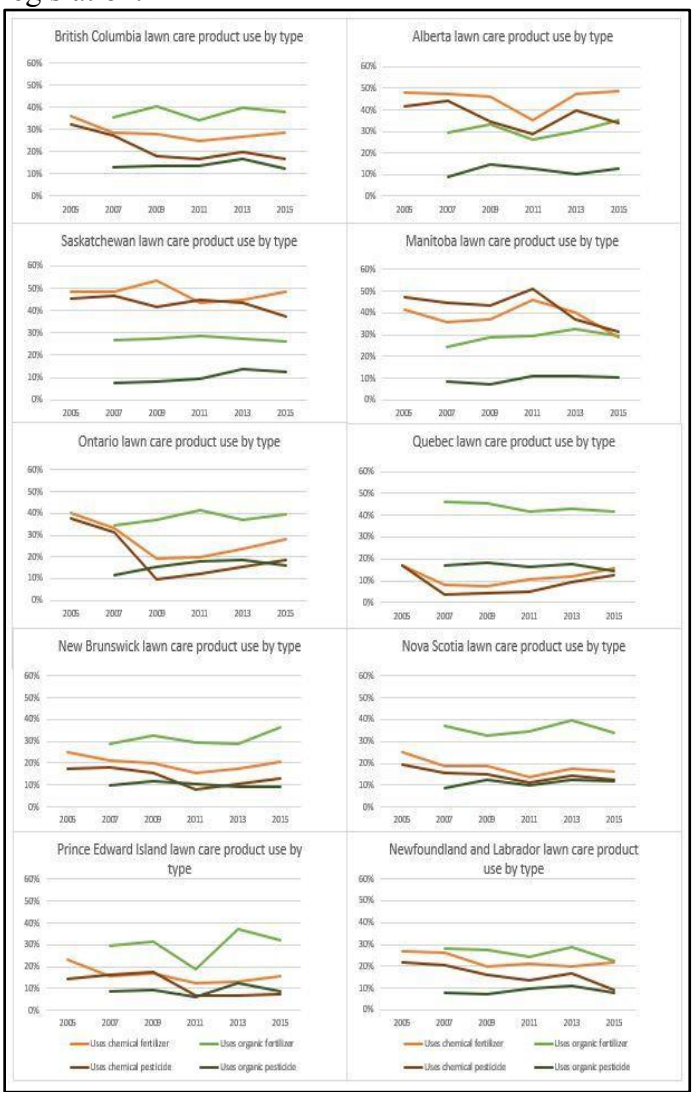

Figure 3: Percentage of households with a lawn using lawn care products, weighted HES PUMF data

Quebec, the first province to introduce legislation, has the highest organic product use of any province, with organic fertilizer use consistently around 45% of households with a lawn. Until 2013, it also had the lowest chemical product use of any province. Quebec's pesticide restrictions fully took effect in 2005. The high 2005 values for Quebec could be due to the inclusion of organic products with chemical products, as previously noted. Chemical fertilizer and pesticide use were at their lowest points in 2007 and 2009 and having been climbing gradually since then. This indicates a diminishing effectiveness of the restrictions over time.

Ontario, comprising of over one-third of the survey, is the primary source of the large overall drop in chemical use between 2007 and 2009, and parallels the overall results in Figure 2. Toronto's pesticide ban took effect in 2007, and the provincial ban in early 2009. Where other provincial bans mostly apply only to lawns, Ontario's is much more restrictive, accounting for the more substantial drop in that province. The drop in chemical pesticide use is accompanied by a similar drop in chemical fertilizer use. Organic product use in Ontario increased steadily from 2007 to 2011 but has been wavering since 2011. Chemical product use stayed low in 2009 and 2011 but has been rising again since 2011. Chemical pesticide use overtook organic pesticide use again by 2015. As in Quebec, the effect of the restrictions appears to be wearing off.

