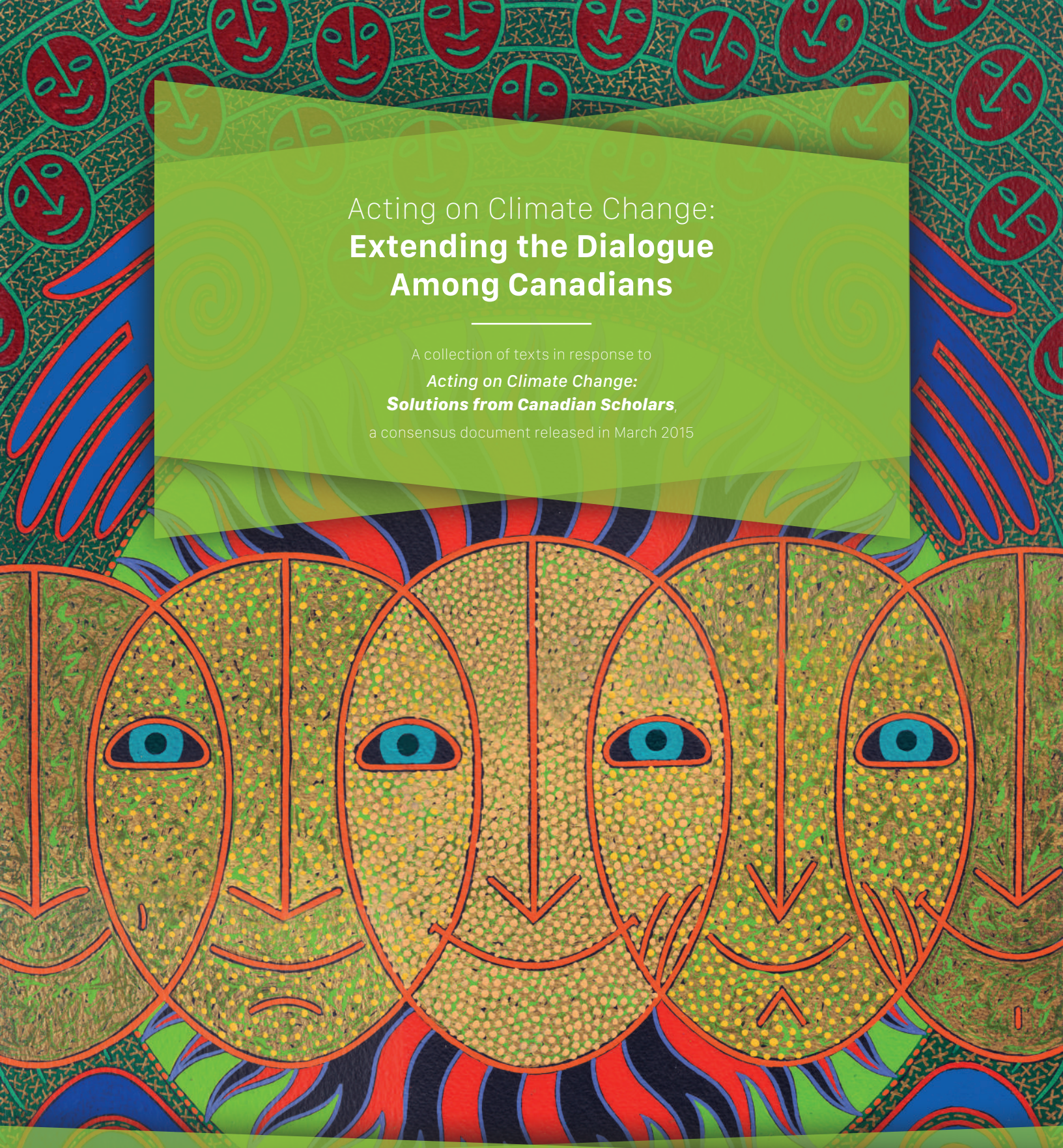

Acting on Climate Change:
Extending the Dialogue Among Canadians

A collection of texts in response to

Acting on Climate Change:
Solutions from Canadian Scholars,

a consensus document released in March 2015

Sustainable Canada Dialogues

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Aknowledgements

October 8th, 2015
Edited by ***Divya Sharma*** *and* ***Catherine Potvin***

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Preface

Sustainable Canada Dialogues has mobilized over 60 Canadian scholars from every province, representing climate change expertise in areas from engineering to sociology, to elaborate a scholarly consensus on science-based, viable solutions for greenhouse gas reduction. This resulted in a position paper, *Acting on Climate Change: Solutions from Canadian Scholars*, launched in March 2015, presenting 10 key policy orientations that could be adopted to kick-start Canada's transition toward a low-carbon society.

We, the scholars, are motivated by a shared view that putting options on the table will stimulate action and is long overdue in Canada. Acknowledging that the policies and actions proposed by the scholars are limited to the authors' fields of expertise, we circulated our position paper to a spectrum of business associations, First Nations, non-governmental organizations, labour groups, institutions, organizations and private citizens, to expand the discussion. The collection of texts, *Acting on Climate Change: Extending the Dialogue Among Canadians*, presents contributions stemming from these interactions. We invited some contributions, while others were offered to us. Sustainable Canada Dialogues and its partners did not lead or endorse the contributions, associated pictures or artwork; content belongs to the respective authors and organizations.

Together, the contributions enrich the scope of possible solutions and show that Canada is brimming with ideas, possibilities and the will to act. With 29 contributions, A*cting on Climate Change: Extending the Dialogue Among Canadians* is not a countrywide consultation. Some key voices are missing. We did not have the resources to engage all sectors of society. However, we do affirm that Canada needs a collective vision of desired pathways to our futures and that such consultation is necessary. As stated in *Acting on Climate Change: Solutions from Canadian Scholars*: "We wish for an intense period of consultation and policy development to identify the policy instruments, regulations and incentives best suited to Canada." This is the challenge we place before decision-makers.

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Foreword

As I sit down to write the foreword to this collection of texts, *Acting on Climate Change: Extending the Dialogue Among Canadians*, I reflect on the path we have traveled in one year. It was a challenge for us to prepare a climate action plan that could be endorsed by more than 60 scholars of various ages, provinces and disciplines. The idea behind the effort was that we, as scholars, represent a microcosm of society and our common position could perhaps become a rallying point around a way forward.

It seems to me that we have won our bet as actors of different political stripes have given our report rave reviews. However, it was the many messages we received that were the most pleasant surprise. When we released our consensus paper, *Acting on Climate Change: Solutions from Canadian Scholars* in March 2015, I anticipated receiving some negative responses from climate-sceptics. To my astonishment, this was not at all the case. In fact, I received many thank-you emails. These messages all shared the same core idea: "Thank you for giving us *hope*."

This recognition has given me great pleasure, because we deliberately positioned our paper from a positive point-of-view. When Sophie Langlois, a Radio-Canada journalist, went to Africa to cover the Ebola outbreak, she said, "the feeling of helplessness leads to inaction." Discussions among Sustainable Canada Dialogues scholars led us to the same conclusion. People feel overwhelmed by the problem of climate change, and for good reason. It's terrifying to hear about a visibly melting Arctic, hurricanes, droughts, floods and how these will affect all humans now and in the future. We thus chose to place Sustainable Canada Dialogues in the field of *The Possible*. Rather than placing blame for past mistakes, our aim is to be inclusive in finding solutions for a future of which we can all be proud.

In *Acting on Climate Change: Solutions from Canadian Scholars*, we acknowledged that no solution would be ideal or immediate. Rather, we will need to engage as a society in a period of transition between the way things are done today and the way Canadians want to see things done in the future. In making the transition to a low-carbon society, we open an opportunity for changes that can improve our quality of life. This is where hope lies, and it is one of the themes that emerges from *Acting on Climate Change: Extending the Dialogue Among Canadians*.

As we speak, Ontario is giving all Canadians a great lesson by transitioning away from coal-generated electricity, showing it is possible to change for the best. In Quebec, we still recall our great energy transition: the nationalization of electricity and development of large dams. Apparently when this work of giants began, existing technology did not allow electricity to be transported over long distances. Yet the dams were built, as were the high-voltage lines. Now all this seems obvious. Both volumes of *Acting on Climate Change* therefore seek to instil that confidence – the confidence in our ability to change, and in our innovative power – so the people of Canada can rediscover the desire to work together on a future that is both better and possible.

I would now like to take you, in this foreword, to a field I know well—the rainforest, where I have worked for over 20 years. In most tropical countries, deforestation is both an important economic engine as well as the largest source of greenhouse gas emissions. This was certainly the case in Brazil, when in 2009 then-President Luiz Inácio Lula da Silva pledged to reduce deforestation in the Amazon by 80% by 2020. When he made the announcement, the deforestation rate was 12 980 km^2 per year[1]. Six years later in 2014, deforestation had decreased to 4 848 km^2 per year – a 62% reduction. Brazil's efforts, which successfully addressed its worst environmental problem head-on, were instrumental in my motivation to undertake the adventure that is Sustainable Canada Dialogues.

The question floating in the back of my mind was, "What makes Brazil do it better than Canada?" I spoke to my Brazilian colleagues about it. According to them, it took mobilization of the entire country to solve the problem. It took an alliance and collaboration between non-governmental organizations, researchers, the business sector and various levels of government. I had indeed witnessed this approach at the climate change conference in Copenhagen in 2009, when a representative of Greenpeace-Brazil was included in the national delegation, and sat next to the Brazilian government representatives during negotiations on deforestation.

Acting on Climate Change: Extending the Dialogue Among Canadians seeks to help build a foundation for such alliances among different sectors of society. Our call for input from civil society was not made randomly. On the one hand, we sought to address gaps in *Solutions from Canadian Scholars* that we had ourselves observed, specifically in the areas of investment, economics and employment. On the other hand, we sought answers to comments made after the position paper's release. For example, the scholars' proposal to make full use of hydroelectric resources was one that raised concerns. We received messages from Labrador and British Columbia that emphasized the environmental and social disruption that can be caused by dams. Therefore this subject is developed further in the present collection.

During the March 2015 launch of *Acting on Climate Change: Solutions from Canadian Scholars*, we met with representatives of the four levels of government that should drive the transition to a low-carbon society, namely: Indigenous Peoples, and federal, provincial and municipal governments. Some examples of sustainable hydropower projects were highlighted in the discussions, like that of the Mashteuiatsh community in Quebec, which develops low-power hydroelectricity with surrounding communities. There is now cooperation between Indigenous

1 Official rate in 2008, http://www.obt.inpe.br/prodes/prodes_1988_2014.htm, accessed on July 17th, 2015

and non-Indigenous partners working together on development[2]. The financial return on the sale of electricity is shared between these partners. Similarly, in Manitoba the government is now working with Indigenous Nations that have become partners in hydroelectricity generation[3]. Thus, we have good Canadian examples to draw upon as we collectively plan the route to our desired future. They share a common element: each was developed with full and effective participation of Indigenous Peoples and implemented with free, prior and informed consent of representative Indigenous institutions. I am pleased that *Acting on Climate Change: Extending the Dialogue Among Canadians* brings an additional perspective on the Nation-to-Nation collaboration with Indigenous Peoples that will allow Canada to use its huge renewable energy potential in the best possible way.

We were questioned about the omission of direct reference to Alberta and the oil sands in *Acting on Climate Change: Solutions from Canadian Scholars*. Scientific evidence indicates that fossil fuel extraction will need to cease in the medium term to keep the increase in global temperature around 2°C[4]. Governments of several provinces are challenged by this issue - provinces and territories through whose lands pipelines could pass; and those, like Quebec, that are considering development of unconventional fossil fuels such as shale oil and gas. This is why, in our position paper, the authors decided not to treat the oil sands as a special case.

Our third key policy orientation, **Integrate the oil and gas production sector in climate policies**, calls for a change in the parameters of environmental impact studies for any project related to transport, oil exploration or fossil fuel exploitation to include full accounting for the impact on climate, the costs of inaction and the need to decarbonize our economy and society. The existing piecemeal approach allows for continuous growth of an industry that should profoundly modify its operations. Several contributions to the present collection of texts address the issue of fossil fuel extraction, adding valuable input to the discussion. I hope readers will discover, as I did, new visions of how this can be achieved.

There is an important aspect of climate change, however, that *Acting on Climate Change: Extending the Dialogues Among Canadians* does not confront, and that is the issue of global responsibility. In 2009, when I was negotiating for the Framework Convention on Climate Change, I attended a technical briefing on the issue of historical responsibility organized for negotiators preparing the Copenhagen Climate Summit[5]. A communication[6] given by Henry Shue, Senior Research Fellow at Oxford University, really struck me. He explained how if a person or state causes harm without knowing, it is not good but it is excusable. By contrast, if a person or state causes harm while being aware of the consequences of the action, it becomes morally unacceptable.

If I rely on this analysis, I conclude the current moral position of Canada is unacceptable. The federal government has adopted an emissions reduction target, but, as noted in this collection

2 http://www.energievertelsj.ca/fr/1/Accueil/, accessed on July 17th, 2015

3 http://www.gov.mb.ca/ana/interest/agreements.html#2, accessed on July 17th, 2015

4 http://www.nature.com/nature/journal/v517/n7533/full/nature14016.html, accessed on July 17th, 2015

5 http://unfccc.int/bodies/awg-lca/items/4891.php, accessed on July 23rd, 2015

6 http://unfccc.int/files/meetings/ad_hoc_working_groups/lca/application/pdf/1_shue_rev.pdf, accessed on July 23rd, 2015

of texts, the target is not accompanied by an action plan to enable its achievement. I have invented a little charade to illustrate the shadow games that can obscure an acceptable moral position for Canada. According to the EDGAR database[7], Canada's emissions in 2013 accounted for 1.56% of global emissions. That implies to some of our leaders that our responsibility is minimal, or even insignificant. However, EDGAR also shows that Canada is the ninth largest emitter of greenhouse gases out of 213 countries in the world[8]. Do you think this changes anything when we consider our responsibility? Let us now consider per capita emissions. According to EDGAR, Canadians have the third highest rate of emissions per capita out of all developed countries after Australia and the United States, with 15.6 tons of CO_2 per capita per year. At what point does it therefore become our global responsibility?

The year 2015 is an important year for those who, like us, believe it is time to act to address climate change. It is crucial to elect a federal government that has a climate action target with a coherent plan to achieve it. This collection of texts enriches the solutions offered by the scholars of Sustainable Canada Dialogues. I hope it helps citizens make clear demands on their governments and believe in the future. It is for this reason that *Acting on Climate Change: Extending the Dialogue Among Canadians* concludes with the voices of youth.

***Catherine Potvin**, Panama, July 23rd 2015*

7 EDGAR is a collaboration between the European Commission and the Government of the Netherlands.

8 edgar.jrc.ec.europa.eu/overview.php?v=CO2ts1990-2013, accessed on July 17th, 2015

Indigenous Perspectives

FNQLSDI
First Nations of Quebec and Labrador Sustainable Development Institute

ABOUT THE ORGANIZATION

FIRST NATIONS OF QUEBEC AND LABRADOR SUSTAINABLE DEVELOPMENT INSTITUTE

CATHERINE BÉLAND AND MICHAEL ROSS

Created in 2000 by the Chiefs in Assembly, the FNQLSDI's mission is to provide First Nations in Quebec and Labrador with a dynamic service hub, supporting their actions towards maintaining territory and resource health, the development of sustainable communities and the recognition of their rights. The FNQLSDI has completed many projects in partnership with First Nations, notably in the area of climate change. Its main accomplishments in this area include a community tour to promote the implementation of greenhouse gas (GHG) reduction measures, the publication of a report documenting the impacts of climate change on 11 First Nations[1], the collaborative development of climate change adaptation plans with seven First Nations, and the organization of the first Forum on climate change adaptation by First Nations in Quebec and Labrador. This event, which took place on February 25th and 26th, 2015 in Quebec City, had the twofold objective of creating a space for dialogue and the search for adaptive solutions to the impacts of climate change, while encouraging future collaborative approaches to implementing adaptation. The Forum was open to both First Nations and non-Aboriginals. In all, about 80 people participated in the event, including representatives from many First Nations, employees of several federal and provincial departments, researchers, scientists, representatives of non-profit organizations and unaffiliated individuals. The Forum program included presentations, a round table, workshops and plenary sessions, which explored four main themes: biodiversity, emergency management, erosion and flooding, and infrastructures and community planning[2].

