

Pacific Institute for Climate Solutions: British Columbia's Universities Collaborating on Climate Change Solutions

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Abstract

In 2007, one decade ago, the Province of British Columbia (BC), Canada announced its commitment to develop a policy framework for climate change mitigation and to reduce greenhouse gas emissions, province-wide. The announcement and subsequent policy and strategies outlined through 2008 positioned the government as a leader in climate policy amongst other jurisdictions throughout North America. Its cutting edge Climate Action Plan (2008) outlined four key areas of action, including legislated greenhouse gas reduction targets; comprehensive economic policy; investment in impacts and adaptation research; and, citizen-wide education and outreach. As part of this plan, under its commitment to investment in research, education and outreach, BC's Ministry of Environment established an endowment to support the creation of the Pacific Institute for Climate Solutions (PICS). PICS is a partnership amongst BC's largest, most research intensive universities—University of Victoria, University of British Columbia, University of Northern British Columbia and Simon Fraser University. It contributes climate change research to inform and shape climate change policies and actions on mitigation and adaptation with a focus on BC, Canada and beyond.

This paper provides an overview of the province of BC's key action areas on climate change. It outlines how the climate action taken by the provincial government, including the adoption of a revenue neutral carbon tax, since 2007 led to its emergence as a climate leader in North America. The paper also highlights interesting challenges to the strategies that were originally unforeseen, such as a change in governing party leadership, opportunities around a growing shale gas industry, and evolving public concern, alongside complexity around maintaining leadership in light of emerging federal commitment and policy frameworks and provincial elections. The paper explains how PICS assists the province in meeting these and other multi-faceted climate change challenges through a range of solutions-oriented research initiatives, including five major policy-relevant projects, known as the "Big Five." These five projects began 2015 and will run until 2020. They cover research in areas related to BC's largest greenhouse gas emissions sectors, including energy efficiency in the built environment; forest carbon management; natural gas development; low carbon energy pathways; and transportation options.

Finally, the paper outlines how PICS' research links and plans to support implementation of the United Nations sustainable development goals, including most specifically:

- SDG 7 - Affordable and clean energy;
- SDG 9 - Industry, innovation and infrastructure;
- SDG 11 - Sustainable cities and communities;
- SDG 13 - Climate action; and,
- SDG 15 - Life on land.

By setting out these linkages to the UN sustainable development goals, PICS aims to situate its BC-based climate change solutions research within an international framework and greater global relevancy.

Introduction

On February 13, 2007, the Government of the Province of British Columbia (BC), Canada launched the third session of its 38th parliament with a speech from the throne calling for definitive action to decrease British Columbia's greenhouse gas emissions. "The science is clear. It leaves no room for procrastination. Global warming is real" states the Honourable Iona Campagnolo, British Columbia's Lieutenant-Governor. "This government will firmly establish British Columbia standards for action on climate change," and, she continues, "aim to reduce BC's greenhouse gas emissions by at least 33 per cent below current levels by 2020" (BC Throne Speech 2007).

The announcement and subsequent policy and strategies developed positioned the BC government, at that time, as a leader in climate policy amongst other jurisdictions in North America. The target, which would bring BC GHG emissions to 10 per cent below 1990 levels, was more aggressive than that introduced August 2006 by its southern Pacific neighbour, the state of California, USA, where Governor Arnold Schwarzenegger announced a reduction to 1990 levels by 2020. While Campbell's target appeared to set him ahead, "Governator" Schwarzenegger also outlined ambitious targets, doing so with short-term milestones and only "after a long period of meaningful consultation with a variety of stakeholders" (Anderson 2007). Campbell's announcement, on the other hand, came largely from left field, leaving many academics, environmentalists and business people questioning the feasibility of the interim targets, and the myriad of policy measures needed to achieve them (Lee 2017).