The Atlantic provinces – New Brunswick, Nova Scotia, PEI, and Newfoundland and Labrador – where pesticide restrictions were enacted shortly after Ontario, all show slight dips in chemical pesticide use in 2011. Between 2009 and 2011, legislation took effect in both New Brunswick and PEI. A very gradual increase in chemical product use can be seen in those two provinces since 2011, indicating a possible wearing off the effect of the legislation. Nova Scotia's legislation was passed in 2010 but did not take full effect until 2012 and Newfoundland and Labrador's legislation was passed in 2012. The rise in chemical use in Nova Scotia and Newfoundland and Labrador in 2013 is, therefore, curious, although it falls again in 2015. The four provinces have a relatively low use of products in comparison to the other provinces. This could be due to a diffusion effect from the City of Halifax's early lead in introducing a cosmetic pesticide ban in 2000. Nova Scotia's more recent pesticide ban is the only one other than Ontario that extends beyond lawns. However, that did not result in a similar big drop, likely due to the earlier municipal bylaw, which was also extensive.

British Columbia, which has no provincial restrictions but many municipal bylaws against cosmetic pesticides, shows little by way of discernable patterns. Chemical pesticide use did drop significantly between 2005 and 2009 and continued to stay at the lower level. This corresponded to pesticide restrictions rolling out in the Greater Vancouver Area (BCLNA, 2019). The lack of a visible bounce-back effect could be due to the continued enactment of new municipal pesticide bylaws beyond 2009.

Chemical fertilizer and pesticide use in the prairie provinces is much higher than in the other regions of Canada. No provincial pesticide restrictions exist in the prairie provinces, except for Manitoba, which introduced restrictions in 2014. Manitoba exhibited sizable drops in both chemical fertilizer and pesticide use between 2011 and 2013 and a further drop by 2015, reflecting the introduction of legislation, but no increase in the use of organic products. The level of use of chemical fertilizer dropped below that of organic fertilizer in Manitoba in 2015. Both Alberta and Saskatchewan exhibited small decreases in chemical pesticide use between 2013 and 2015, reflecting Edmonton's 2015 herbicide bylaw and possibly echoing the Manitoba legislation. Manitoba's spike in chemical use in 2011 and Alberta's dip at the same time are puzzling. Organic product use in Alberta appears to be on the rise.

Conclusion

Most provinces exhibited a decrease in chemical pesticide use corresponding in timing with the enactment of pesticide restrictions. That decrease

was generally accompanied by a decrease in chemical fertilizer use, reflecting increased awareness of the environmental impacts of chemicals and/or a general change in industry practices. Many provinces, however, also experienced something of a bounce-back effect after the initial decrease in chemical use, as the restrictions lost their impact. The legislation, moreover, has not resulted in a significant increase in the use of organic alternatives. In fact, the use of organic pesticides appears to be on the decline. The failure to shift to organic pesticides could be due to frustration with results, conflicting reports on their environmental benefits, lack of enforcement, and the reality that many chemical versions are still available for purchase, even though they are banned for cosmetic use. Essentially, chemical pesticides are perceived to work with minimal effort, so people continue to use them.

One potential explanation for the steep decrease in product use in 2009 is the financial crisis of 2008. Similar analyses were undertaken by level of income, but there was no noticeable difference in patterns between low-income and high-income respondents that would indicate a financial effect. Of more relevance is the difference between provinces, where the patterns clearly correspond to the introduction of restrictions on cosmetic pesticide use. The overwhelming effect of Ontario – over a third of the sample – on the results provides the main explanation for the large drop in chemical product use in 2009.

The implication for policymakers is that the dated pesticide legislation needs to be readdressed if it is to have a continued positive impact. Social norms and concerns have tended to outweigh compliance. American studies have concluded that increased education on the environmental effects of lawn chemicals is warranted, and that a neighbourhood approach is more likely to achieve success than broadly addressing the general population (Blaine et al., 2012). Educational approaches should address barriers of cost, time, and lawn appearance.

An interesting development is new government financial support for alternative landscaping in Minnesota, replacing lawns with “bee-friendly wildflowers, clover and native grasses” (Return To Now, 2020). This is a win-win-win as it simultaneously reduces the negative impacts of lawn chemicals, assists struggling pollinator populations, and eliminates the time and cost factors for homeowners through a self-maintaining property, once installation is complete. Social acceptability is the key to behaviour change for a visible behaviour such as lawn care.