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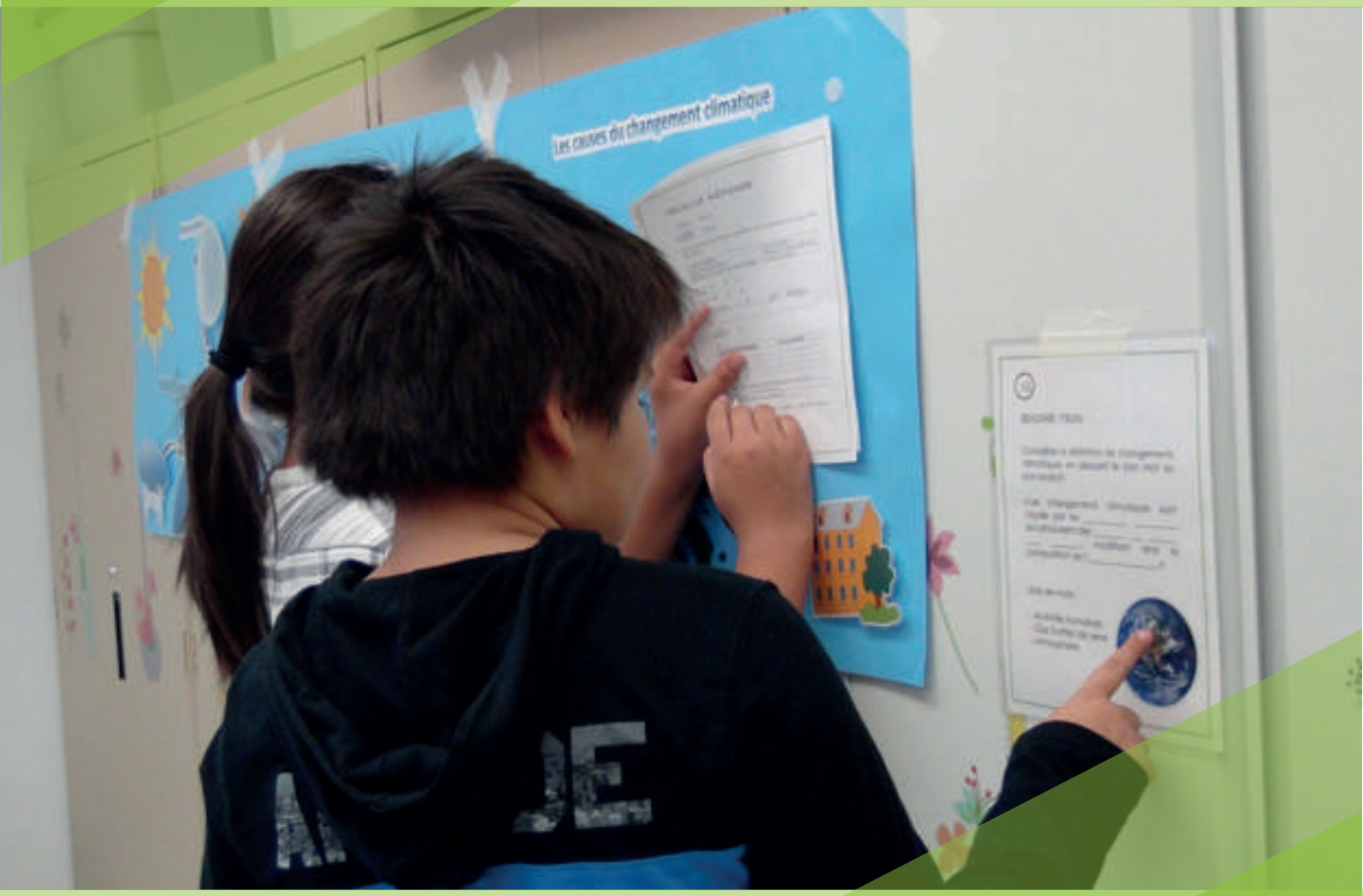

BUILDING CLIMATE CHANGE AWARENESS DURING A WORKSHOP IN A UASHAT MAK MANI-UTENAM SCHOOL

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FNQLSDI

Decolonizing the Transition

Towards a Sustainable Canada

Foreword

The invitation to contribute to this collection of texts was originally addressed to the Assembly of First Nations Quebec-Labrador (AFNQL). However, despite the fact that the AFNQL shares many of the preoccupations underlined in the position paper *Acting on Climate Change: Solutions from Canadian Scholars*, it declined the invitation as its role is to gather in assembly the Chiefs of 43 First Nations in Quebec and Labrador. First Nations hold an Aboriginal Title and Aboriginal and Treaty Rights. First Nations are considered as equals with other governments. The Aboriginal Title and Aboriginal and Treaty Rights held by First Nations fundamentally set them apart from stakeholders such as unions, environmental or research organizations which took part in the writing of this collection of texts.

However, considering the extent of climate change impacts on First Nations, both on their territories and their communities, the AFNQL delegated the First Nations of Quebec and Labrador Sustainable Development Institute (FNQLSDI) to prepare this text.

We present here three fundamental issues, in the context of this national dialogue.

First Nations, a distinct jurisdiction

First Nations must be recognized as a distinct jurisdiction in the debate on the adoption of new climate policies. First Nation governments, elected by community members and therefore accountable to them, are legitimate governments. They have stated responsibilities with regards to all their citizens, regardless of their place of residence. In order to meet these responsibilities, First Nation governments may collaborate with other jurisdictions, in particular with federal and provincial governments. In the context of this collaboration, First Nations engage in government-to-government relationships with their partners[3].

The Aboriginal Title and Aboriginal and Treaty Rights of First Nations mean that they have rights that are distinct from those of

1 IDDNPQL (2015). Impacts des changements climatiques sur onze Premières Nations au Québec. Wendake, Quebec, pp. 79

2 IDDPNQL (2015a). Proceedings of the Forum on adaptation to climate change, The Changing Climate: Adaptation by First Nations in Quebec. Wendake, Quebec, pp. 41

3 Assembly of First Nations Quebec-Labrador (2015). Political Relationship: Assembly of First Nations Quebec-Labrador and Government of Quebec. Wendake, Quebec, pp. 25

non-Aboriginal Canadians. According to the Supreme Court of Canada, the Aboriginal Title gives rise to rights comparable to those of ownership rights. The rights stemming from from the Aboriginal Title include the right to determine the use of the lands, including for non-traditional uses; the right to enjoy and occupy lands; the right to possess lands, the right to economic benefits derived from these lands; as well as the right to use, control, and manage the lands in a proactive manner[4].

Considering the wide-ranging impacts that climate policies could have on the Aboriginal Title and Aboriginal and Treaty Rights of First Nations, in particular regarding the use of their territories, it is essential that First Nation governments be involved from the beginning in this dialogue. This involvement and mutual respect are solutions to the barriers embodied by colonialism and the exclusion of First Nations, in the context of a transition towards a Canada that is to be sustainable for all.

Equity

The position paper identifies five principles which should guide the transition process. We wish to comment on the principle of equity, to underline that it is currently absent in the debate on climate policies in Canada. First Nations are disproportionately affected by the impacts of climate change, while they contribute little to overall GHG emissions. Moreover, they bear the brunt of the impacts related to the exploitation of their territories, deriving little if any real benefit from this exploitation. Both of these situations are fundamentally inequitable.

This inequity represents a barrier to the implementation of climate policies. The solution brought forth by the FNQLSDI is the recognition, by all jurisdictions, of the Aboriginal Title and Aboriginal and Treaty Rights, and the creation of collaboration mechanisms that are respectful, transparent and equitable. However, it is unfortunate that the foreword of the position paper, while mentioning objectives related to other governance jurisdictions (municipal, provincial and federal), fails to mention the part that First Nations could play in this dialogue.

Fighting climate change: some distinct issues

The position paper *Acting on Climate Change: Solutions from Canadian Scholars* sheds light on certain Canadian issues related to the reduction of GHG emissions for various sectors, in particular the extractive sector, electricity, transportation, construction and urban planning, as well as business development.

However, the situation of First Nations differs generally from that of non-Aboriginal communities for each of these issues, in terms of both diagnosis and potential solutions. The following paragraphs underline some of these differences and attempt to suggest solutions to facilitate the transition towards a low-carbon society.

Extractive Sector

The extraction of natural resources is a sector where the differences between First Nation and non-Aboriginal communities are particularly striking, as the extractive activities often take place on a First Nation's territory, without consultation and practically without any sharing of the benefits linked to this extraction with First Nation members. In spite of the existence of the Aboriginal Title and Aboriginal and Treaty Rights, First Nation governments have little power over the planning and authorization process of

4 Ibid.

the activities performed on their territory. Yet, the impacts of those extractive activities affect many aspects of a First Nation's way of life, in particular the practice of the subsistence activities on which many families rely for income. Natural resource extraction can therefore contribute to decrease the quality of life of community members. The diagnosis of natural resource extraction issues will therefore be different, according to whether one looks at a First Nation or at a non-Aboriginal community. Accordingly, the proposed solutions should be adapted to the context within which the issues are examined.

Recent Supreme Court of Canada rulings underline that the absence or insufficiency of prior consultation and accommodation processes is unacceptable, suggesting that new consultation and collaboration mechanisms will have to be implemented to respect the First Nations' Aboriginal Title and Aboriginal and Treaty Rights, in every sector of activity. These consultation and collaboration mechanisms represent solutions that will facilitate the transition towards a sustainable Canada.

Electricity

The position paper proposes to increase the capacity to transport electricity between provinces, which will involve constructing new infrastructures. However, the construction of these new infrastructures will inevitably take place on Aboriginal land. The consultation, collaboration and prior consent of the affected First Nation communities should be prerequisites to the implementation of an energy policy based on a new orientation of the electricity transport infrastructure. Moreover, the fair sharing of the benefits derived from this network restructuration represents another solution to facilitate the transition towards sustainability. In fact, First Nations should be able to profit from the use of their territory, be it in terms of royalties, employment or training opportunities.

Furthermore, many isolated communities are not connected to an integrated electricity grid, despite the presence of high voltage cables, power plants, pipelines and mines on their territory. Their dependence on fossil fuels, on top of having negative implications in terms of GHG emissions, contributes to increased local pollution levels, impacts the health of community members and puts a strain on the local economy. In this sense, the issues of First Nations are distinct from those of non-Aboriginal communities and need to be addressed by alternative solutions. While some First Nations are already involved in the production of energy from renewable sources (e.g. solar, wind, biomass, etc.), sometimes with external partners[5], increasing the participation of First Nations in the production of renewable energy constitutes another solution to the transition towards a low-carbon society in Canada.

Transportation

When it comes to transportation, it is imperative to underline the differences that set First Nations apart from non-Aboriginal communities. Many First Nation communities are located far from urban centres, a fact that creates specific challenges in terms of public and sustainable transportation options. This remoteness, too often coupled with reduced financial capacities, renders the search for alternative solutions complicated and requires a specific analysis. Taking the needs of small isolated communities into account when transport-related climate policies are developed represents a solution in the transition towards reducing Canadian GHG emissions in this sector.

5 Centre for Indigenous Environmental Resources (2006). Report 3: Impacts of Climate Change on First Nation Economies, pp. 37

Construction and Urban Planning

The on-reserve reality is very different from that of Canadian municipalities, regardless of their size. Construction criteria for houses and community buildings are generally set by government representatives and are rather removed from the needs of the communities. The reduced size of most reserves, their overpopulated status and their landlocked position limit the diversity of urban planning options available. These parameters illustrate how First Nation issues in this sector are distinct from those pertaining to municipalities. In this context, many solutions could be implemented to achieve the transition towards increased sustainability, including the elaboration of new construction and urban planning norms, established by First Nations and adapted to their reality, as well as increased federal funding, to ensure decent on-reserve living conditions, consistent with the government's fiduciary responsibilities.

Business Development

While the economy of some First Nations is of the conventional type, based on the market economy, many First Nations have a mixed economy, where subsistence activities – such as hunting, fishing, trapping and harvesting – coexist side by side with paid jobs. These subsistence activities often represent 25 to 50% of a community's economy. This reality, which already distinguishes First Nation communities from municipalities, is further complicated by major differences in terms of unemployment rates and income. In fact, most First Nations exhibit unemployment rates of 30 to 40%, while per capita income represents barely 50% of that observed in non-Aboriginal communities[6].

6 Ibid.

Many barriers have been identified with respect to business development by First Nations, in particular: inadequate access to capital and to federal programs supporting businesses, the absence of income linked to land property, the inability to use the land as matching funds to access bank loans under the Indian Act, and the limited access to the natural resources of their territories[7]. These barriers slow the creation of First Nation jobs and businesses, which in turn limits their capacity to benefit from the opportunities that will result from the transition towards a low-carbon, sustainable economy.

Conclusion

First Nations are among the communities most impacted by climate change, both community officials and members already observing those impacts on their territory and their way of life. First Nations want to participate in the transition towards a sustainable, low-carbon Canada, to ensure that the next seven generations will be able to preserve their sacred link with the Earth. However, for this participation to be real and equitable, it must be at least based on: the respect of First Nation Aboriginal Title and Aboriginal and Treaty Rights, the conservation and preservation of resources, an equitable sharing of the management responsibilities and benefits derived from the territory, as well as the implementation of consultation and accommodation mechanisms that are both efficient and transparent.

7 Centre for Indigenous Environmental Resources (2006). Report 4: First Nations' Governance and Climate Change: Key Issues, pp. 27

Contributed by

JUDITH DESBRISAY

Resonance

Photography by Judith DesBrisay

My husband, Mike Cannell, and I visited Mittimatalik (Pond Inlet) as part of our extensive 2006 Arctic explorations with Adventure Canada. We toured the picturesque community where we were privileged to witness a cultural presentation which included Inuit games and throat singing at the community centre.

This 2006 "snapshot in time" shows a young mother and child framed by a historic photograph of an elder... their multiple generations echoing in our memories. It underscores intergenerational importance, interaction and above all: the necessity to acknowledge historical context when seeking to understand and appreciate current life and future visions for individuals, families and communities

Judith DesBrisay

Business
and Investment

Network Canada

ABOUT THE ORGANIZATION

GLOBAL COMPACT NETWORK CANADA

The United Nations Global Compact (UNGC) is a strategic policy initiative for businesses that are committed to aligning their operations and strategies with 10 universally accepted principles in the areas of human rights, labour, environment and anti-corruption. By doing so, business, as a primary driver of globalization, can help ensure that markets, commerce, technology and finance advance in ways that create sustainable economies and societies everywhere.

Launched in June 2013, the Global Compact Network Canada (GCNC) is the local network chapter of the United Nations Global Compact (UNGC). As the formal local network of the UNGC, the GCNC supports Canadian signatories (both Canadian firms and subsidiaries of global signatories) in the implementation of the Ten Principles, while facilitating and creating opportunities for multi-sectoral and multi-stakeholder collaboration[1]. See Table 1 for the list of organizations in the GCNC.