Background of climate change policy in Canada

Canada has been soundly criticised by academics and environmental organizations for little to no action on climate change since talks originated in this country in 1988 (Simpson et al 2007). The Toronto Conference was "the first major political gathering of researchers, policy makers and nongovernment organizations to make global warming its principle focus," which concluded with "the Toronto Target"— which stipulated a 20 percent reduction from 1988 GHG levels by 2005 (Cohen 2009). Since the Toronto Conference, Canada's emissions have continued to grow. It sits as one of the world's largest per capita emitters at over 21 tonnes CO₂e per person, nearly four times that of the global average (Conference Board of Canada, 2010). Saskatchewan and Alberta are among the developed world's largest emitters at 68 and 67 tonnes respectively, while per capita emissions in BC, Ontario, and Quebec are in the 10-14 tonne range, comparable to emissions per capita of Western European countries (Boothe et al 2016).

Canada has primarily relied on voluntary emission reduction programs (Simpson et al 2007). In 1998, the federal Liberal government of Canada becomes one of the first countries to sign the Kyoto Protocol, and under the agreements, commits to cut emissions by 6 percent below 1990 levels by 2012 (Dorskoch 2011). The Canadian federal Conservative party, under leadership of Stephen Harper, came to power in 2006, maintained its minority government in the 2008 federal election, and won a majority in 2011. They were unfavourable about the Kyoto and rallied for "a made-in-Canada approach" (Duff 2009), which included energy efficiency, relying on intensity improvements, investing in research and "monitoring climate change and its causes" (Duff 2009). Prime Minister Harper is an economist from Alberta—where the world's third largest crude reserves are held—and carries "skepticism about the science of climate change" (Simpson et al 2007; Williams et al 2017).

As Canada's emissions continue on a trajectory to exceed the Kyoto commitment by more than 30 percent above the 2012 target, the Harper government, in December 2011, pulls out of the Kyoto Protocol rather than negotiating new targets for phase two of the program. They are the first nation to withdraw from this global treaty, suggesting a new deal, which includes the world's large emitters such as US and China, be formed by the United Nations (Curry and McCarthy 2011; Leach 2011). Canada remains largely quiet at subsequent UN Framework Convention on Climate Change (UNFCCC) Council of the Parties (COP) events, and becomes even an "outlier" and "increasingly isolated" on climate action as the US and China announce agreements to cut and cap greenhouse gas emissions just ahead of the COP 20 in Lima, Peru (Chung 2014).

Yet, 2015 becomes a turning point for the federal government of Canada, and its focus on climate change. In October 2015, the Liberal government supplants the Conservatives, winning a majority of seats in the national election. Just a few weeks after being sworn in the new Liberal Prime Minister, Justin Trudeau, announces to the world at COP 21 in Paris "Canada is back, my friends. Canada is back, and here to help," outlining commitment towards a new international leadership on climate action (Fitz-Morris 2015). At COP 21, the federal government recognizes and highlights the leading climate policy and action a number of Canada's provinces and territories have taken on over the years, with BC being at the forefront.

British Columbia embraces a climate change agenda

Through the year of 2006, Canada begins to experience a significant change in public opinion around critical policy issues. By 2007 the "environment surged to the top of the public's agenda." (Harrison 2012) Though many feel the federal government still lagged in terms of action on climate change, the public trend in favour of the environment prompted provincial jurisdictions to take note issuing their own regulatory programs. (Harrison, 2012) However, the extent to which the British Columbia government embraced and implemented climate change policy was a surprise. The Liberal government, led by Gordon Campbell had been "reviled by environmentalists for deep cuts to its environment budget and for supporting offshore oil and gas exploration and proposals for two new coal-fired electricity-generating stations." (Harrison 2012)

Yet BC was beginning to experience economic impacts of climate change. Warmer BC winters were enabling pine beetle populations to thrive. The increase in their numbers resulted in significant consequence to the BC forest industry. Wildfires were predicted to grow in number and intensity, in addition to flooding and extreme weather events. (BC 2008 and Dean 2011) Many surmise, however, that it was more than impacts to ecosystems and the economy that were influencing the Premier's thoughts on climate change. He notes that a trip to China 2006 where he experienced air pollution increased his concerns about the environment, air quality and climate change. (Simpson et al 2007)