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THE POLITICS OF CLIMATE CHANGE - EMBEDDING REGULATORY GUIDANCE FOR SCENARIO ANALYSIS AND CLIMATE RISKS DISCLOSURE IN THE FINANCIAL SECTOR

BY: ADEBOYE OYEGUNLE

The increasing risk of climate change on the financial sector's investment and assets threatens financial stability and the economy. This challenge is exacerbated by inadequate climate accountability, especially the "answerability" and "enforceability" of climate commitments (Newell, 2008), and inadequate data on the possible impact of climate change on the financial system. This situation has created the need for a clearer and more robust climate disclosure commitment, which speaks to the need for financial institutions to clearly disclose the climate risks they are exposed to, backed by realistic scenarios' assessment of financial assets and investments to help support the mitigation of climate impact on the financial system.

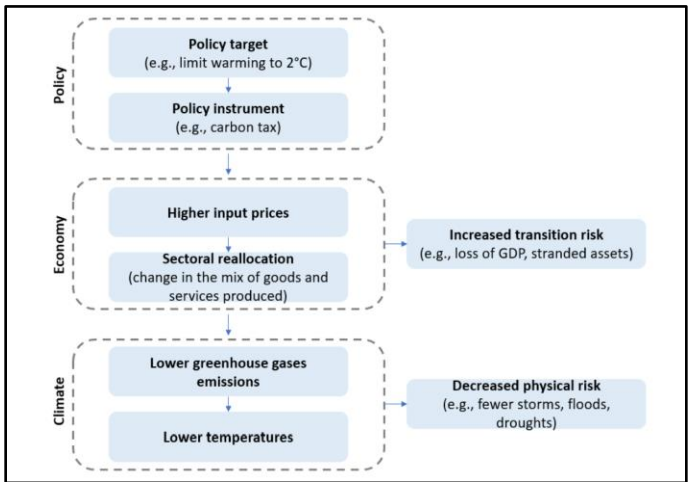
The ability to project a probable future is why scenario analysis is important to financial institution's climate risk impact. Climate change risks threaten the ability of economies to thrive and may negatively impact key sectors of the economy. This will be detrimental to financial assets and investment of firms and the financial institutions that finance them (Dafermos, Nikolaidi, & Galanis, 2018). It may also result in serious risk to financial stability, since efforts to control the negative impacts of climate may necessitate the development of climate policies or other transitions to low carbon economy efforts that are targeted at mitigating climate change effects instigated by rising temperature and weather unpredictability. This will threaten the global economy and financial systems and can impede banks' and other financial institutions' ability to meet their financial objectives (Batten, Sowerbutts, & Tanaka, 2016).

At the heart of understanding the financial risk of climate change is the need to identify and mitigate its impact on financial assets and investments. This calls for collaborative input from financial institutions and central banks since climate risks have macroeconomics implications which threatens the financial system (Batten, S., Sowerbutts, R., Tanaka, M., 2020) and may require prudential guidance approach to managing it. Unfortunately, achieving this goal is not straightforward as there is no clear understanding or data to show the extent of financial impact of climate risk exposure and its inherent risks and opportunities (Battiston, Mandel, Monasterolo, Schütze, & Visentin, 2017).

Illustration of a person shielding (themselves) from plummeting stock prices that are drawn to look like rain falling from the sky (adapted from Inter Press Service News Agency)

To address this, the Financial Stability Board's (FSB) Financial Task Force on Climate-related Financial Disclosures (TCFD), recommended the use of scenario analysis to help provide forward-looking assessments of climate-related risks, while highlighting climate risks and opportunities upon which strategic decisions on climate change risks can be made (TCFD, 2017a). Since the introduction of TCFD, a growing number of stakeholders in the financial sector are beginning to adopt scenario-based assessment on a voluntary basis as its

recommendations become more critical to bridging the unknown impact of climate risk on their assets and investments. This paper aims to review the growing relevance of scenario analysis and climate disclosure in the financial sector, especially in helping to determine plausible impact of climate risk on financial assets and investment and how regulatory guidance can help steer the financial sector towards averting worse case climate scenarios.



The relationship between policy, the economy and climate (Bank of Canada, 2020)

Climate Risk Disclosures and Scenario Analysis

Climate risks can be categorized into two groups; physical risks, which refer to the risk of physical damages on physical investment such as severe weather, and transition risks, which occurs as a result of a shift to low-carbon economy, such as changes in technology, market, reputational or policy conditions (Gros et al., 2016; Scott, Huizen, & Jung, 2017; UNEP, 2018). Physical risks can be classified either as chronic – referring to gradual changes in weather patterns, or acute which refer to hazardous impacts of extreme weather events such as hurricanes (Mazzacurati, Firth, & Venturini, 2018; TCFD, 2017). These risks can have macroeconomic impacts such as inflation and/or price instability, or losses due to extreme weather leading to a growing interest in understanding their nature and effects.