The Global Compact Network Canada Environment Working Group (the Working Group) provides a forum where a sub-group of cross-sector and cross-industry representatives and other stakeholders can discuss, collaborate, and innovate on the most pressing environmental and economic challenges in Canada and globally. The Working Group believes there is alignment between the 10 key policy orientations, which recommend the pathway to a low-carbon economy in Canada outlined in A*cting on Climate Change: Solutions from Canadian Scholars*, and the UNGC Principles. Additionally, the Working Group agrees that clear and comprehensive climate change policies will drive the development of a sustainable future.

Working Group members come from the oil and gas, telecommunications, banking, consulting, law and education sectors.

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THE THREE ENVIRONMENTAL PRINCIPLES OF THE UNITED NATIONS GLOBAL COMPACT

© UN GLOBAL COMPACT TEN PRINCIPLES

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GLOBAL COMPACT NETWORK CANADA

Linking the Roadmap

to the UNGC Environmental Principles

Table 1. List of organizations in the Global Compact Network Canada (GCNC)[1]

Agrium Inc.	National Vaccum
B. Accountability	Native American Resource Partners
Baker & McKenzie	Nexen Energy ULC
Bank of Montreal (BMO)	O Trade Market Access
Barrick Gold Corporation	Optimum Talent Inc.
Blake, Cassels & Graydon LLP	Power Corporation of Canada
BCE - Bell Canada Enterprises	Power Financial Corporation
BDO	Quick Mobile
Corporate Knights	Rideau Recognition Solutions Inc.
Davies Ward Phillips & Vineberg LLP	Save the Children
Enbridge Inc.	Scotiabank
Export Development Canada	SNC-Lavalin
Goldcorp	Stantec
Hudson's Bay Company	Suncor Energy Inc.
JFL International Inc.	Teck Resources Limited
Jones Lang LaSalle Canada	TELUS Corporation
Kinross Gold	Unilever Canada
KPMG MSLP	WSP Group

1 For a complete list of participants in the UNGC see here: http://www.globalcompact.ca/our-participants.

Objective

The purpose of this paper is to demonstrate how the UNGC Environment Principles align to the 10 policy orientations in *Acting on Climate Change: Solutions from Canadian Scholars*. In adopting the policy recommendations, the UNGC Canada Environment Working Group acknowledges that this would provide clear direction for Canadian Business. However, the Working Group does not necessarily endorse any specific policy recommendation. As the *Acting on Climate Change: Solutions from Canadian Scholars* paper repeatedly recommends, there is a need for multi-stakeholder dialogue and for the Canadian Government to create an integrated climate action plan, and in so doing, embrace its leadership role.

It is agreed by the Working Group, however, that in transitioning to a low-carbon society, the following factors (outlined in the paper) will need to be taken into consideration in setting national policy:

- **Environmentally effective:** Policies meeting greenhouse gas (GHG) reduction targets without causing other excessive environmental impacts
- **Cost-effective:** Policies achieving the necessary GHG reductions at the least possible cost
- **Economically productive:** Framework of policy driving business opportunities towards investment in the transition to a low-carbon economy
- **Administratively feasible:** Complexity of policies being within the governance capacity of the implementing jurisdictions
- **Equitable:** Policies that are not placing unjustified burdens on any region, sector, or income group
- **Politically feasible:** Policies acceptable to Canadian publics and their elected representatives

The Working Group reviewed the 10 policy orientations outlined in the *Acting on Climate Change: Solutions from Canadian Scholars* paper and evaluated how they are supported by the three UNGC Environment Principles[2] and how they could be further enhanced.

For the purpose of this paper, the three UNGC principles related to the environment will be the focus:

Principle 7: Business should support a precautionary approach to environmental challenges

Principle 8: Undertake initiatives to promote greater environmental responsibility

Principle 9: Encourage the development and diffusion of environmentally friendly technologies

Principle 7: Business should support a precautionary approach to environmental challenges[3]

There are a number of key enabling policies that align with the UNGC's precautionary approach. The key element of a precautionary approach, from a business perspective, is the idea of prevention rather than cure. In other words, it is more cost-effective to take early action to ensure that irreversible environmental damage does not occur.

From the UNGC's perspective, precaution involves the systematic application of risk assessment tools (hazard identification,

2 https://www.unglobalcompact.org/what-is-gc/mission/principles

3 https://www.unglobalcompact.org/what-is-gc/mission/principles/principle-7

hazard characterization, appraisal of exposure and risk characterization), risk management, and risk communication. When there is reasonable suspicion of harm and decision-makers need to apply a precautionary approach, "lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation"[4].

Global temperatures are increasing and science has confirmed that GHG emissions and other human activities have been the dominant cause of observed warming since the mid-20th century. There is international consensus[5] that an increase in average global temperatures must be limited to no more than 2°C above pre-industrial temperatures. If this is not achieved, the consequences of climate change will be disastrous for people, the environment, and economies. The transition to a low-carbon economy, by embedding climate change into regulatory policies and how the market functions, is the only way to secure sustainable economic growth.

Bearing this in mind, ***key policy orientation #1: put a price on carbon*** is considered by climate policy analysts as a key component of any comprehensive climate change policy. From a business perspective, any market mechanism for carbon management needs to be palatable for business and map well economically. The Working Group does not endorse any specific market mechanism, be it carbon tax or cap-and-trade, however, a mechanism is needed to meet ambitious GHG reduction targets in a framework that meets the needs of the jurisdiction in which it is established.

There is no question that ***key policy orientation #8: safeguard biodiversity and water quality during Canada's transition to a low-carbon society, while aiming for net positive approaches when possible*** and ***key policy orientation #9: support fisheries, forestry and agriculture practices offering opportunities to limit GHG emissions, enhance carbon sequestration, and protect biological diversity and water quality*** align to the UNGC's precautionary approach principle. Adopting more rigorous forest management policies that reduce deforestation from all activities, accelerate reforestation, increase forest diversity and resilience, promote local and adaptive management of forests, and conserve large areas of continuous forests is key to enabling climate change mitigation. The resulting forests will sequester carbon and continue to provide the wide range of ecosystem services on which humans and biodiversity rely. Water quality may also be adversely impacted by the effects of climate change. Reduced availability of clean and accessible water supplies will impact both food and energy production (i.e. hydroelectric facilities) along with ecosystem biodiversity, which rely on proper watershed management. Recognizing these potential impacts, robust polices around watershed protection and enhancement must be adopted to avoid losing these valuable resources for the multiple functions they support.

Principle 8: Undertake initiatives to promote greater environmental responsibility[6]

Economic opportunities afforded by a transition to a low-carbon economy are a key driver for businesses looking at long-term strategy development. Initiatives such as federal or provincial funding for public transportation or regulatory policies to incite development of clean technologies or energy storage

4 http://www.unesco.org/education/nfsunesco/pdf/RIO_E.PDF

5 https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf, p. 8

6 https://www.unglobalcompact.org/what-is-gc/mission/principles/principle-8

will contribute to greater environmental responsibility among the members of the business community. The A*cting on Climate Change: Solutions from Canadian Scholars* paper suggests that the public is also more likely to restrain wasteful behaviour voluntarily if they recognize the logic in setting limits around carbon emissions and embracing a low-carbon economy. It is imperative to include awareness and education around the interconnectedness of environmental and social risks and how to manage them, as well as how responsible energy management can be a positive aspect of government initiatives.

Furthermore, responsible energy management is very important for business in the context of rising energy costs, security of supply issues, and increased awareness of corporate environmental sustainability. The world is facing unique environmental challenges including climate change, an emerging global crisis in water availability and water pollution, record loss of biodiversity, and long-term damage to the earth's ecosystems. In recent years, some Canadian businesses have acknowledged their contributions to these challenges and developed broad based strategies to manage these risks and, in some cases, opportunities. For example, Suncor states in its most recent sustainability report, "Suncor is tackling both global environmental issues such as greenhouse gas emissions and regional issues such as land use, reclamation, water use and air quality. Our approach is to invest in innovative technologies to improve environmental performance and reduce our impact on air, land and water"[7]. Suncor's strategy is to both manage risk and take advantage of opportunity through technological innovations such as reducing tailings, and was the first oil sands company to complete surface reclamation of a tailings pond[8].

In Chapter 30 of Agenda 21[9], the 1992 Rio Earth Summit spelled out the role of business and industry in the sustainable development agenda as: "Business and industry should increase self-regulation, guided by appropriate codes, charters and initiatives integrated into all elements of business planning and decision-making, and fostering openness and dialogue with employees and the public"[10]. By this it is meant that businesses have the responsibility to ensure that activities within their own operations do not cause harm to the environment, and since the operating rules of businesses are found in codes of conduct, policies, procedures and the like, incorporating measures to foster openness and dialogue about environmental issues into these instruments of self-regulation will promote greater environmental responsibility.

Businesses in Canada that are signatories to the UNGC have the opportunity to share their knowledge through their commitment to issue an annual Communication on Progress (COP), a public disclosure to stakeholders (e.g., investors, consumers, civil society, governments, etc.) on progress made in implementing the UNGC environment principles.

The following policy orientations, which recommend that businesses integrate planning and various levels of self-regulation, including developing regulatory frameworks, setting emission reduction targets, and updating standards, are all aligned with what the UNGC proposes in Principle No. 8:

7 http://www.suncor.com/en/responsible/302.aspx

8 http://www.suncor.com/en/responsible/3708.aspx. See the list of growing risk and opportunity projects on its website at: http://www.suncor.com/en/responsible/1429.aspx

9 https://sustainabledevelopment.un.org/index.php?page=view&nr=23&type=400

10 https://www.unglobalcompact.org/what-is-gc/mission/principles/principle-8

- ***Key policy orientation #2: include aggressive goals for low-carbon electricity production in federal and provincial climate action plans***, which proposes ambitious sectoral targets for low-carbon electricity production

- ***Key policy orientation #3: integrate the oil and gas production sector in climate policies***, which calls for the development of a clear framework for the transition to a low-carbon economy

- ***Key policy orientation #4: adopt a multi-level energy policy with energy efficiency and electrification at its core***

- ***Key policy orientation #5: throughout Canada rapidly adopt low-carbon transportation strategies***, which calls for emission standards to be updated for vehicles

- ***Key policy orientation #6: integrate landscape, land use, transportation, and energy infrastructure planning policies at multiple scales to ensure climate change mitigation***, which proposes integrating climate change into urban planning

- ***Key policy orientation #7: support evolution of the building sector toward a carbon neutral or carbon-positive sector***, which proposes the adoption of ambitious targets for energy demand and efficiency of buildings as well as including climate change mitigation in national building codes.

Principle 9: Encourage the development and diffusion of environmentally friendly technologies[11]

As business is the primary driver of globalization, it can help ensure that markets, commerce, technology, and finance can benefit society by demonstrating that environmentally sound processes can be profitable. UNGC Principle No. 9 demonstrates the need for business to respond by embedding climate change action into their strategies, which will drive investment and innovation in clean energy, scale-up low-carbon services and technologies, create jobs, and support economic growth.

According to the UNGC, environmentally sound technologies should protect the environment, be less polluting, use resources in a more sustainable manner, recycle more of their wastes and by-products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes. Technological innovations thereby create new business opportunities, help increase the overall competitiveness of companies, and will have long-term economic and environmental benefits.

Improved energy efficiency measures across all industrial and commercial sectors, along with greater adoption of clean technologies contribute to meeting climate change commitments. The *Acting on Climate Change: Solutions from Canadian Scholars* paper clearly sets out to demonstrate that producing electricity from low-carbon emission sources is a key component to emission reduction to help Canada meet its collective carbon emissions reduction targets. The following key policy orientations (2, 4, 5, and 7) all point to the need for increased funding for research, development and deployment of low-carbon technologies, stronger regulatory standards, and measures to encourage public initiatives and education:

- ***Key policy orientation #2: include aggressive goals for low-carbon electricity production*** in federal and provincial climate action plans, which proposes ambitious sectoral targets for low-carbon electricity production

11 https://www.unglobalcompact.org/what-is-gc/mission/principles/principle-9

- ***Key policy orientation #4: adopt a multi-level energy policy with energy efficiency and electrification at its core***

- ***Key Policy orientation #5: throughout Canada rapidly adopt low-carbon transportation strategies***, which proposes new models of transport, and electrifying road transport

- ***Key policy orientation #7: support evolution of the building sector toward a carbon neutral or carbon-positive sector***, which proposes investing in renewable and ambient energy for new and existing buildings.

By strengthening green and low-carbon innovations, it is possible to address the challenge of climate change and increase opportunities for prosperity and sustainable development. This would put Canada at the forefront of green electricity internationally, provide significant cost-savings, and give leverage to a number of Canadian industrial sectors. According to Bloomberg New Energy Finance, 79% of Canada's electricity is already produced from low-carbon emission sources[12]. Combining current hydroelectric production capacity with plentiful untapped renewable energy resources and east-west intelligent grid connections between provinces could allow Canada to adopt a target of 100% low-carbon electricity production by 2035.

Summary

In summary, the 10 key policy orientations presented in the *Acting on Climate Change: Solutions from Canadian Scholars* paper are supported by the three environmental principles of the UNGC in the following manner:

1. Recognition that climate change poses a credible threat to the planet's ecosystems and must be addressed by all levels of society certainly requires a "precautionary approach" (UNGC Principle 7). The approach includes the development of policies and strategies that both incite a reduction in carbon emissions while incenting the transition to a low-carbon economy, particularly in the areas of transportation, electricity generation, and building energy management.

2. Both government and business must develop robust initiatives that facilitate the transition to a low-carbon economy (UNGC Principle 8). This can be achieved through government subsidies, removal of regulatory barriers, and a market-based mechanism for managing carbon emissions. This regulatory environment creates the opportunities for a shift in public behaviour and business decision-making and strategy.

3. Development and adoption of environmentally friendly technologies (UNGC Principle 9), such as generation of electricity from renewable sources or increasingly energy efficient vehicles, promotes the responsible use of energy and recognizes the inherent impacts of current energy policy. In order for Canada to meet its carbon reduction goals it will need to assess the benefits of the transition to a low-carbon economy, not only from an anthropogenic perspective but also from the perspective of ecosystem protection and watershed management. It will become increasingly evident that in a rapidly energy-constrained world it is essential to manage it effectively and responsibly.

12 https://www.bnef.com/core/country-profiles/can

ABOUT THE AUTHOR

FRANÇOIS MELOCHE

François Meloche is Extrafinancial Risk Manager for Bâtirente, a pension system established by the Confederation of National Trade Unions in Quebec. Through external managers, Bâtirente manages assets of approximately C$1 billion. Mr. Meloche's role is to contribute to the implementation of the responsible investment strategy at Bâtirente, particularly in terms of shareholder engagement.

Mr. Meloche says climate change is at the heart of Bâtirente's strategy. Climate change is discussed with businesses in the energy sector, such as oil and gas, but also with industrial companies, retail trade, supermarkets, and so on. Bâtirente expects that companies disclose the greenhouse gas (GHG) emissions from their operations, and also that they provide plans to reduce those emissions. As a signatory to the Montreal Carbon Pledge, Bâtirente is currently conducting a carbon footprint exercise of its equity portfolios.

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FRANÇOIS MELOCHE

Investing to Facilitate Transition to a Low-carbon Society

An Interview With François Meloche, Bâtirente

Conducted by Ms. Divya Sharma, *Sustainable Canada Dialogues*

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

Question from Sustainable Canada Dialogues:

You work in the investment sector. How is climate change a risk for investors?