Furthermore, he may have had, suggests political scientist Kathryn Harrison (2012), "stronger than usual motives to pursue [climate change] policy in light of the recent birth of his first grandchild in 2006 as well as greater capacity to do so having won a second significant majority in 2005." It was common knowledge amongst staff closest to the premier that he committed to reading "a hefty pile" of nonfiction on his annual vacations. "We were always nervous about what he took with him to read on vacation" comments Brent Sauder, former civil servant with BC government (pers. comm. 2013). In 2006, on his way to his annual trip to Maui, his stack of books included those on climate change (Harrison 2012). In addition to the new focus on the environment and climate change, Premier Campbell had embarked on an important new alliance south of the BC border. Republican Governor of California, Arnold Schwarzenegger had "sailed into re-

election...by appealing to the centre...on environmental issues.” (Harrison 2012)
Premier Campbell and the “Governator,” had meetings throughout 2006 and 2007, which are believed to have culminated in a BC climate change plan that “clearly reflected California’s influence,” such as outlining substantial GHG reduction targets to be enacted by law, as well as tailpipe emissions and low carbon fuel standards to match California (Duff 2008; Harrison 2012).

It is recognized that Premier Campbell was instrumental in establishing BC as a clear leader among Canadian provinces and even within North America in addressing climate change. On February 13, 2007, Lieutenant-Governor Iona Campagnolo delivers her Speech from the Throne to resonate the Premier’s words: “Climate change is real, and British Columbians are telling us we must do more as a government and as individuals...We will act to stem the growth of global warming and minimize the impacts already unleashed by establishing targets and actions and by working with our national and international neighbours” (BC News Release 2007).

The means to achieve ambitious GHG reduction targets

The throne speech and the subsequent extent of BC’s new climate policy agenda was a “shock even to...insiders closely aligned with the Liberal government” (Harrison 2012). Premier Gordon Campbell announces the Province of BC will establish “targets, action and processes aimed at reducing BC’s GHG’s by 33% below 2007 levels by 2020” (BC News Release, 2007). In 2008, the BC government launched the Climate Action Plan. The plan outlines a four-part framework to address climate action: (1) legally binding greenhouse gas reduction targets and supporting legislation; (2) comprehensive economic policy measures; (3) investment in climate change impacts and adaptation research; and (4) citizen-wide education and outreach, and outlines many climate-related initiatives to support the adopted legislation including a (Government of BC 2008):

- New Green Building Code.
- \$14-billion Provincial Transit Plan for improved infrastructure and ridership and support for communities to establish anti-idling policies.
- \$25 million Innovative Clean Energy (ICE) Fund, for exploration of alternative energy technologies.
- \$25 million Bioenergy Network for research and development in areas such as wood-waste cogeneration, biofuel production and wood pellet production.
- Net zero deforestation policy among other programs and initiatives to maximize forestry potential beyond timber use.
- Consumer-based incentive program through Live Smart BC that offers rebates on the purchase of low energy efficient products, including space and water heating systems and fuel-efficient vehicles.
- New Pacific Carbon Trust a Crown corporation designed to manage BC-based offsets to meet public sector organization carbon reduction goals.
- **\$94.5 million endowment to create the Pacific Institute for Climate Solutions that brings together universities, government and the private sector to facilitate cutting-edge solutions.**

The government indicates “independent economic modelling estimates that the climate action initiatives [outlined in the plan]...will take us approximately 73 per cent of the way to our 33 per cent 2020 reduction target.” (Government of BC 2008)

BC’s Comprehensive Economic Policy: A revenue neutral carbon tax

As a critical component of its Climate Action Plan, the government established a revenue-neutral carbon tax based on greenhouse gas emissions from the combustion of

fossil fuels. The tax covers all domestic use/combustion of fuel, including home heating, fuelling a vehicle, generating electricity, and accounts for about 70 percent of BC's GHG emissions. It does not apply to the processing, venting or resulting fugitive emissions of energy extraction. (Government of BC 2012)

The tax puts a price on each tonne of GHG emitted to create a price signal and a comprehensive market response to fossil fuel consumption. (Government of BC 2008). As a consumption-based environmental tax, it is the first of its kind in North America (Duff 2008). At a cost of \$10 per ton of CO₂ equivalent emission in 2008 (equalling about 2.34 cent per litre of gasoline) up to \$5 per year till reaching \$30 per tonne, it is one of the most aggressive policy measures in Canada, perhaps even North America, in addressing climate change. As such, it has received considerable media and research attention throughout Canada and internationally (Economist 2011). The initial reaction from academics and environmentalists to the tax has been positive, and even the business community is seen as being "cautiously supportive." (Harrison 2012)