The need to understand impacts of climate risks and potential opportunities is one of the reasons the call for climate disclosure is becoming mainstream in the financial industry's efforts to manage physical and transition risks. For example, financial analysts may ask what the impact of a new policy directing the zero-carbon goal in Canada in the next decade will be? Considering the Canadian banking industry's current high exposure to oil sands and other carbon intensive investment such as mining, it begs the question of what the future of this industries will be and the ability of banks to recoup investments, if such policies take effect.

This is why the interest in scenario analysis as a forward-looking tool to assess plausible future realities of climate change risks and opportunities for financial sectors portfolios (Battiston et al., 2017; Scott, Huizen, & Jung, 2017; UNEP FI, 2019b) is on the rise, since it can help bridge the gap by providing realistic insight into probable outcomes even with the lack of historical precedent on the impact of climate-related financial risk. Understanding these risks and opportunities and how they may impact financial portfolios will help the financial sector to take necessary mitigating actions against these risks and adequately position for the opportunities that either scenarios may present.

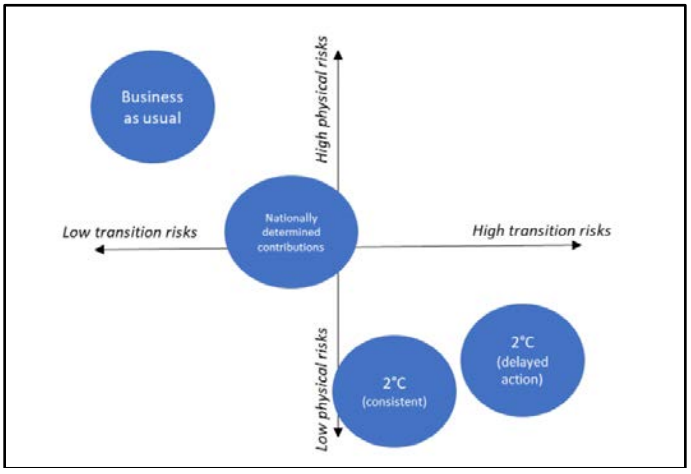
Carving Financial Sector's Scenario Pathway

Climate scenarios have been utilized in strategic decision making, risk mitigation and to determined future scenarios. It has also been useful for climate modelling efforts developed in response to specific scenarios of temperature change or aerosol concentration, whose results were achieved by manipulating models output and climate data (Mearns et al., 2001). Likewise, scenario modelling was adopted by the IPCC and other reports to determine plausible climate and emission pathways into the future (IPCC, 2014; IPCC, 2019; Masson-Delmotte et al., 2018; Mearns et al., 2001; Tol, 2016) and had been used to assess energy and GHG pathways (Van Vuuren et al., 2017). Despite its relative usefulness in crafting plausible consistent

description of possible futures, its use is relatively new and in its infancy in the financial sector (Battiston, Mandel, Monasterolo, Schütze, & Visentin, 2017). However, there has been increased interest in its use by the sector since the TCFD recommendations were released, with different recent studies and reports defining what and how this will look like considering that most scenario models were not originally designed for the financial sector (UNEP FI, 2019a; UNEP, 2018).

As the need to assess what the likelihood of climate impact will look like, there has been an uptick in the use of scenario analysis to help access the likely impact of climate risk on financial institutions portfolio and operations of industries they are exposed to. The increasing interest in climate scenario and adoption by financial institutions has been encouraged mainly by three major factors. First, the unpredictability of climate effects on financial sectors' portfolio and need to develop applicable mitigation and adaptation process to help manage these impacts. Second, the lack of adequate historical model upon which decisions can be patterned against, which makes decision-making for future impact almost impossible, due to limited research on climate change impact in the financial sector. While we have an idea of what the impacts of climate change maybe, it is difficult to predict the extent of these impact on financial investments. Third, the need to create a climate disclosure approach that will help meet diverse stakeholders' expectations, while bridging the unknown gap of future state of assets and investments in financial systems portfolios and their exposure to different climate risks and opportunities.