François Meloche: It's a risk at two levels: it's directly a financial risk for the companies in which we invest. Some economic sectors, such as energy suppliers, will be more affected by climate change than others, but all will be affected. Moreover, climate change has and will continue to have an impact on the global economy, resulting in what we can call a systemic risk. We also see a wider risk to the beneficiaries who have entrusted us with their retirement savings: a global risk. We make sure, of course, that our beneficiaries have money when they take their pensions. But our duty is broader than strictly their financial interest; it includes their interests as citizens, consumers and workers. Think of someone who's 20 years old and begins to contribute to our pension fund. After 40 years, this person will have to live with all the costs generated by the enterprises they helped finance through their pension fund.

Institutional investors are therefore, in our societies, among the few companies that have long-term public interest at the heart of their business plans. Insurance companies have similar motivations because they look at the long-term and they fear the costs of climate change. So I think institutional investors like Bâtirente and others have a role to play.

One way to manage carbon risk is to reallocate assets of carbon intensive sectors toward renewable energy, green infrastructure and energy efficiency, as well as toward the commodity sector, including agricultural land and forests. In other words, we must take the money from old industries and invest in new. This will help the transition to a low-carbon economy. At the same time, it could be more profitable and reduce risk. It's a kind of hedging: maybe climate change will have less impact than expected. Maybe governments will not do much. In this case, moving assets out of the older sectors would result in losses. It's a risk, but there's also a risk of continuing to invest in oil companies while other sectors

are developing, such as renewable energy, and not participating in their development.

Question from Sustainable Canada Dialogues:

Acting on Climate Change: Solutions from Canadian Scholars asserts a need to invest in technology that's clean, in terms of energy production and consumption. What are the necessary conditions to stimulate sufficient investments that can aid the transition toward a low-carbon economy?

François Meloche: First, we must put a price on carbon. This will allow companies and organizations to allocate their capital to clean energy. Without this price imposed on GHG emissions, we are in some ways now subsidizing fossil fuels.

Currently the price of carbon in most economies is non-existent or not high enough to have the desired effect. Taxation has to be seen both as a way to finance the activities of the government *and* as a way to shape behaviour. For example, with a price on carbon, oil companies will have to consider this cost when assessing the profitability of significant development projects. Now, when we ask, "What will you do if production costs, including the price of carbon, continue to rise and demand is lower than expected? Upon which scenarios of demand growth do you base your cost-benefit analyses? How do you manage these risks?", oil sector businesses respond that they don't see how the economy will get rid of oil in 50 years. However, we're beginning to hear a new discourse that evokes the desire to survive even if the sector is declining (i.e. "we want to be the last man standing").

Investors should integrate climate change issues into the strategic allocation of assets, which is to begin to allocate assets where they would be less exposed to the risks associated with climate change. This would help ensure that more assets go toward activities contributing to climate change mitigation. Governments have a role to play in terms of providing subsidies toward renewable energy rather than fossil fuels. At the moment, some speak of a ratio of 6:1 – that global fossil fuel subsidies are six times higher than clean energy subsidies. However, estimates vary widely: the International Monetary Fund (IMF) estimates there are approximately $5 trillion in global subsidies to the fossil fuel industry, versus $100 billion in subsidies for renewable energy[1,2]. The arrival of green bonds is promising. It has to be done well and the certification must be appropriate, but I think eventually it will give a new asset class that will be very interesting for investors. There will be more and more ways to reduce the carbon footprint of investment portfolios.

Question from Sustainable Canada Dialogues:

In September 2014, the Principles for Responsible Investment (PRI)[3] announced creation of the Montreal Carbon Pledge[4]. Can you tell us about this initiative?

François Meloche: This initiative is part of the effort to measure the carbon footprint of investment portfolios. More than 50 investors worldwide have signed the Montreal Carbon Pledge[5]. That is to say, at Bâtirente, we measure the carbon footprint of our investments – the emissions that we have in some way financed. I do not mean the GHGs we produce directly, such as through employees' travel. With around 10 employees, our emissions are relatively low. I'm referring

1 http://www.imf.org/external/pubs/cat/longres.aspx?sk=42940.0

2 http://www.theguardian.com/environment/2015/may/18/fossil-fuel-companies-getting-10m-a-minute-in-subsidies-says-imf

3 http://www.unpri.org

4 http://montrealpledge.org

5 http://montrealpledge.org/signatories/

to the carbon footprint of our investments, of the companies in which we invest. The idea is to measure our share of emissions in these companies. So the Montreal Carbon Pledge ensures that by the end of 2015, we are able to begin to measure the impact of our equity portfolios.

So the Montreal Carbon Pledge calls for the measurement of carbon footprints. Once the carbon footprint is measured, what happens? We're currently studying various approaches to reduce this footprint. Having a broader view would enable adopting a strategy like reallocation into different sectors, different geographies and different asset classes. Or it could allow us to liquidate a security that contributes significantly to our footprint. Thus, ultimately, it promotes the transition to a low-carbon economy. Take for example the idea of divestment, i.e. selling oil-related shares. Divesting from oil companies (for example, as called for by DivestMcGill[6]) means there will be hundreds of millions of dollars to re-allocate – many assets to invest. The idea of reallocation is to send this capital to the right places to aid in the transition to a decarbonized economy.

Another strategy is shareholder engagement, which is what we practice actively at Bâtirente. In this case we encourage, with dialogue, GHG emitters to reduce their emissions and invest in the transition to a low-carbon economy. We engage in dialogue with the company, asking environmental and social questions to understand how the company manages risk, how it tries to reduce its environmental footprint, and how it's trying to improve its products/services to improve its environmental and social value. Basically, we aim to encourage companies to adopt responsible practices toward their stakeholders. For example, we're talking to Suncor, the most important oil sands company, among others, about business opportunities for its Petro-Canada service stations. Could they not promote electric vehicles by installing charging stations?

Question from Sustainable Canada Dialogues:

Since the Rockefeller Foundation publicly announced its divestment from oil companies[7], we often hear about this type of initiative. What are the risks related to divestment and how can these be minimized?

François Meloche: Indeed, fossil fuel energy divestment is the biggest divestment movement since the 1980s, when South Africa was targeted for the Apartheid system and which had an impact. Now the movement is really very large and it has triggered several discussions on the subject. Does it have a financial impact? That's difficult to measure. Rockefeller, which announced it would divest from fossil fuels, is a symbolic example, but there is the sovereign fund of Norway, which manages assets of $900 billion and has liquidated its shares in coal companies[8]. However, we must remember that in divesting the shares are bought by other investors. It's possible this has an impact on share prices, but it's certain that it has an impact on the industry's reputation.

Again, one really must have an overview, and know where one's assets are allocated. They're mostly found in large pension funds, which should also pay particular attention to climate risk. Most large banks are cautious about the idea of completely withdrawing from a sector because they have to maintain some level of diversification to meet their obligations to their beneficiaries. They could,

6 http://divestmcgill.com

7 http://www.theguardian.com/environment/2014/sep/22/rockefeller-heirs-divest-fossil-fuels-climate-change

8 http://www.theguardian.com/world/2015/may/27/norway-sovereign-fund-reduce-coal-assets

however, decide to reduce their exposure to the fossil fuel sector and invest more in assets that are resilient to climate risk. An interesting example is that of CalPERS, a pension fund manager in California[9], which announced it would invest in green bonds. CalPERS continues to invest in oil and coal but we can expect that, over time, for investors who decide to invest in clean energy, the fossil fuel industry will occupy less and less space in their portfolios.

What happens in sectors that have reached a level at which there is no more prospect of growth? Some investors are beginning to see fossil fuels as such a sector. Investing in a declining sector may, however, meet certain needs; for some, investing in oil will enable them to earn dividends. Another factor in the oil industry's decline is its reputation. I suspect there's a decline in young engineers who want to work for oil companies. It's hard to imagine oneself 40 years in the future becoming a petroleum manufacturer and giving one's career to oil. Young people will think it's better to become a mining geologist, for example, than to make a career as a petroleum engineer.

Question from Sustainable Canada Dialogues:

Do you think divestment from oil companies will necessarily result in an increase in investment in clean technologies?

François Meloche: No. This is not a mandatory requirement, but it certainly helps. We must be careful. For example, if an investor sells its oil shares, but then transfers into companies that produce cement, what is the benefit? The exposure (risk) will perhaps be as large, since cement production emits a lot of GHGs. Similarly, supermarkets have many emissions via their supply chains. For example, a company like Alimentation Couche Tard is a food retailer, but also has petrol service stations. In fact, approximately half of Alimentation Couche Tard's turnover comes from gasoline sales. Even though it's not an oil company, it's a company that depends directly on the oil economy.

Governments encourage the mining industry by giving a tax return when one invests in a mining company, which promotes investment in this sector. This financial instrument is known as the "flow-through share"[10]. Governments could use the same kind of incentive for clean energy. One would even have to think more broadly than clean energy, because the objective of keeping a global temperature increase below 2°C will require many changes. Governments must accelerate the transition, and investors should encourage governments to do so and also demonstrate leadership and contribute to the transition. At the end of the day, I believe that the investment community is not sufficiently present in the public square to request appropriate action.

In *Acting on Climate Change: Solutions from Canadian Scholars*, Sustainable Canada Dialogues calls for elimination of all direct and indirect subsidies to the fossil fuel industry. This is not enough. We must eliminate fossil fuel subsidies, but we must also *create* subsidies that will direct investment towards low-carbon society. The Green Budget Coalition has worked on this[11].

9 https://www.calpers.ca.gov/index.jsp?bc=/investments/home.xml

10 http://miningtaxcanada.com/flow-through-shares/

11 http://greenbudget.ca

ABOUT THE ORGANIZATION

INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT

SCOTT VAUGHAN

IISD's mission is to promote human development and environmental sustainability through innovative research, communication and partnerships.

The institute has offices in Canada, Switzerland and the United States, and operates in over 70 countries around the world. As a registered charitable organization in Canada, IISD has 501 status in the U.S. IISD receives core operating support from the Government of Canada, provided through the International Development Research Centre (IDRC) and from the Province of Manitoba. The Institute receives project funding from numerous governments inside and outside Canada, United Nations agencies, foundations, the private sector, and individuals.

Scott Vaughan is President of the International Institute for Sustainable Development (IISD), a Canadian based global environmental think tank that marked its 25th anniversary in 2015[1].

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INDUSTRIAL SMOKE

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IISD

Climate Investment,

Low-Carbon Innovation and Green Industrial Policy

Decarbonization and Radical Transformation

Climate debates are changing. In mid-June 2015, the Pope issued a detailed statement calling for urgent action to address climate change[2]. The same month, G7 leaders urged ambitious action—the cutting of greenhouse gas (GHG) emissions by 40 to 70% by 2050, and complete decarbonization by end of this century[3]. As a member of the G7, Canada later clarified that it viewed this commitment as aspirational.

More surprising than the G7 commitment was the statement of the Saudi oil minister, who, in an interview in the *Financial Times* in June 2015, anticipated that his country—the largest oil exporter in the world—would end all fossil fuel exports by as early as 2040. The energy future, according to the Saudi oil minister, lies in solar and wind[4].

The Saudi minister isn't the lone voice in the energy sector contemplating a dramatic shake-up in world energy markets because of climate change. Among the most interesting of the recent flurry of public statements, petitions and promises is the joint letter of CEOs from the six largest European oil and gas companies—including BP, Shell and Statoil—urging governments to adopt broad-based carbon pricing[5].

Such statements aren't new, nor is the underlying economic work to support them.

Economists have looked to apply fiscal policies to address environmental externalities stretching back four decades, for example from early work by Solow (1970), Kneese (1970), Wallace and Oats (1979), followed by Repetto, Wilcoxen, Pearce, Nordhaus and others, as well as underlying work by the Organisation for Economic Co-operation and Development (OECD) in the late 1980s and throughout the 1990s. This rich analytic body of work has shown that carbon pricing is the most efficient means to nudge markets to reveal climate truths about

1 Thanks to Brendan Haley and Harsha Singh for their helpful comments and insights especially with regards to industrial policy, as well to Aaron Cosbey, Peter Wooders and Mark Halle.

2 http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html

3 http://www.theguardian.com/world/2015/jun/08/g7-leaders-agree-phase-out-fossil-fuel-use-end-of-century

4 http://www.ft.com/intl/cms/s/0/89260b8a-ffd4-11e4-bc30-00144feabdc0.html#axzz3hIbdpXjJ

5 Please see http://newsroom.unfccc.int/unfccc-newsroom/major-oil-companies-letter-to-un/.

the extent and consequences of damaging externalities. Today, carbon pricing is mainstream in economic thought. The International Monetary Fund (IMF) — that most cautious and conservative of all international financial organizations — has for several years concluded that carbon pricing (notably a carbon tax) is the most effective means of addressing GHG emissions.

If carbon pricing isn't new, then its uptake today needs to be both welcomed and viewed with caution. The mere existence of a carbon tax isn't a guarantee that GHG emissions will be reduced to limit a global temperature increase to 2°C — the target governments promised in Copenhagen. Put another way, it is not the existence of the policy instrument that matters. Instead, it is the level of ambition within each policy instrument chosen that does. A carbon tax with modest tax rates may give the impression of action, but will have an equally modest impact on actual emissions in the same way that a weak cap within a cap-and-trade emissions trading scheme or a weak regulatory threshold will be less than what climate science demands.

The IMF clearly suggests that carbon taxes need to be stringent enough to bring about what it calls the "radical transformation" in global energy systems to move beyond fossil fuels toward cleaner, low-carbon energy systems.

Ambition Matters More Than Instrument

In Canada and elsewhere, much attention has focused on the optimal policy choice to lower GHG emissions, with little discussion of what the actual tax rates will look like besides principled positions to be revenue neutral. While impressive research is underway to adopt carbon taxes specifically, this has prompted surprising infighting between carbon tax advocates and emissions trading. For example, *The Globe and Mail* recently criticized Ontario's alignment with the Quebec emission trading scheme, arguing apparently without irony that emissions trading was vulnerable to regulatory capture, omitting the thousands of pages of corporate tax loopholes and subsidies that have arisen due to the efforts of lobbyists[6]. The simple point is that any public policy runs the risk of capture by special interests.

Debates about policy choices are important. Yet critiquing all options other than carbon taxes is unhelpful in the real world for at least three reasons. First, the debate implies that first-best taxes are Canada's climate silver bullet to tackle its climate challenges. In the real world, first-best policies in theory are hard in practice. Simon Upton, the head of the OECD Environment Directorate, recently called carbon taxes the "third rail" in many countries, due to the combined forces of low-tax lobbyists and carbon sceptics[7]. In Canada, the federal government commonly links four words together: "job-killing carbon tax."

In most countries, domestic climate policies comprise an array of different policy measures, from the 40 jurisdictions that currently deploy carbon taxes to varying degrees (notably the European Union, the Quebec–California emissions trading scheme recently joined by Ontario), regulatory approaches to emission reductions used, for example, by the U.S. Environmental Protection Agency (EPA) and Environment

6 http://www.theglobeandmail.com/globe-debate/editorials/bcs-global-warming-lesson-for-alberta-and-ontario/article25028188/. The editorial warned that Ontario's cap and trade would lead to the "impulse to misspend—to subsidize well-connected companies, to support favorite industries or to pay for politically popular projects—will be hard to resist."

7 http://www.ft.com/intl/cms/s/0/fad8327e-03c8-11e5-a70f-00144feabdc0.html#axzz3hIbdpXjJ. Upton was quoted in the article thus: "Politically, it's still regarded as a third rail issue: touch it and you are out of office," pointing to Australia's repeal of its carbon tax as one example of lobbying efforts by companies against high carbon taxes.