Reports indicate since the carbon tax took effect in 2008, the province's fuel consumption has decreased by 17.4% per capita, and fallen by 18.8% relative to the rest of Canada (Pedersen 2015). Pedersen's study (2015) indicates reductions have occurred across all the fuel types covered by the tax and (not just vehicle fuel), while BC's GDP has remained in keeping with the rest of Canada's. The tax was deemed "revenue neutral" by the BC government through the personal and business tax cuts, and low income and rural ownership credits. It appears the tax shift has benefited taxpayers as cuts to income and other taxes from 2008 to 2012 have exceeded carbon tax revenues by \$500 million, positioning BC as the province with the lowest income tax rates in Canada. Though the BC carbon tax has maintained public support – polls show greater than 50% of BC public are in favour of the policy (Pedersen 2015)—several more years of study will be required to fully understand effects. Little work has been done yet concerning "industry competitiveness, carbon leakage, or household efforts to conserve energy" (Harrison 2012).

The BC Liberal government indeed shows strong leadership in addressing climate change through adoption of legislated GHG targets, implementation of carbon pricing, and substantial investment in research and education. While a trend towards emissions reduction may have been set course by the Liberal government, maintaining the leadership, commitment to the environment and GHG targets, alongside public support for its climate action has been less steadfast.

In November of 2010 the Premier Gordon Campbell resigns after losing caucus support over a very unpopular decision to harmonize federal goods and service tax with the provincial service tax. Christy Clark wins the provincial Liberal leadership race in 2011 and took on the role of premier. Further, Clark wins the May 2013 provincial election on a platform geared towards BC's jobs and economy, which includes growing BC's liquefied natural-gas industry (LNG) (Mason 2013). This new leadership, which resulted in a stall of some key climate action measures, such a freeze on the incremental increase of the province's carbon tax, alongside new commitments to growing the province's LNG sector—and growing controversy over the government's carbon neutral claim (Auditor General BC 2013) challenged the feasibility of the ambitious climate action plan her predecessor, Gordon Campbell, had so skilfully, albeit single-handedly, chartered out.

BC'S 2016 Climate Leadership Plan – Leading or Lagging?

In 2016, the province issues a second climate plan, the BC Climate Leadership Plan. To many, the plan is a long awaited update to BC's 2008 climate strategies, outlining 21 key actions in all major sources of greenhouse gas (GHG) emissions (Government of BC

2016). Yet academics, environmental groups, and clean energy institutes indicate the new plan lacks ambition and, even PICS, the institute that credits the government with its very creation, reports that with “few hard targets, explicit regulation or funding numbers,” the plan won’t enable BC to achieve its legislated greenhouse gas reduction targets, questioning whether BC’s climate leadership role in Canada, and across NA, remains (Phillips 2016).

Christy Clark remains leader of the Liberal Party and the province until 2017. In the 2017 provincial election the Liberals win a minority government, with 43 seats in the province’s 87 ridings. The New Democratic Party (NDP) takes 41 seats in the election, while the Green Party lands an historic three seats. Remarkably, and “for the first time in Canadian history, the results of the election left the Green party holding the balance of power” (Canadian Press, 2017). Within three weeks, the Greens have a formal agreement with the NDPs, and a new “Green-NDP” minority government is formed for the province (Globe and Mail 2017). Andrew Weaver, Green Party leader and former climate scientist states climate issues were key to partnering with the NDP (Canadian Press 2017). In terms of the road ahead for the new government, climate change becomes an important component, with the parties agreeing on policies for action, including the reinstatement the carbon tax increase of \$5 a tonne CO₂e per year starting April 2018, and an expanding coverage of the tax to account for fugitive emissions and forestry sector slash-pile burning (Canadian Press 2017). This unprecedented Green NDP partnership, may well position the new BC government to regain a prominent climate leadership role, indeed across Canada, and throughout North America.