The argument for scenario analysis is that it is very useful for determining future probable state for medium-to-long-term models that are often uncertain, hence its suitability for understanding possible future outcomes of climate risks (TCFD, 2017b). The fact that there has been no antecedent to follow or specific methodology to address financial risks exposure makes this more important as it means the industry will either formulate its own process or adapt established scenario analysis models that may not have any correlation with the financial industry. The latter has been the most common approach with recent studies showing the adaptation of various scenario models from other sectors. There are also series of ongoing efforts to help develop diverse climate related risk scenario analysis which are led by both regulators and industry actors for the financial sector (Ens & Johnston, 2020; NGFS, 2019; UNEP FI, 2019a; UNEP, 2018).



Illustrative scenarios show a range of physical and transition risks (Bank of Canada, 2020)

Scenario Relevance and Evolving Regulatory involvement

The use of scenario analysis is not to forecast or predict (Schoemaker, 1991) but to frame differing and complex set of hypotheses about the future (Coreau, Pinay, Thompson, Cheptou, & Mermet, 2009). Scenario analysis is best applicable in uncertain situations in which there is a lack of human ability to control outcomes, (Bohensky et al., 2011). By using scenario analysis as part of climate disclosure measures, financial institutions will be able to determine the effectiveness of their climate strategy into the future. This will allow them to take advantage of opportunities that may arise or mitigate risks that may occur through climate change (Scott et al., 2017). Addressing this will help ensure that necessary steps are taken against projected risks in terms of policies as financial institutions get to

understand how the financial system may be impaired by climate risks.

Globally, there is increasing interest in the impacts of climate risks on financial systems (Battiston et al., 2017). For example, the French Energy Transition law expects companies to provide extensive disclosures on climate-related risks of their portfolios and the mitigating steps being taken to address such risk (Ameli, Drummond, Bisaro, Grubb, & Chenet, 2019). It also requires that banks conduct climate-related stress testing of their portfolio of loans and disclose the results. In December of 2017, eight central banks and financial regulators in high-income and emerging economies formed a Network for Greening the Financial System (NGFS) to tackle climate exposure and other similar risk issues in surrounding financial risks (Campiglio et al., 2018). By September 2020, the NGFS membership has risen to 73 members and 13 observers made up of central banks, settlement houses, financial supervisory authorities, and other multilateral organizations.

The Bank of Canada (BoC) is also part of this effort and has already taken steps aimed at encouraging climate disclosures and scenario analysis at the financial institution level, while it published its first paper on climate scenario analysis for the Canadian banking sector in May 2020, though it has made no commitment on taking regulatory action. However, the Bank of England is leading the way on this effort. In June 2020, it released the first climate-related financial disclosure, where it laid out its approach to managing climate risks across its operations and how it intends to tackle future climate challenges. The Bank had also provided support for NGFS and plans to develop a biennial exploratory scenario on financial risks from climate change by 2021 which will help test the financial industry's current business model climate resilience to physical and transition climate risks in the United Kingdom and beyond. However, despite these efforts, most central banks have made the implementation of this a voluntary rather than required process, with most regulators arguing that they are not in the business of policing banks and other financial players (Ens & Johnston, 2020), which technically leave financial institutions to act at their discretion.

Need for Regulatory Input and Guidance

As scenario analysis use for assessing climate risk becomes more mainstream in the financial sector, there is a need for regulatory direction to help provide guidance on climate disclosure and scenario analysis models. This is important for two reasons – understanding and appraising climate risk needs to be premised on scenario models that provides realistic insights into probable climate solutions and realistic future projection that are reliable. Second is the challenge with data and relevant disclosures, which speaks to the need for regulatory led disclosure requirements. This is important as financial data is not often readily available and financial institutions do not often share their individual data beyond regulatory required information, which makes it challenging to determine the extent of climate impact on their portfolio and other investments.

The systemic nature of climate risk is another reason regulatory input is necessary. Managing the systemic risk of climate change requires a different approach because of its externalities (NGFS, 2019), and the unpredictable nature of its risks (Batten, Sowerbutts, & Tanaka, 2016). Current trend data and scientific evidence points to the fact that there is a need to act, since failure to prepare for or late transition to a low-carbon economy may come at a huge cost to the financial system (Gros et al., 2016).