Canada, mandatory and voluntary energy efficiency standards, third-party certification systems such as product-specific carbon footprints, renewable energy power targets with lock-in purchasing contracts, and public procurement practices that include clean, low-carbon buildings and infrastructure — to name just a few of the mitigation measures in the domestic toolboxes of most countries.

Suggesting that all these approaches should be replaced by a single and comprehensive carbon tax is unfeasible, especially given the enormous positive impacts that efficiency standards are reaping.

Debates about policy instrument are important. Yet in most countries, responses to climate mitigation will be composed of a suite of multiple instruments and approaches. Of greater relevance is ensuring the coherence of different policy choices, including the cumulative impact they must have in clearly mapping out new investment options in clean energy systems. Tax policies clearly are important, but their mere existence won't automatically uncover alternative energy solutions.

Second, supporting market-based approaches like pricing and taxes makes sense when markets work. The magnitude of energy-related market failures is staggering, leaving aside global damages associated with carbon externalities. For example, global oil markets are cartelized. Oil companies are oligopolies. The amount of global subsidies allocated yearly to distort fossil fuel prices is an estimated US$550 billion, comprising direct payments to both consumption and production. The IMF recently estimated that the combined cost of these subsidy payments, including externalities, is more than US$5.3 trillion a year[8].

In Canada, the amount of subsidy support to the fossil fuel sector was estimated to exceed C$800 million per year in 2012[9]. Although tax breaks for the oil sands were coming down, the 2015 budget saw more tax breaks allocated to the Canadian gas sector (through accelerated capital cost depreciation rates)[10].

There has been progress to exposing fossil fuel subsidies as a first step to eliminating them. For example, at an IISD-hosted meeting of a group of countries called the Friends of Fossil Fuel Subsidy Reform held during the annual World Bank/IMF annual meetings in April, finance and energy ministers lent their support to a joint communiqué to cut out harmful subsidies[11]. Both the United States and France joined Denmark, Sweden, New Zealand, Costa Rica, Ethiopia and others in pledging to reduce such subsidies. The Canadian federal government recently noted that eliminating these fossil fuel subsidies was also aspirational.

And third, carbon pricing requires strong domestic institutions to design, implement and ensure compliance with either tax or emission trading schemes. In most OECD countries, the black and grey economies are substantial, while many developing countries have weak national institutions to ensure implementation.

The Investment Roadmap Ahead

Given distortions within energy markets coupled with other challenges, the recent letter from the six energy company CEOs is newsworthy not because of the reference to carbon pricing, but rather its reference to

8 Coady, D., Parry, I., Sears, L. and Shang, B. (2015). How large are global energy subsidies? International Monetary Fund, http://www.imf.org/external/pubs/ft/wp/2015/wp15105.pdf

9 Office of the Auditor General of Canada (2012). Report of the Commissioner of the Environment and Sustainable Development, A Study of Federal Support to the Fossil fuel Sector, http://www.oag-bvg.gc.ca/internet/English/parl_ces-d_201212_04_e_37713.html

10 http://www.budget.gc.ca/2015/docs/plan/toc-tdm-eng.html

11 https://www.iisd.org/media/communique-launch

laying out the roadmap for future investment linked to climate policy choices.

The question is whether markets alone can move quickly enough to achieve the "radical transformation" in energy systems, or whether innovation needed to identify clean energy options needs the proactive partnerships of governments to accelerate innovation.

Industrial policy clearly has had a bad rap. Yet industrial policy is alive and well not only in Europe (notably the Nordic countries), but also in China (for example, state-owned enterprises broadly and the huge jump in renewable technologies specifically), Chile (with support to the successful expansion of salmon, grapes and other exports), Brazil (aircraft) and elsewhere[12].

Industrial policy typically entails a suite of tools that differ within and between sectors and countries. Based on an extensive literature survey, Harrison and Rodriguez-Clair (2010)[13] find that there is an important role for "soft" industrial policy, whose goal is to develop processes for government, industry, and cluster-level private organizations to collaborate on interventions that increase productivity and improve systems for enhancing policy impact and links of production to markets. The focus is on shifting to directly addressing coordination problems that keep productivity low for domestic producers, limit their innovative capacities or abilities to link up with new technologies.

While coherence and policy space matter, it is money that talks. Public finance to spur green innovation is crucial in the same way venture capital is important. Rodrik (2010)[14] notes that the U.S. Department of Energy alone has provided US$40 billion in loan guarantees to accelerate a range of green technologies such as wind turbines, solar technologies, the electric car and other technologies. Sustainable Development Technology Canada, supported by the federal government by more than C$900 million, similarly provides venture capital to support pre-commercialization development of clean technology options. In Alberta, the Climate Change and Emissions Management initiative similarly provides start-up capital to promising clean technologies, with more than C$400 million in funding from the carbon intensity tax imposed by the provincial government on major GHG emitters.

Rodrik (2014) argues that a "serious debate about the design of industrial policy would bring it out of the shadows and allow it to be carried out in an explicit manner"[15].

One example of new approaches to Canada's climate challenge is offered by Brendan Haley, who suggests that the transition to a low-carbon economy will require overcoming structural rigidities within energy markets that hinder innovation. Compared to other sectors, the oil, gas and coal sectors are significantly less innovative, when measured by standard indicators like research and development expenditures[16]. Haley argues that the structure of most energy sectors is less conducive to transitional innovation infrastructure networks. Haley thus argues

12 Rodrik, D. (2010). The return of industrial policy, Project Syndicate, http://www.policyinnovations.org/ideas/innovations/data/000165

13 Harrison, A. and Rodriguez-Claire, A. (2010). Trade, foreign investment, and industrial policies for developing countries. In D. Rodrik and M. Rosenzweig (Eds.), Handbook of Development Economics, Amsterdam, North Holland.

14 Rodrik, D. (2010). The return of industrial policy, Project Syndicate, http://www.policyinnovations.org/ideas/innovations/data/000165

15 Rodrik, D. (2014). Green industrial policy. Oxford Review of Economic Policy, 30(3).

16 Haley, B. (2014). Exploring low-carbon energy transitions in Canada: Natural resource staples, the carbon trap and innovating from a hydroelectric base (Ph.D. thesis), University of Ottawa.

that climate debates need to turn towards the opportunities to link Canada's lead in a number of low-carbon energy systems because of various rigidities such as long-term start costs, high capital-intensive fixed costs including a dependence on large-scale energy systems with its existing industrial structures. Linkages could be forged between structurally rigid and capital intensive systems (like hydro) and more networked and modular energy innovations like electric vehicles and wind.

As Canada and other countries look beyond Paris, the challenge is both to move from examining how to halt GHG emissions as an end in itself, and instead to accelerate zero-carbon energy options that benefit from a longer tradition of purposeful industrial policy that supports and focuses market activity.

Canadian
Climate Change Policy

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- Decision-making, as a container, in order to equip organizations with methods and tools useful for decision-making by generating value-added information (content structuring in sustainable development, and the design of diagnostic and monitoring tools).

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ACCUMULATION OF ICE ON THE SAINT LAWRENCE RIVER

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NATHALIE BERTHÉLEMY

A Comprehensive Look at Canada's Greenhouse Gas Emissions:

Which Actions for Which Reduction Targets?

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

In accordance with the international climate agenda, Canadian federal and provincial governments have periodically set greenhouse gas (GHG) emission reduction targets. In May 2015, for example, Canada committed to reducing its GHG emissions to 30% below 2005 levels by 2030 but, for the time being, has failed to reverse the overall upward trend in emissions affecting climate. Because the spectrum of GHG emissions covers multiple aspects of our economy and society, it is important to establish an overall picture that can facilitate the review of objectives to be set and actions to be taken.

To take a step forward in this direction, I propose to use my summary tool, "the CO_2 Manager"[1], developed in its first version in 2015, to analyze the new target set by Canada in May 2015 and the actions proposed to achieve it. The tool is a dashboard showing the progression of the components of GHG emissions in Canada, containing configurable projections and a simulation of the effects of emission reduction measures. The simulation could become the basis for a more comprehensive, publicly available tool to support analysis and decision-making.

Methodology

The methodology consists of three phases that, together, give us the GHG emissions tool:

1. Sampling from two main data sources and some complementary sources:

- Annual emissions records submitted by Canada to the United Nations[2]
- Company and institutional emissions records filed with Environment Canada[3] (565 facilities in 2013).

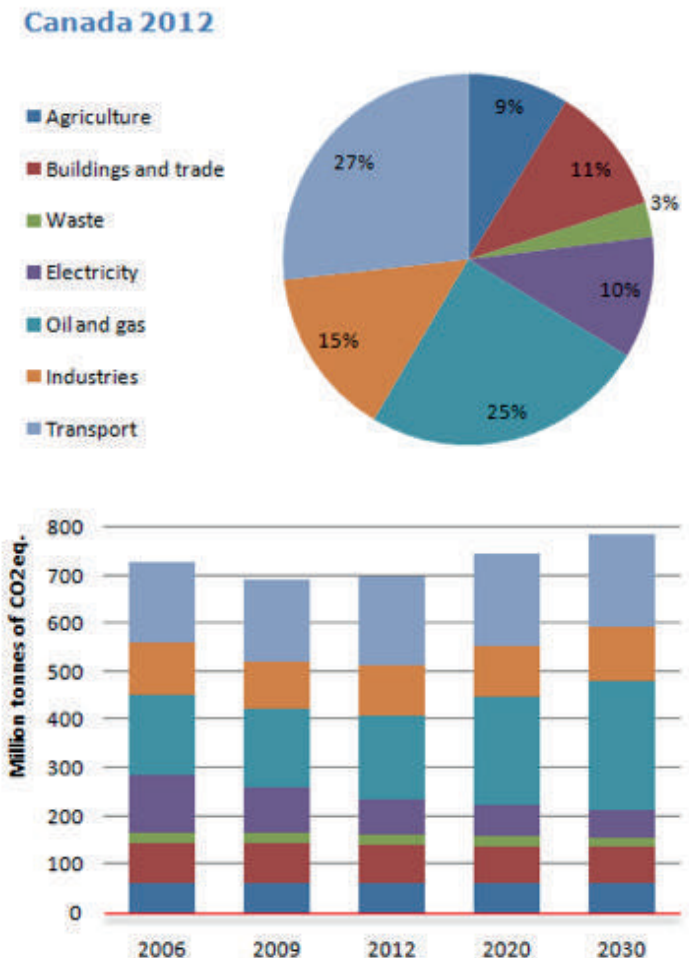
The first database presents the whole spectrum of emissions. The second provides a greater level of detail, especially for three

1 www.co2canada.net/en/purpose

2 These are data from the National Inventory Report (NIR) 1990 - 2012, Part 3, Annex 11, accessible from: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8108.php

3 http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=8044859A-1

Figure 1. Canada's emissions in 2012 by sector: actual progression 2006-2009 and projections for 2020 and 2030[9]



of the examined sectors: industry, electricity generation and hydrocarbon production. For the CO_2 Manager tool, I selected three years in the period 2004-2012, namely 2006, 2009 and 2012.

2. Gathering and projection of data

The method I used was inspired by "hypercubes", an IT tool used in decision-making[4]. The method involves building a data set with a relatively detailed level of information that can be arranged according to the perspective of choice, according to several criteria of analysis[5]:

- Sector/subsector/component (e.g. business/facility/type of vehicle, if available)
- CO_2-equivalent emissions level/type of gas emitted
- Canada-wide/province/location
- Year

4 https://en.wikipedia.org/wiki/OLAP_cube

5 The full methodology is explained at www.co2canada.net/en/methodology

Projections were made at detailed levels for 2020 and 2030. They were based on observation of trends with linear equations associated with threshold effects, and are adjustable.

3. Integration of measures inspired by existing plans

Policy interventions are then simulated as interventions on projected data. The review tool contains a series of measures inspired by existing plans, studies and examples of regulations set elsewhere and configured for Canada. In this document, I focus my study on the actions that Canada presented as a contribution for 2030 and addressed to the UN[6].

Observable trends

First, we must acknowledge the ongoing progression of emissions in a significant upward trend over time. With the model, we see an elevation in emissions very similar to that presented by Environment Canada[7], despite not having used an identical database or grouping methodology[8].

At the level of "all sectors/all provinces", there is a decline in GHG emissions from 763 to 689 million tonnes (Mt) from 2006-2009 (Figure 1); a slight increase from 2009-2012; then a larger emissions increase reaching a total of 786 Mt in 2030. Some sectors emit more (oil production) and others become more efficient (electricity generation). In the future, the reductions are an order of magnitude lower than the increases, while most sectors remain broadly stable (transport, industry, agriculture and waste).

Proposed regulatory measures

Let us now look at the measures proposed by Canada to achieve the target of reducing GHG emissions by 30% from 2005 levels by 2030. To evaluate the impact of measures, I associate them with interventions for which I will define the parameters and that I will apply to the relevant segments (Figure 2).

These measures are:

1. *To establish more stringent standards for the transport sector, especially for models of heavy-duty vehicles designed after 2018[10];*

To simulate such a measure, I add a standard on the "utilities/all provinces" segment that ensures that sport utility vehicles (SUVs) operating from 2018 onwards consume on average 20% less gasoline for the same mileage[11]. We get a reduction of 8 Mt by 2030, corresponding to a 26% reduction below 2005 levels.

2. *Gradually reduce the use of hydrofluorocarbons (HFCs) and thus limit the emission of powerful GHGs, which are expected to increase significantly over the next 10-15 years;*

It seems possible to replace HFC gases, which have a very high global warming potential, with HFCs that rapidly degrade in the atmosphere[12]. By gradually replacing these gases used as refrigerants, in air conditioners and

6 http://www4.unfccc.int/submissions/INDC/Published%20Documents/Canada/1/CPDN%20-%20Canada%20-%20Fran%C3%A7ais.pdf

7 The study of emissions trends is available from: http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=E0533893-1&offset=5&toc=show

8 See www.co2canada.net/en/methodology

9 These figures are taken from a combination of data from the 1990-2012 National Inventory Report (NIR), http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8108.php, and balance sheets filed with Environment Canada on company and institutional emissions, http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=8044859A-1

10 http://oee.nrcan.gc.ca/fcr-rcf/public/index-e.cfm?attr=0

11 For the models on the market in 2015, consumption of SUVs ranges from 7.4 to 21.4 litres per 100 km. http://eia-global.org/blog/bringing-hfcs-to-the-table-on-climate-and-health

12 http://www.actu-environnement.com/ae/news/hfc-gaz-effet-serre-substitution-14185.php4

in the manufacture of insulating foam, we obtain a reduction of 12 Mt by 2030. This corresponds to a reduction in the sub-segment "production and consumption of halocarbons" of 62% below 2005 levels.

3. *Reduce GHG emissions associated with electricity production from natural gas and produced by chemicals and nitrogen fertilizers;*

Across all provinces, this measure applies to three separate segments that each emits different levels of GHGs. Because Canada did not specify whether this measure would entail replacement of one technology by another, I associate it with a type of "performance improvement" intervention. Since the purpose of the measure is to facilitate achievement of the 2030 target, I set a fairly significant optimization rate of 40%.

- With the switch from coal to gas in electricity production, the segment "electricity generation from natural gas" rises sharply. The measure therefore applies to an emissions baseline of 13 Mt in 2005 to 28 Mt in 2030. By applying the measure, we obtain a reduction of 11 Mt by 2030, corresponding to a segment increase of 29% compared to 2005.