Pacific Institute for Climate Solutions (PICS): BC’s Universities Collaborate on BC’s Climate Change Impacts, Adaptation Research and Citizen-wide Education

An important component of BC’s original Climate Action Plan (2008) includes the investment in climate change impacts and adaptation research and citizen-wide education and outreach. As a means to meet this commitment, the BC government awarded the University of Victoria a \$94.5 million dollar endowment—the largest in Canadian history—to establish the Pacific Institute for Climate Solutions (PICS) in 2008. PICS is a collaborative knowledge network that brings together leading researchers from BC and elsewhere to study the impacts of climate change and to develop solutions that will lead toward climate change mitigation and adaptation (PICS 2017).

PICS shares a global vision of net-zero greenhouse gas emissions by mid century alongside all communities adapting to a changing climate (PICS 2017). PICS’s mandate is to produce leading climate solutions research, actively used by decision makers to develop effective mitigation and adaptation policies and actions (PICS 2017). PICS is hosted and led out of the University of Victoria in collaboration with Simon Fraser University, the University of British Columbia and the University of Northern British Columbia. This four-university collaboration is the foundation upon which PICS builds networks of wider partnerships, with governments, the private sector, First Nations, other research organisations and civil society. The institute maintains a focus on climate solutions for BC, with considerations to its neighbouring provinces, the Pacific Northwest, Canada, and internationally (PICS 2017).

With research as its foundation, PICS produces publications and educational tools and engages in outreach activities that inform a diverse audience of policy makers, industry representatives, educators, students and the general public about climate change issues and solutions. Since its founding, PICS has supported over 180 solutions-focused research projects across the four universities, funded 87 internships, 125 post-graduate fellowships, 19 post-doc fellowships, produced 29 white papers with policy recommendations, 43 briefing notes, and hosted or supported more than 40

events annually for both general audiences and technical briefings for policymakers and industry (PICS 2017).

Since 2015, PICS has focused on a core body of climate solutions research organized under research themes, known as the “Big Five.” These five projects will run until 2020. They cover research in areas related to BC’s largest greenhouse gas emission sectors—buildings, transportation and industry. Specifically, the projects investigate: 1) energy efficiency in the built environment; 2) forest carbon management; 3) natural gas development; 4) low carbon energy pathways; and 5) transportation options for BC’s future. By virtue of its climate solutions mandate, PICS research offers linkages to the United Nations sustainable development goal SDG 13: *Take urgent action to combat climate change and its impact*. Yet PICS big five research projects also tie to the UN’s:

- SDG 7 - Affordable and clean energy;
- SDG 9 - Industry, innovation and infrastructure;
- SDG 11 - Sustainable cities and communities; and,
- SDG 15 - Life on land.

PICS Energy Efficiency in the Built Environment Research Project

In BC, more than half of all greenhouse gas emissions come from the built environment, which urban and semi-urban areas such as the villages, towns and cities in which the vast majority, 86 percent, of the provinces population lives. Yet the form of these urban and semi-urban areas can greatly affect energy and emissions intensity today and for many years to come. Much of the energy performance differences can be attributed to architectural building practice, alongside standards and practice that govern the planning and regulation of land use and transportation, as well as the design, engineering, construction and operation of buildings and their supporting infrastructure (PICS 2017).

Since 2013, the Energy Efficiency in the Built Environment research, led by Ron Kellett, School of Architecture and Landscape Architecture, with other researchers from the University of British Columbia, as well as Simon Fraser University and the University of Victoria, has been exploring three key themes related to the built environment: policy and finance; community scale; and buildings. The policy and finance theme explores research in existing and proposed federal, provincial and local government policy mechanisms in achieving greenhouse gas emissions targets, using the City of Vancouver as a case study (Murphy et al 2016).

The community theme research focuses on spatial simulations at the neighbourhood scale of policy alternatives for local governments across the province. Most urban form energy performance research focuses on transit oriented, urban centres. Yet it is the smaller, lower density semi-urban communities where the majority of BC’s population lives, and it is these lower density communities that exhibit the largest emissions reductions performance gaps (Salter et al 2017). As such, the community stream is working towards developing a replicable and scalable community energy simulation model that practitioners and local government planners can use to evaluate the effectiveness of energy and emission interventions around building form and density, land use planning and development, and transportation demand of the different types of communities that comprise the province.