Some papers and academic studies have already reviewed the need for central banks' involvement in climate risk efforts, especially around what roles the central banks should be playing in climate change efforts (Campiglio et al., 2017). However, the question of regulatory enforcement and best approach remains unanswered. Also, the suggestion that central banks should aid best practice through information sharing on scenario analysis modelling (Campiglio et al., 2018) will not be enough because

we are already behind on climate action. The argument has been that enforcing regulatory standard and climate disclosure on financial institutions may have an adverse impact on the financial system. Also, central banks despite having regulatory and supervisory authority are unwilling to assume a position that may be perceived as policing the financial system. These stance are however not without fault considering the economic and environmental impact of inaction which may result in sudden shift in market demand, technological shift or policy change that may expose financial institutions to transition risk impacts which the financial sector may be completely ill-prepared for.

Despite these realities, this paper is not advocating for a direct regulatory enforcement, but rather seeks to recommend a more involved approach by central banks and guidance on provision on the way forward. One area that central banks can start getting involved is in charting a path forward for scenario analysis modelling in the finance industry. Very few central banks are doing this currently, but more needs to be done both in terms of oversight and leadership.

There is also the need for collaboration and standardization of scenario analysis methodologies in the financial sector. There are too many scenario models method with often conflicting approaches, which makes existing studies incomparable and results inconsistent for useful research conclusions. There are a few reasons for this – first, the scenario analysis models that are available utilizes different methodologies and were mostly developed for purposes other than the use of the finance industry, the industry being late to the game are only adopting these available standards for its use. Second, there are inconsistencies in approaches and results due to proliferation of methods and diverse objectives, most of which are driven by profit motives, with each business and consultants trying to outdo one another on the best method and approach. Likewise, there is the evolving nature of scenarios and inaccessibility of financial data, which without adequate policy direction on expectations may not be effectively tackled. Unfortunately, there may be no immediate end to this since implementation is at the behest of individual institution's voluntary discretion. Voluntary reporting is susceptible to greenwashing and have not always been effective. Yet, this can be addressed through a policy guide approach that will support financial institutions on the appropriate models, methods and technical input where necessary.

Through the NGFS, there is now an increased awareness and interest in understanding the financial risk of climate change by central banks. There are also ongoing efforts by multilateral organizations such as United Nations Environment Programme Finance Initiative (UNEP FI) and Principles for Responsible Investment (PRI), to help their members develop scenario methodologies and how to manage climate risks in their portfolios using scenario analysis. But despite these efforts, there are still gaps in implementation due to lack of guidance framework, hence the need for regulators to do more.

Some of the ways that has been suggested for central banks to act in addition to disclosure requirement includes discouraging investment in fossil fuel, through green financial assets purchase, change regulatory weight for financial assets to reflect the assets climate risks exposure, and utilize credit allocation mechanisms that will help influence increased lending to green investment and businesses (Vaze, Meng, & Giuliani, 2019). Regulatory direction in these areas will enable banks to make coping decisions that will ensure that regardless of the impact of transition to a carbon-free economy or physical damages to assets, they will avoid resultant financial effects (Campiglio et al., 2018). Also, considering the threat to the financial system and to financial stability it is expedient that a regulatory directive is in place to guide scenario development at financial sector level and to help manage the stability of the economy.

What Next? Policy Direction and Recommendations

The nature of the financial sector and investors such as banks puts them at risk of the unpredictability of climate change. This has necessitated the need for the development and coordination of policymakers and regulators to address the concerns of climate-related financial risks (Campiglio et al., 2017). Lack of action now may lead to a need to take abrupt actions in the near to medium term, which may have consequences that may be detrimental to the economy (Ens & Johnston, 2020). This is a possibility if we consider the IPCC warning and the need to act now by reducing emission to net zero by the middle of the century (IPCC, 2019).

This paper has established that to achieve this goal, there is a need for regulatory action, particularly considering that the present voluntary corporate action approach by financial regulators are not effective. While this paper does not advocate for the complete enforcement of a climate risk regulatory mandate or the complete overhaul of the current approach, it proposes the development of policy guidelines that will help financial institutions navigate the scenario assessment path and provide an industry relevant climate disclosure approach that has relevant indicators, which can help drive efforts toward climate risk mitigation. The following actions need to be taken for climate risk mitigation and implementation of regulatory driven climate disclosure expectations based on scenario pathway expectations.