- With a similar measure, we obtain a reduction of 4.5 Mt in the "chemicals" segment and 5 Mt in the "fertilizer" segment by 2030. In these two sectors, this decrease represents a 16% reduction of the total compared to 2005.

4. *Reduce methane emissions from the oil and gas sector.*

Following the model of the U.S.[13], Canada could establish regulations for oil and gas facilities and pipelines. The proportion of methane in the oil and gas sector is around 30% of emissions. With the expected increase in production in this sector, methane emissions will increase from 50 to 75 Mt of GHG in 2030.

With a set of measures to either avoid or repurpose methane emissions, and reduce them by 45% by 2030, we obtain a savings of 34 Mt by 2030, corresponding to a segment decrease of 19% compared to 2005.

In the model, these measures represent a reduction of 75 Mt, equivalent to a decline of 3.4% compared to the 2005 reference year. In other words, with these measures, emissions would reach a greater level than in 2009-2012.

Those measures that concern segments that increasingly emit GHGs total 147 Mt in 2005. To achieve greater reductions, we must work to reduce emissions in a greater number of segments.

Review of segments that emit the most GHGs

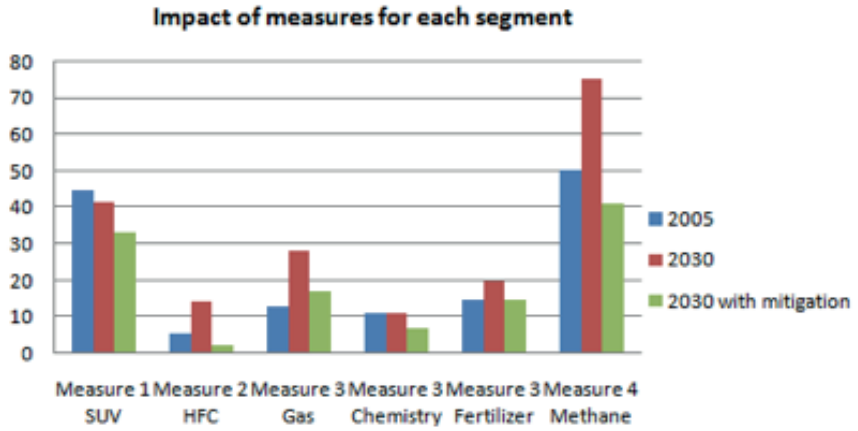
To review the segments that emit the most GHGs, I now select (by province and sector) those that together total more than 50% of emissions. I thus select 24 segments out of 500, grouped here by sector and placed on a scale of 200 million tonnes of GHG (Figure 3).

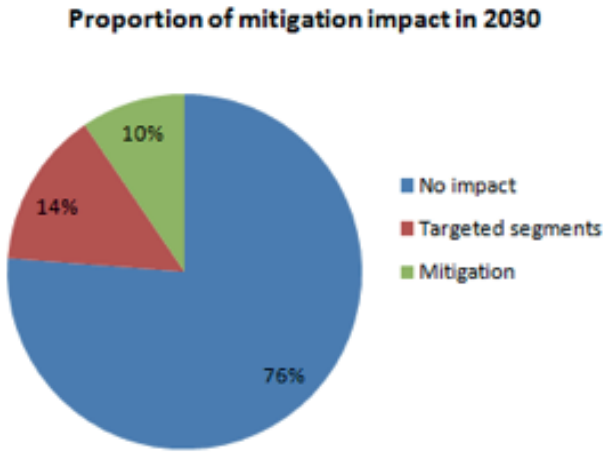
It is clear that the sharp increase in emissions expected in the hydrocarbons sector (mainly in the segment "oil sands/Alberta", which is close to 100 Mt alone[14]), cannot easily be offset by other emitting segments. For example, if reduction efforts already underway were strengthened (such as replacing coal in power stations) in all sectors, the total potential reductions would not exceed 60 Mt.

13 http://www.actu-environnement.com/ae/news/methane-fuites-reduction-gaz-effet-serre-obama-etats-unis-23662.php4

14 Projections of GHG emissions in the oil sands were made using the list of current and future projects available at http://navigator.oilsandsreview.com/listing website

Figure 2. Impact of measures by segment, for every intended measure, and share of emissions of the projected total for 2030



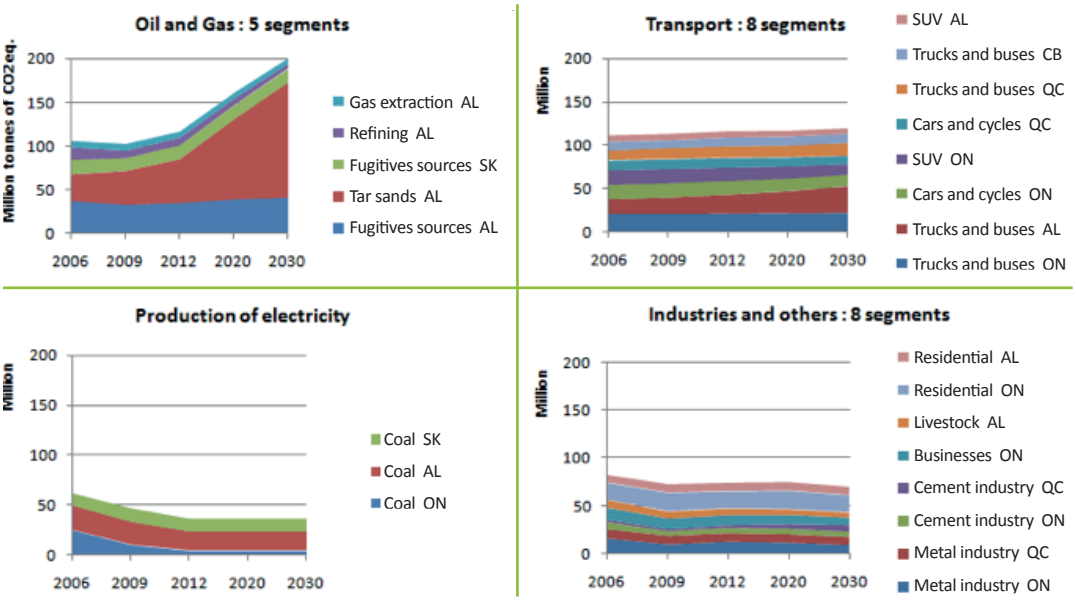


Countries that succeed in their GHG emission reduction approaches implement a combination of measures that in total target a much larger spectrum of emissions. For example, one can use sectoral measures targeting the segments that emit the most, and general measures that have an impact on several sectors simultaneously (such as a carbon market or infrastructure) to intervene on a wider spectrum.

In Canada, we should also reflect on the strategy of distribution of effort across sectors and provinces:

- If, for example, we wish to share the burden evenly among all stakeholders, each sector in each province would be asked to reduce its emissions by 30% from 2005 levels. The hydrocarbon sector will meanwhile offset the expected increase. For the "oil sands/ Alberta" segment, this corresponds more or less to a decrease of about 84% from the projected level in 2030. The structure of this industry would be deeply changed as a result. In terms of measures, this corresponds to more or less an imminent cessation of any new development (e.g. via moratorium).

Figure 3. Projected progression of the 24 segments that emit the most GHGs (i.e. those representing more than 50% of total emissions), 2006-2030



- If, however, efforts are prioritized in some "sector/province" segments while in other sectors the emissions continue to increase, these efforts, whatever they are, will amount to more than 30% of total emissions. This, of course, leads to questions of fairness and the need for interprovincial arrangements: if the burden of reductions and the compensation of increases fall to certain actors and not others, a system of rebalancing should then be put in place.

Conclusion

As the measures announced by the Canadian government in May 2015 will clearly fail to meet the target set, we must define a much more proactive GHG reduction strategy that will involve a broad emissions spectrum. Whatever the strategy, it will have a profound economic and social impact, and will interfere with the current model of development. This raises questions of equity and requires a societal debate.

By presenting a method for rapid assessment of proposed solutions, the results and simulation models can help identify the best options. Assessment of proposed solutions could be combined with other information, such as: cost of measures, level of production, efficiency, employment, tax generation, risk factors, other environmental factors, and more.

David
Suzuki
Foundation

ABOUT THE ORGANIZATION

DAVID SUZUKI FOUNDATION

IAN BRUCE AND RYAN KADOWAKI

The David Suzuki Foundation is a non-profit, charitable organization. We collaborate with Canadians from all walks of life, including government and business, to conserve our environment and find solutions that will create a sustainable Canada through science-based research, education and policy work. Our mission is to protect the diversity of nature and our quality of life, now and for the future. Our vision is that within a generation, Canadians act on the understanding that we are all interconnected and interdependent with nature.

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DAVID SUZUKI FOUNDATION

Building On the Best:

Keeping Canada's Climate Promise

Read the full report[1] at *www.davidsuzuki.org/publications/reports/2014/building-on-the-best-keeping-canadas-climate-promise/*

In 2009, at the United Nations climate conference in Copenhagen, Canada made an international promise to reduce carbon pollution by 17% by 2020, a step that mirrored the United States' commitment. However, unlike the U.S., Canada is not on track to meet this target[2]. While countries like China and the U.S. are working together to address climate change[3], a national guiding policy in Canada has been lacking. In the lead up to the 2015 UN climate conference in Paris, it is important for our country to learn from past mistakes and develop a strong, unified strategy to cut emissions and do our part to keep global temperature rise below the 2°C threshold deemed critical to avoid climate change's worst impacts.

Fortunately, this goal is not completely out of reach. While federal policy-makers have been slow to act on climate change, their provincial counterparts have spent the past decade developing innovative and effective emissions reduction strategies. A recent report[4] by Navius Research, a private consulting firm working in the field of energy and climate change, and led by the David Suzuki Foundation, has demonstrated that if Canada had adopted its existing "best-in-country" provincial policies at a national level in 2008, we would already be on track to meet our 2020 target. These results were revealed using a comprehensive, quantitative (mathematical) model of Canada's energy system and economy. If federal policy used these existing ideas — already backed by years of data supporting their efficacy — to reduce emissions across the board, we would make significant progress in closing the gap between where we are and where we need to be.

1 Special thanks to Jotham Peters and Michael Wolinetz of Navius Research. This research has been made possible with funding from Bullfrog Power, Bullitt Foundation, Claudine and Stephen Bronfman Family Foundation, Gencon Foundation, and the Sitka Foundation.

2 http://www.theglobeandmail.com/news/politics/canada-wont-meet-2020-greenhouse-gas-emission-targets-report/article21998423/

3 The White House: Office of the Press Secretary (2014). FACT SHEET: U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation, https://www.whitehouse.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c

4 David Suzuki Foundation (2014). Building on the best: keeping Canada's climate promise, http://www.davidsuzuki.org/publications/reports/2014/building-on-the-best-keeping-canadas-climate-promise/

Canada's climate action opportunities

There's no shortage of innovative and potent policy opportunities competing for the label of "best-in-country." Within the global market context, where the price of solar panels has fallen by 83% since 2008 and the cost of wind turbines declined by 70% between 1990 and the early 2000s, renewable energy is an obvious area of interest[5,6]. There are, however, significant gains that can also be made through transportation and land use, energy efficiency, biofuels and carbon pricing policies. This section presents emissions reductions strategies already at work in Canada and the amount of carbon emissions they will cut by 2020.

Cutting coal

Canada is fortunate to have access to multiple sources of electricity generation, from renewable wind, solar and hydro power to fossil fuels like coal and natural gas. Coal is by far the dirtiest option for generating power, accounting for roughly 10% of Canada's current emissions[7]. Coal power generation significantly degrades air quality in the areas where it's produced. This is a serious health concern in Canadian cities accounting for an estimated $4 billion in lost worker productivity and health care costs in Ontario alone[8]. Reducing emissions from coal power plants through initiatives like Ontario's coal phase-out and Nova Scotia's cap on coal emissions will eliminate 25 million tonnes of carbon pollution annually by 2020[9].

Prioritizing renewable energy

The renewable energy industry represents a clear means to reduce carbon pollution and a huge economic opportunity for Canada. As the cost of producing wind and solar energy has fallen dramatically in recent years, the clean technology industry, including clean energy and other environmental technologies, has grown rapidly and now contributes nearly $12 billion annually to the Canadian economy, employing 50 000 people[10]. British Columbia requires that 93% of electricity generation come from renewable resources and Ontario has incentivized industry growth by guaranteeing a price for wind- and solar-produced electricity. These renewable energy policies will reduce Canada's emissions by 21 million tonnes annually by 2020[11].

Storing carbon

While carbon capture and storage holds some promise to cut emissions from the oil and gas and power sectors, the technology will never reach the threshold of scalability necessary to form the basis of a national climate strategy without mandatory regulations or a strong price on carbon. While the future of provincial and federal investment in this technology is uncertain, if present policies were continued

5 National Renewable Energy Laboratory (2012). IEA wind task 26: the past and future cost of wind energy.

6 Clean Energy Canada (2014). Tracking the Energy Revolution, http://cleanenergycanada.org/wp-content/uploads/2014/09/Tracking-The-Energy-Revolution-Global-2014.pdf

7 Environment Canada (2014). National Inventory Report 1990–2012: Greenhouse Gas Sources and Sinks in Canada.

8 Canadian Medical Association (2008). No breathing room: National illness costs of air pollution, http://www.healthyenvironmentforkids.ca/sites/healthyenvi- ronmentforkids.ca/files/No_Breathing_Room.pdf

9 David Suzuki Foundation (2014). Building on the best: keeping Canada's climate promise, http://www.davidsuzuki.org/publications/reports/2014/building-on-the-best-keeping-canadas-climate-promise/ and Navius Research (2014). Progress on Canadian Climate Policy, http://www.davidsuzuki.org/publications/downloads/ProgressonCanadianClimatePolicy-TechnicalReport.pdf

10 Analytica Advisors (2015). 2015 Canadian Clean Technology Industry Report Summary, http://www.analytica-advisors.com/assets/file/2015%20Report%20Synopsis%20Final_wcovers.pdf

11 David Suzuki Foundation (2014). Building on the best: keeping Canada's climate promise, http://www.davidsuzuki.org/publications/reports/2014/building-on-the-best-keeping-canadas-climate-promise/ and Navius Research (2014). Progress on Canadian Climate Policy. http://www.davidsuzuki.org/publications/downloads/ProgressonCanadianClimatePolicy-TechnicalReport.pdf

to 2020 they would keep 3.8 million tonnes of emissions out of the atmosphere annually[12].

Clean transportation

Transportation contributes 28% of Canada's greenhouse gas (GHG) emissions, excluding pipelines[13]. Providing cleaner, more efficient systems to move people and goods is key to cutting carbon pollution and getting us back on track to meet future targets. The federal government, with leadership from British Columbia, Quebec and California, has already passed regulations to improve passenger and freight vehicle efficiency. By 2020, these regulations will mean that each new vehicle sold will be 44% more efficient than the passenger fleet of 2011 and will prevent 13 million tonnes of emissions[14] per year by 2020. Providing better access to public transportation, as well as walking and cycling routes in cities, will also help address the 200 000 kt of CO_2 produced by Canada's transportation sector each year[15].

Biofuels

Emissions reductions achieved through improved transportation can be enhanced by accelerating the use of biofuels (fuel derived from plants or other organic sources). Biofuels do not add any net carbon to the atmosphere because the carbon they contain was pulled from the atmosphere during photosynthesis. As fuel efficiency standards become stricter for passenger and freight vehicles, biofuels can help address any continued demand for liquid fuel. In addition to federal requirements for biofuels in gasoline, Manitoba has created financial incentives to promote biofuel production. These incentives and standards will reduce emissions by two million tonnes annually by 2020[16]. Renewable and low-carbon fuel standards (RLCFS) also show great potential. A recent analysis of B.C.'s RLCFS predicts the policy will reduce the province's emissions by up to 3.5 million tonnes annually by 2020[17].