The building theme research focuses on aligning policy objectives with policy mechanisms to support delivery of energy-efficient low-carbon buildings in BC, as to date many current provincial-level policies lack sufficient mechanisms to enable implementation by relevant stakeholders, whether they be local government, or private industry practitioners. This research is in early stages, yet preliminary results indicate the importance of identifying implementation gaps and deficiencies in the top-down policy

landscape. Together, these three streams are investigating how BC's built environment can accommodate action on climate change (SDG 13), while promoting resilient, sustainable communities and cities (SDG 11).

PICS Forest Carbon Management Research Project

The PICS forest carbon management project aims to develop recommendations for regionally specific climate change mitigation activities throughout the province of BC, “while maximizing the environmental, economic and social benefits” (Peterson St-Laurent et al 2017). The project is led by principal investigator, Werner Kurz, a senior research scientist with Natural Resource Canada in partnership with researchers from the University of British Columbia and the BC Ministry of Forest, Lands and Natural Resource Operations.

BC's 55 million hectares of forest offer enormous economic and environmental resources, providing biodiversity and water conservation, alongside employment and socioeconomic wellbeing for many communities throughout the province, as well as the province, and the nation, as a whole. Furthermore, BC's forests offer “significant opportunities to take action against climate change” (Government of BC 2016). The forest carbon management project aims to design, evaluate and recommend potential climate change mitigation strategies for reducing GHG emissions and increasing the carbon sink potential of BC's forests. The project explores forest adaptation and mitigation strategies, including a policy gap analysis and management practices around afforestation, forest conservation and the use of harvested wood products (to both store carbon and displace emissions-intensive materials such as concrete and steel, and displace fossil fuels used in heating and transportation) as a means to reduce GHG emissions, province-wide. The project involves stakeholders in government, industry, ENGOs, First Nations, and the public (Peterson St-Laurent et al 2017).

The project has three research themes: mitigation options; ecosystem risks; and, policy analysis and stakeholder engagement (PICS 2017). At the time of this paper, project findings show BC forest management practice can offer a wide range of mitigation potential, with the greatest potential—an estimate of up to 421 MtCO₂e cumulative mitigation of emissions from 2017 to 2050, which is about 35 percent of BC's GHG emission reduction target by 2050—achieved through improving forest harvest utilization, focusing commodities to longer-lived wood products, and using harvest waste as bioenergy (Xu et al 2017; Government of BC 2016). In terms of relevance to the UN SDGs, the PICS forest carbon project explores how forest carbon management can support action to combat climate change (SDG 13), while protecting, restoring and promoting sustainably managed forests (SDG 15).

PICS Transportation Futures for BC Research Project

Transportation within and across the province accounts for nearly 40 percent of BC's greenhouse gas emissions, which total 62.7 MTCO₂e in 2014 (Government of BC 2016). It is the single largest contributor of emissions, and for all communities across the province, possibly the most complex to manage and mitigate. Principal investigator Walter Merida, the director for Clean Energy Research Centre, alongside co-researchers from the University of British Columbia, Simon Fraser University and the University of Victoria, lead the transportation futures project. The project has three core research areas including integrated social, economic and technical analysis of the alternative fuel vehicle market; review and investigation of low to zero carbon transportation infrastructure; and, transport mode electrification, grid integration and demand-side response (PICS 2017).

Under the social, economic and technical analysis of alternative fuel vehicle market, the research team has developed a “plug-in electric vehicle (PEV) policy report card” to

compare effectiveness of policies (in place by November 2016) for PEV uptake (at a goal of 40 percent of new passenger vehicle market by 2040) across Canada's provinces. The preliminary research has resulted in development of a framework, which policymakers in BC and across Canada can use to evaluate the effectiveness of different PEV-supportive policy scenarios (Melton et al 2017). The team will continue this line of work on freight vehicles, assessing market factors and policy scenarios for alternative fuel vehicle uptake and deep GHG reductions. In addition, theme two of the project will review hydrogen and liquefied natural gas network potential and infrastructure requirements, as well as standards harmonization along the Pacific West Coast. The PICS transportation project's theme three will explore options for electrification of BC's public transit system, demand response for fleet vehicles, and e-bike and cargo bike opportunities and lifecycle assessments. (PICS 2017) In terms of the new UN SDGs, these transportation research themes support (SDG 13) action to combat climate change, while exploring resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation (SDG 9).