(1) Need for prudential guidance

There is a need to embed regulatory expectations for financial institutions by providing guidance for climate disclosure that has scenario assessment as its key component. This guideline will help serve three purposes: It will show the central banks' commitment to climate risks, while providing a necessary path for climate reporting and relevant disclosures that will help stakeholders make informed decisions on probable and obvious climate risk. Central banks' leadership in this area this will compel financial institutions to act especially in terms of taking action towards a low-carbon economy. This is necessary as it will enable financial institution plan and understand the nature and extent of risks they may be faced with. It will also avail the regulator a fair understanding of the possible macroeconomic impact and the nature of systemic risk in the financial sector. This disclosure must include but should not be limited to declaring the probable and realistic climate impact of financial institutions loan exposure, investment and assets and providing necessary information that will be relevant to financial sector's ability to develop a resilient system based on the knowledge of possible scenario pathways for economic and climatic realities.

(2) Climate disclosure measurement and reporting

One of the key challenges with climate risk impact measurement is the lack of available data to measure climate risk impact which is critical to understanding climate effects. It is also very necessary to know this to be able to accurately undertake a scenario assessment and other quantifiable calculation of future climate projections. The reality is that data is sparse and not readily available in the financial sector and has been an impediment for researchers to accurately study and estimate what climate risk impact may look like for the financial system. This challenge can be resolved to a large extent if clear, deliberate and detailed climate disclosure is required from financial institutions. The goal is to collect data and publicly report to provide access to both investors and other stakeholders to make informed decision on the climate exposures of financial institutions.

(3) Taking the lead making climate disclosure expected regulatory deliverable

The Bank of England has already taken the lead by releasing its own disclosure report. But central banks need to do more by making it standard for the industry they regulate to be more open and to disclose their ongoing exposures to climate change. In doing this, central banks need to make sure that climate disclosure becomes a key regulatory expectation without necessarily introducing a punitive mandate, developing a reporting standard

alone for financial institutions will go a long way in ensuring compliance. As part of this, central banks need to develop their respective disclosure approaches and overarching scenario models that are locally or regionally applicable. It could also create incentives to encourage involvement, while taking deliberate proactive measures to contribute to the protection of the economy and ensure financial stability.

Conclusion

With a growing regulatory interest there needs to be a concerted effort on policy guidance and direction, since one of the major challenges with implementing climate risk mitigation effort is the lack of strategic policy guidance. Although there is no immediate solution to climate risk challenges, implementing some or all these measures is important to the success of mitigating the impact of physical and transition risk on the financial sector. The need to act is further established by the fact that scenario analysis use in the financial sector is in its infancy, which can be supported by financial regulators' action on standardization, guidance, and collaboration. The extent of action taken by the central banks for their respective economies will go a long way in the climate fight and may help define the outlook and relevance of scenario assessment in the financial sector into the near future.

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MEET THE TEAM

OSIVUE ITSEUMAH

Osivue is a recent Master's degree graduate of the Public Administration program at the School of Policy Studies at Queen's University. He received his Bachelor's degree in Political Science & Communication Studies from York University. Osivue is passionate about community development, youth employment and equitable public infrastructure.

DOMINIC MOTT

Dom has an Honors Bachelor of Arts degree in Criminal Justice and Public Policy from the University of Guelph and is completing a Master of Public Administration at the Queen's School of Policy Studies. Born and raised in the small town of innerkip, his research currently focuses on innovative policy approaches to cybercrime and has recently completed a research paper analyzing the applicability of espionage legislation in the cyber domain.

MICHAEL MANTLE

Before entering the Master of Public Administration degree at Queen's University, Mike attended the University of Guelph, the University of Ottawa, and McGill University respectively. Hailing from Hamilton, Ontario, Mike is keen on serving to protect vulnerable populations under the Human Rights Code of Ontario and other legal mechanisms available.

ADAM HARRIS-KOBLIN

Prior to beginning his studies at Queen's University, Adam earned his Honours Bachelor of Arts in American Studies and English Literature from the University of Toronto. He is a lifelong resident of Toronto.

SHELBY DOCKENDORFF

Shelby completed her Master of Public Administration at Queen's University's School of Policy Studies. She previously attended Wilfrid Laurier University, where she graduated with an Honours Bachelor of Arts in Communication Studies with a Minor in Religion and Culture. Shelby is interested in Indigenous policy and environmental policy and passionate about working in municipal government where she feels she can make the most significant impact on residents and help make cities more accessible, inclusive and enjoyable.