Reducing energy consumption

Programs across Canada, including ecoENERGY and ENERGY STAR, are already at work cutting emissions by reducing the demand for electricity. By improving the efficiency of consumer products from washing machines to furnaces, these programs take pressure off the grid and help reduce utility peak energy requirements. These initiatives are, therefore, good for both the environment and the economy. By 2020, policies that encourage energy efficiency will reduce emissions by 15 million tonnes annually[18].

Carbon pricing

Once the most feared and misunderstood emissions cutting strategy in the country,

12 Ibid.

13 This figure is based on the 1990-2011 National Inventory Report (NIR). Emissions in transport include: domestic aviation; road transportation; railways; domestic marine transportation; and other transportation (e.g., off-road), http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=A07ADAA2-E349-481A-860F-9E2064F34822. In the 1990-2013 NIR, transport accounted for 27% of Canada's total emissions, http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=5B59470C-1.

14 David Suzuki Foundation (2014). Building on the best: keeping Canada's climate promise, http://www.davidsuzuki.org/publications/reports/2014/building-on-the-best-keeping-canadas-climate-promise/ and Navius Research (2014). Progress on Canadian Climate Policy. http://www.davidsuzuki.org/publications/downloads/ProgressonCanadianClimatePolicy-TechnicalReport.pdf

15 http://www.statcan.gc.ca/pub/16-001-m/2010012/part-partie1-eng.htm

16 Ibid.

17 Navius Research (2014). The Renewable and Low Carbon Fuel Requirement Regulation, http://www.naviusresearch.com/data/pages/cleanfuel.php

18 David Suzuki Foundation (2014). Building on the best: keeping Canada's climate promise, http://www.davidsuzuki.org/publications/reports/2014/building-on-the-best-keeping-canadas-climate-promise/ and Navius Research. (2014). Progress on Canadian Climate Policy, http://www.davidsuzuki.org/publications/downloads/ProgressonCanadianClimatePolicy-TechnicalReport.pdf

carbon pricing has become an accepted norm of responsible climate policy. In 2007, Alberta led North America by introducing its Specified Gas Emitters Regulation, charging $15 per tonne on carbon pollution above set levels. In 2008, British Columbia introduced a more broadly applied tax that rose in increments to $30 per tonne in 2012. Quebec and Ontario have since agreed to a cap-and-trade carbon pricing system that will cap and ratchet down emissions from industrial and transportation sectors. Carbon pricing in these regions has not adversely affected their economies. In fact, both B.C. and Alberta have outpaced the Canadian average for economic growth since introducing carbon pricing. These measures will reduce emissions by 15 million tonnes annually by 2020[19].

Best-in-country policies

While many provinces have played a part in reducing Canada's carbon emissions, a few have demonstrated national, and even global leadership on specific policies. This section outlines the three policies that stand out as best-in-country and presents the projected outcomes of adopting these policies nationally. These ideas have received extensive support from Sustainable Canada Dialogues in their *Acting on Climate Change: Solutions from Canadian Scholars* report.

Eliminating coal-fired power

In 2008, Ontario began phasing out coal power entirely, completing this goal in 2014[20]. The 15 plants that were eventually closed represented 20% of the province's installed electricity capacity in 2007. This initiative represents the single largest climate action undertaken in North America and was equivalent to taking seven million cars off the road[21].

Over this period, Ontario was able to eliminate coal power at an annual rate of 2.4% of 2020 expected electricity capacity. The analysis below reflects the outcome of all other provinces reducing coal emissions at the same capacity rate, either through closing or retrofitting existing coal power plants.

Prioritizing renewable energy

In order to replace the electricity generating capacity of coal plants in Ontario, the provincial government increased investment in renewable energy through the Green Energy and Economy Act. Few policies have been as effective at quickly developing clean, renewable energy in North America. By 2020, it is expected that 25% of the province's electricity capacity will come from renewable solar and wind power (excludes hydro power), up from 2% in 2007[22]. The Ontario government estimates this effort has already created more than 20 000 jobs[23].

The key lesson is that Ontario has supported renewable energy in a region not as richly endowed with renewable resources as other provinces. If Ontario can make this kind of progress and overcome more significant technical challenges, there is no excuse for other provinces with higher quality clean energy resources not to accelerate renewable energy.

The analysis below reflects the outcome of the rest of Canada increasing renewable energy capacity by the same rate as Ontario (23% share increase by 2020).

19 Ibid.

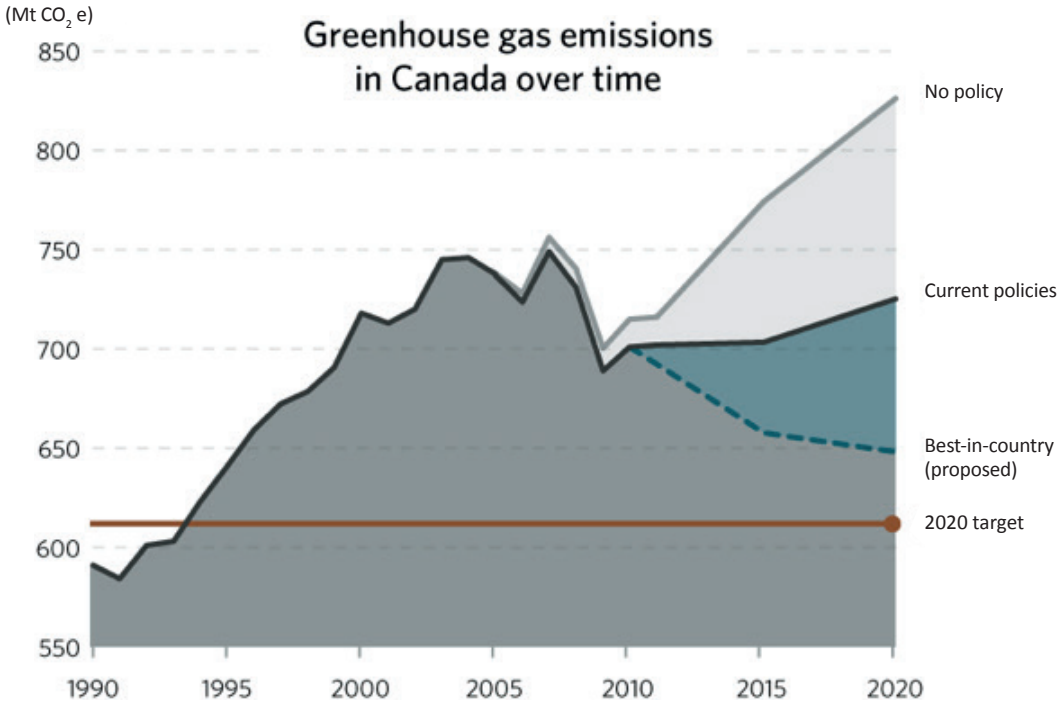
20 http://news.ontario.ca/mei/en/2014/04/creating-cleaner-air-in-ontario-1.html

21 http://www.cleanairalliance.org/support-a-clean-energy-future/ontarios-coal-phase-out/

22 http://www.energy.gov.on.ca/en/ltep/

23 http://news.ontario.ca/mei/en/2011/07/green-energy-act-creates-20000-jobs.html

Figure 1. Canada's greenhouse gas emissions to 2020[24]



Driving cleaner energy by pricing carbon

British Columbia has established the strongest carbon price in the country. The tax was introduced in 2008 at $10 per tonne of carbon emissions and rose in $5 per tonne increments to reach $30 per tonne in 2012 where the tax was capped. This freeze was put in place due to provincial government concerns regarding competitiveness with other regions who had not yet adopted a similar policy. Initial public wariness of carbon pricing has given way to acceptance. Sustainable Canada Dialogues recognizes this approach as its key enabling condition for climate action.

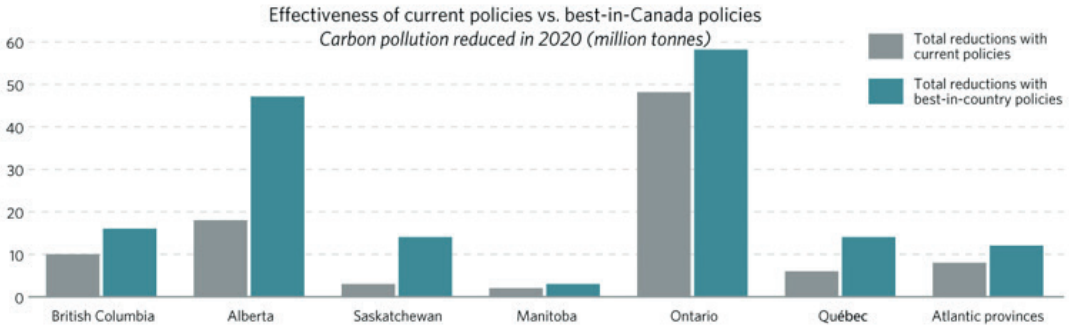
For the best-in-country analysis, the effect of all other provinces adopting the same tax at $10 per tonne in 2008 is considered. It is assumed that given the alleviation of competitiveness concerns, the tax would continue to rise to $70 per tonne by 2020.

Replicating Canada's best policies is key to progress

Figure 1 shows three trajectories for Canada's GHG emissions based on modelling by Navius Research[24]: a no-policy scenario, the scenario reflecting current policies and what would have happened had Canada adopted the best-in-country policies at a national level in 2008. Without the policies already in place, Canada's emissions would have continued to rise to a level of 830 million tonnes (Mt CO_2 e) of carbon dioxide by 2020. Given the actions taken by provincial governments across the country, a significant proportion (100 Mt CO_2 e) of these emissions will be eliminated. However, this figure is still 100 Mt CO_2 e (19%) greater than Canada's 2020 target. If Canada,

24 David Suzuki Foundation (2014). Building on the best: keeping Canada's climate promise, http://www.davidsuzuki.org/publications/reports/2014/building-on-the-best-keeping-canadas-climate-promise/ and Navius Research (2014). CIMS model; Environment Canada (2014). Canada's sixth national report on climate change.

Figure 2. Potential emissions reductions by province



starting in 2008, had adopted the best-in-country policies as they were introduced, we would be within striking distance (within 5.6%) of meeting our 2020 emissions target.

The lesson to be learned is that the policies needed to meet the targets necessary to avoid climate change's worst impacts are not radical, new ideas. They are solutions that are already working to reduce emissions in Canada. The groundwork is already in place and history has shown that these effective environmental policies also stimulate and diversify economies while promoting public health.

Another key finding of this research is that every region in Canada has the potential to further reduce its emissions simply by adopting the policies already in place elsewhere in the country. Provinces that are already global leaders, namely B.C. and Ontario, would each see their emissions fall by 4%. Regions that have been slower to act hold even greater potential. Saskatchewan, for example, will reduce its emissions by 4% through current policies, but under a national policy including the best-in-country policies would see its emissions drop by 18% more. Alberta, too, would more than double the emissions reductions it is expected to achieve, cutting carbon pollution by 9% on top of the 6% cut under current policies. Figure 2 summarizes the potential reductions that could be achieved by adopting best-in-country practices in each province.

As nations prepare for the UN climate summit in Paris this December, many will be forced to invest significant resources into establishing emissions reductions targets and plans outlining how to achieve them. In Canada, national policy-makers are fortunate to have several examples of world-leading action within their own country. They will not need to start from scratch in developing a strategy to achieve success. Canadian leaders will need work to develop additional methods to reduce carbon pollution across the country, but implementing the best-in-country strategies outlined above will substantially contribute to regaining our reputation as an environmental leader.

ABOUT THE AUTHOR

RALPH TORRIE

Torrie Smith Associates (TSA) has been engaged in the global warming issue since 1988 when TSA principal Ralph Torrie organized the energy workshop for the Toronto Conference on the Changing Atmosphere. The firm developed the framework and conventions now used around the world for local government climate change response strategies, produced the first low-carbon scenario analysis for Canada, and continues to help public and private sector clients identify and pursue the opportunities being generated by the current global energy transition.

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MY GRANDSON WAS BORN IN 2015, AND WILL LIVE OUT HIS LIFE IN THE CENTURY OF CLIMATE CHANGE. WHAT WILL BE OUR LEGACY TO HIM?

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RALPH TORRIE

Some Reflections

On Climate Change Response Policy

Critique of Current Climate Change Response Policy Agenda

The current menu of climate change mitigation policies focuses on improving the utilization efficiency and reducing the carbon content of fuel and electricity. Carbon pricing, efficiency regulations, feed-in tariffs, renewable electricity and biofuel mandates, public investment in efficiency and carbon-free alternatives, consumer education and social marketing – these are the elements we find in climate change response policies around the world. They have worked, but not well enough to bend the curve of growing emissions to the extent needed to avoid dangerous climate change. They will give us futures in which emissions are lower than they would otherwise be, but they will not lead to low-carbon futures in the context of avoiding dangerous climate change.

Globally, greenhouse gas (GHG) emissions have *increased* by more than 50% since 1990, the reference year in the Framework Convention on Climate Change. In the rich, industrial countries of the Organisation for Economic Co-operation and Development (OECD) only four countries had emissions in 2013 that were more than 15% below 1990 levels: Germany, Sweden, Denmark and the United Kingdom. In the case of Germany and the United Kingdom, a significant portion of the emission reduction resulted from economic structural change that had nothing to do with climate change response policy. Even if this small group of countries could repeat their historical performance *and then repeat it again*, by 2060 their emissions would still be more than twice the levels needed to qualify as low-carbon economies. And these are the world leaders.

In the context of the challenge of achieving truly low-carbon futures, there are two problems with the current policy menu:

- First, it is not politically popular; much of it is not even politically feasible, even when very weakly applied.
- Second, even if and when it can be mounted with some vigour, it is not sufficient to achieve the transformation to the low-carbon future (i.e. emissions at least 80% below current levels).

The current policy menu starts in the world of status quo emissions and political ambivalence, and **efforts to move it to greater**

mitigation efficiency also tend to move it into the realm of political infeasibility (Figure 1). It is the difference between a carbon tax of $15-$30/tonne and a carbon tax of $200-$300/tonne, or the difference between continued harmonization with U.S. fuel efficiency standards vs. banning gas guzzlers or making electric vehicles mandatory.

Even if the current policy menu trended in the direction of increasing political feasibility with increasing intensity, so that political support grew as the carbon taxes went up and the government intervention and/or regulation of fuel and electricity production and consumption grew stronger (accelerating climate change itself may help to do this), our best analysis now suggests that, ***while items from the current menu would be necessary, they would not by themselves be sufficient to achieve the transformative change required for a low-carbon outcome in this century***.

This last point may not be so obvious, given the hyperbole that often accompanies popular coverage of clean energy technology progress. However, a close reading of the low-carbon scenario literature[1] suggests that while low-carbon futures (emission reductions in the 80% range in this century) are technically possible, there are daunting practical issues facing their implementation on a 2050 time scale, especially given the "business-as-usual" forecasts that are employed. Quoting the Deep Decarbonization Project:

> *"staying within 2°C will require deep transformations of energy and production*

1 See Torrie, R. et. al. (2013). Low Carbon Futures: A Review of National Scenarios. Trottier Energy Futures Project, Vancouver, http://www.trottierenergyfutures.ca.