PICS 2060 Project: Integrated Energy pathways for BC and Canada

Dr. Andrew Rowe leads Project 2060 out of the Institute for Integrated Energy Systems at the University of Victoria (IESVic). This IESVic, PICS partnership project explores the costs and benefits of a range of electrical grid integration options. The initial research focuses on integration of BC's hydroelectric grid to its neighbouring province, Alberta (AB) as a substitute to current and possible future carbon intensive coal powered electricity plants to assist AB in achieving its greenhouse gas emission targets. The project also explores nation-wide grid integration potential, and southward expansion to western North America. Through the use of large-scale techno-economic models, the research team evaluates costs, reliability and emissions of an expanded grid interconnection, and investigates the impact of more integrated energy systems across Canada under various carbon policies and global growth scenarios (IESVic 2014).

Since its start in 2013, a number of studies have been completed, including the impacts of carbon policies and intertie capacity on combined BC-AB emissions, as well as the impacts of carbon policies on GHG emissions and overall costs in AB. Preliminary results indicate little benefit for AB in terms of greenhouse gas reductions, given current (2015) suite of carbon policies. Yet in the event of more stringent carbon policies greater intertie transmission capacity lowers both overall costs of electricity generation and emissions. Initial findings also show that carbon taxes can accelerate decarbonisation, with even a modest tax of (\$30/tCO₂) resulting in cost-effective emissions reductions through the transition of AB's electricity generation from coal to natural gas (PICS 2017).

The project is also exploring opportunities for renewable energy grid integration, including analysis of large-scale wave energy integration for Vancouver Island. Preliminary results of this study show the capacity for up to 500 MW of wave energy for the island, whereby new transmission lines are built to accommodate this renewable supply. Project 2060 will continue to explore the role of wave energy and other forms of renewables—wind, geothermal, solar and biomass—in tying into and decarbonizing BC, AB, the Pacific Northwest and Canada's future energy systems. In terms of relevance to UN sustainable development goals, Project 2060 links to action on climate change (SDG 13), while supporting SDG 7 on ensuring access to affordable, reliable, sustainable and modern energy.

Conclusion

The BC government 2007 Throne Speech, which highlighted BC's commitment to action on climate change launched the province into a leadership position on climate policy in North America. The original BC Climate Action Plan (2008) outlines a four-part framework to address climate action: (1) legally binding greenhouse gas reduction

targets and supporting legislation; (2) comprehensive economic policy measures; (3) investment in climate change impacts and adaptation research; and (4) citizen-wide education and outreach. Though continued climate leadership was questionable with the change in the governing provincial party's leadership and the freeze of key measures, such as an increase to the province's carbon tax, aspects of the original plan have proven instrumental in supporting steadfast action on climate and the advancement of policy and research.

For instance, as part of the climate action plan commitment to research, the province set aside an endowment for the establishment of the Pacific Institute for Climate Solutions (PICS), which is led out of the University of Victoria in partnership with BC's other research intensive universities. The tie to the universities ensures PICS remains independent, and at arms length from government, enabling it to stay steadfast in its mandate for climate solutions regardless of the political climate. Furthermore, "the combination of its climate solutions focus, cross-university collaboration, interdisciplinary approach, strong and independent financial underpinning, and commitment to go beyond the academy and partner with industry, government and other key sectors of society makes [PICS] unique in the world" (PICS 2017).

At that time of this paper, PICS is focusing on a core body of climate solutions research organized under BC's largest greenhouse gas emission sectors—buildings, transportation and industry. By virtue of its climate solutions mandate, PICS research offers linkages to the United Nations sustainable development goal SDG 13: Take urgent action to combat climate change and its impact. Yet PICS big five research projects also tie to the UN's current agenda on (SDG 7) affordable and clean energy; (SDG 9) industry, innovation and infrastructure; (SDG 11) sustainable cities and communities; and, (SDG 15) life on land (United Nations 2016). By setting out these links to the UN sustainable development goals, PICS aims to situate its BC-based climate change solutions research within an international framework, greater global relevancy and assist in implementation of the UN SDGs.

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