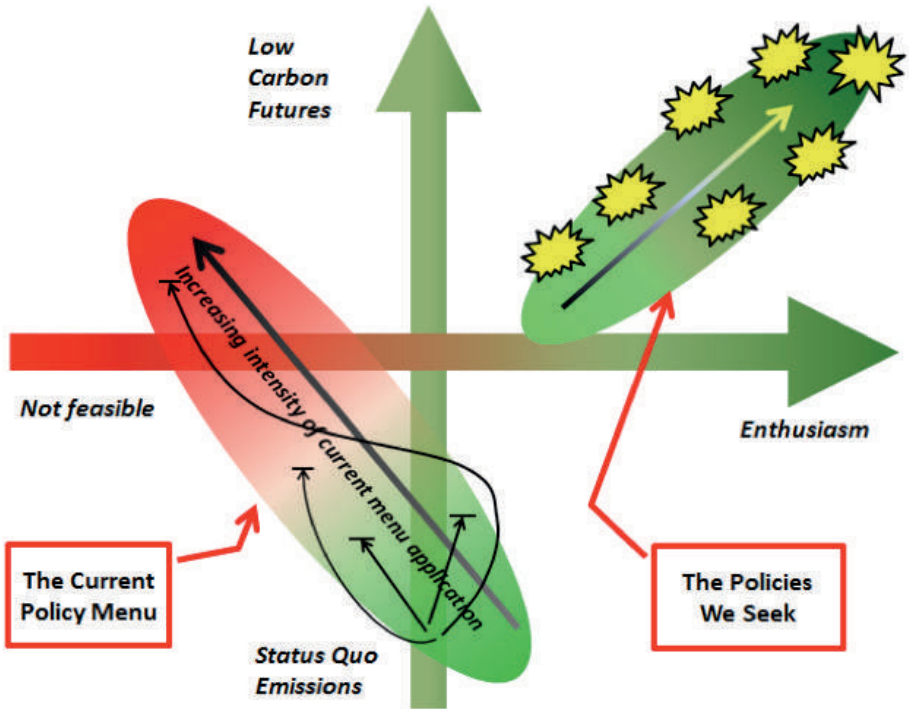


Figure 1. *Individual policies on the current menu may start out in the direction of increasing feasibility but, as intensity of application (e.g. carbon price, regulatory standard) increases, they trend toward political infeasibility before hitting a limit, well short of low-carbon futures. What are the "breakthrough policy strategies" that will allow us to jump over to or tunnel through to the upper quadrant?*

systems, industry, agriculture, land use, and other dimensions of human development. It will require profound changes in the prevailing socio-economic development frameworks. Many of the technologies that will need to underpin these transformations are available, but many others are not"[2].

We are at a political feasibility impasse with versions of the current policy agenda that would not even meet our 2020 targets, let alone put us on a path to deep decarbonization[3,4]. To make the transition to a low-carbon future on a 30 to 50 year time frame, the emissions baseline itself must also curve down, and we must find the policy levers for helping that along.

Low-Carbon Futures — What Might They Look Like?

For Canada, a low-carbon future is defined as one in which GHG emissions are brought to and maintained below 125 Mt CO_2e by 2050, about 80% below their level in 1990 of 600 Mt CO_2e. Emissions haven't been this low in Canada since before World War II. This is not to suggest low-carbon futures will look like the past — they will not — but to underscore that the transition to a future in which fossil fuels play much smaller a role in the economy will be transformative, and that changes in the level and pattern of fossil fuel production and consumption will be much greater than the incremental emission reductions targeted by the current policy menu.

Quantitative scenario analyses[5] of what low-carbon futures might look like in rich, industrial economies like Canada agree on a number of necessary elements:

Efficiency Doubles and Redoubles

Without exception, low-carbon future scenarios include much greater efficiency of fuel and electricity use than currently prevails. In the case of fossil fuel applications (e.g. vehicles, aircraft, furnaces, kilns, boilers, and some power plants), the direct contribution of efficiency gains to emission reductions is obvious, but efficiency gains are also a necessary enabling condition for the displacement of fossil fuels by the emerging carbon-free sources of fuel and electricity. Low-carbon future scenarios typically include per capita levels of fuel and electricity use that are about half the current Canadian average, and energy productivity (GDP/energy) four times higher than current Canadian levels.

Electricity's Market Share Grows

Another universal feature of low-carbon futures is the growing share of electricity in meeting our energy end use needs. Electricity is generally very efficient at the point of end use, and if it can also be manufactured efficiently with a low- or zero- carbon footprint, then a shift to greater use of electricity can play a key role in achieving a

2 Sachs, J. et. al. (2014). Pathways to Deep Decarbonization: Interim 2014 Report. Sustainable Development Solutions Network et Institute for Sustainable Development and International Relations, http://www.deepcarbonization.org, pp. xiii

3 Even if we could get support for the incremental, shallow decarbonization that the current extreme versions of the current policy menu would deliver, successful incremental efforts to "at least get started" could very well make it more difficult and expensive to get on a low-carbon pathway, notwithstanding technological progress, discounting the future and all that. Path dependency matters.

4 Climate change itself will eventually move climate change response policy up the public policy agenda, and we have witnessed the beginning of this in places like New York City in the wake of Tropical Storm Sandy. If this type of motivation can be generated soon enough and acted on in the creative and visionary way led by Mayor Bloomberg in the NYC response, then the accelerating pace of extreme weather can and will improve the political feasibility of a direct response. But it is a razor's edge; extreme weather, climate refugee crises, public health and other consequences will make it increasingly difficult to get and stay on a path to deep carbonization that preserves our traditions of democratic and social rights and freedoms. In those futures climate change will foster a different, darker set of policy responses.

5 See Torrie, R. et. al. (2013). Low Carbon Futures: A Review of National Scenarios. Trottier Energy Futures Project, Vancouver, http://www.trottierenergyfutures.ca

low-carbon future. In Canada, less than 25% of the final demand for energy is provided by electricity, and only 12% of the final demand for energy is *necessarily* electric (e.g. lighting, small motors and appliances, cooling, information processing and telecommunications). Electricity's share of final energy demand varies from province to province in Canada, depending on local circumstances, from 12% in Alberta to more than 40% in Quebec. While most low-carbon scenario analyses envisage electricity providing no more than 50% of total energy use on a 2050 time horizon, this would still represent more than a doubling of the average market share in Canada, and a quadrupling in Alberta.

Carbon-Free Electricity Prevails

Low-carbon futures invariably include a "decarbonization" of the electricity system, with carbon-free energy sources eventually displacing most fossil fuel power generation. Canada's hydroelectric resources give it an advantage in this regard, and the country also has a large surfeit of wind, solar, and other carbon-free primary electricity resources. The acceleration of the deployment of these carbon-free power supplies will depend on the pace with which other aspects of the "new grid" can be developed, including an array of information technologies, energy storage techniques, responsive demand technologies and a transmission and distribution infrastructure that supports a high degree of local, regional and inter-provincial interconnectivity.

Bioenergy

Almost all low-carbon scenario analyses include a greatly expanded role for bioenergy, particularly in the provision of carbon-free liquid fuels for those end uses that will be difficult or impossible to electrify, at least in the medium-term (e.g. long haul trucking, aircraft, marine transportation, and some industrial processes). There are serious issues with respect to whether the scale of the necessary bioenergy contribution could be made sustainably, and for this reason some low-carbon scenario analysts opt for an "all-electric" future. However, most analysts do not believe there is a credible "100% electric" scenario in the medium-term (i.e. on a 50 year time scale) and argue that achieving low-carbon futures in this century will require the emergence of a large, global, environmentally sustainable and technologically sophisticated bioenergy industry.

Bending the Baseline

The above elements of low-carbon futures – efficiency gains, electrification of end uses, decarbonization of electricity supply and the growth of the biofuels industry – are largely restricted to changes in energy technologies, energy commodity markets and related policies. ***There is a fifth element that is critical to achieving a low-carbon future – systemic changes in the larger economy that allow human needs for comfort, health, convenience, access, knowledge and happiness to be met in ways that require less energy in the first place***. The economy that generates energy service demands is about 20 times larger than the energy industry itself, and trends and events in that larger economy that are not much influenced by fuel and electricity markets will continue to have profound implications for both the prospect and the economics of a low-carbon future. For example:

- Mobility needs and automobile dependence are largely determined by community design and urban form. The trend to mixed-used, high-density cities in Canada also reduces the carbon footprint of the urban population.

- Energy has become at least a secondary factor in the design of buildings in recent years, but interest in green buildings is being driven more by the improvements they offer in comfort, aesthetics, marketability, and overall technical performance.

- Notwithstanding efforts to improve the efficiency of fuel and electricity utilization, the growth of the service economy and general manufacturing at the expense of primary processing industries, and the drive to increase value added in the primary industries, have done as much to improve the energy productivity of the Canadian economy as all the technological efficiency improvements combined.

- In the other direction, the shift of freight movement from rail to road has trumped any vehicle efficiency gains in the freight sector, making goods movement second only to the fossil fuel industry itself as a source of recent growth in Canada's GHG emissions.

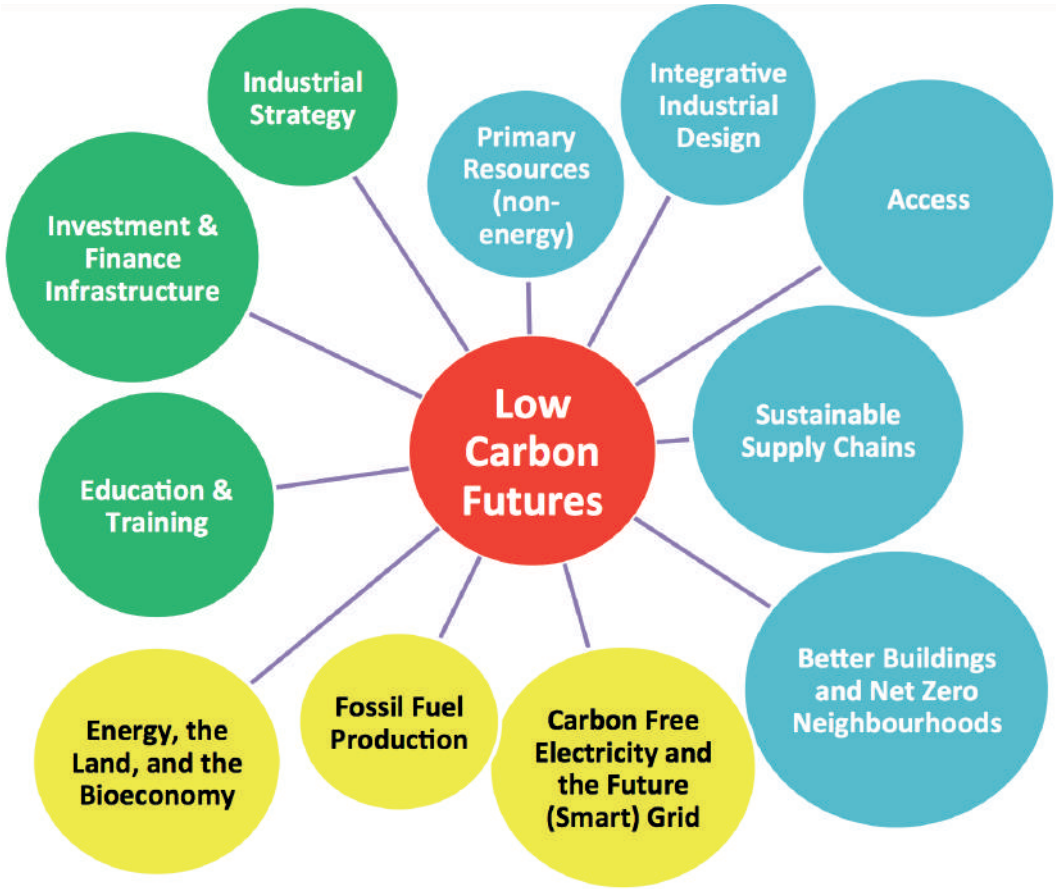
Reframing the Low-Carbon Challenge

Breakthrough strategies for achieving low-carbon outcomes and political feasibility will emerge from those areas where the social and economic goals and aspirations of Canadians align with the objective of a low-carbon future. Achieving that goal will also require the pursuit of policies that encourage trends outside of the energy sector that have the "side effect" of improving energy productivity. The challenge is to identify solutions that appeal to decision-makers while at the same time resulting in low-carbon outcomes in the energy demand sectors. Breakthrough business strategies and public policies for achieving low-carbon futures will occur when and where this type of alignment can be achieved.

Reframing the area of mitigation actions will help identify such solutions. For example, "personal transportation" is seen as an important focus of mitigation actions in traditional energy analysis, and the corresponding solutions are defined in terms of transportation modes (automobiles, public transit) and fuels. Reframing personal transportation as "Access" (see Figure 2) widens the system to include all the decisions and behaviours that give rise to the demand for personal mobility, including urban form and spatial structure, the substitution of telecommunications for mobility, etc. This widening of the system boundary expands the solution set to include technologies and techniques that can provide the fundamental amenity – access – without necessarily requiring the degree of personal mobility that characterizes modern urban life. Telecommuting, teleshopping, multi-use zoning of suburban developments and many other solutions are now included alongside vehicle technologies and carbon-free fuel options as ways of achieving carbon-free outcomes to the fundamental demand for access. When these novel low-carbon solutions align with the motivations of the decision-makers then "game changing" strategies emerge. For example, urban managers and policy-makers seeking ways to lower infrastructure capital spending will be attracted to the urban densification proposals that also have the side effect or collateral benefit of lowering GHG emissions.

Similarly, what would have been characterized as the "freight transportation" sector in traditional energy analysis, with a corresponding focus on vehicles (mostly trucks and trains) and their fuels, can be recast as "Sustainable Supply Chains", thus expanding the potential solution set to include techniques and technologies that address the underlying demand for "tonne-kilometres" of goods movement.

Figure 2. Reframing Climate Change Mitigation Strategies



New frameworks including broader potential strategies and solutions for achieving low-carbon outcomes need to expand beyond the traditional focus on energy commodities, as illustrated in Figure 2. Most importantly, rapid and transformational change can take place when that expanded solution set contains policies and strategies that respond to the needs and motivations of the key decision-makers who are outside the energy economy *per se*, but whose decisions and behaviours are nevertheless instrumental in setting the level and pattern of energy service demand in the society. Indeed, one could argue that given the inherent limitations of the current climate change response agenda, with its relatively narrow focus on fuel and electricity, that our best hope for achieving a transition to a low-carbon future on a time scale that is relevant to the pace of climate change itself, is the identification and acceleration of opportunities for just such disruptive and transformation change.

Employment
and Labour

ABOUT THE ORGANIZATION

CENTRALE DES SYNDICATS DU QUÉBEC

ERIK BOUCHARD-BOULIANNE

The Centrale des syndicats du Québec (CSQ) represents more than 200 000 members, nearly 130 000 of which are educational personnel. It is the largest trade union organization in education and early childhood in Quebec. The CSQ is also active in health and social services, childcare, municipal, leisure, cultural, community and communications sectors.

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PARTICIPATION OF THE CSQ AND EVB IN THE PAST "ACTION CLIMAT" MARCH IN QUEBEC

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CENTRALE DES SYNDICATS DU QUÉBEC

The Role of Workers in the Transition to a Low-carbon Economy

An Interview With Erik Bouchard-Boulianne, CSQ

Conducted by Ms. Divya Sharma, *Sustainable Canada Dialogues*

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

This contribution is an interview with Erik Bouchard-Boulianne, economist at Centrale des syndicats du Québec (CSQ) specializing in public finance issues, the role of the state and public services, and the distribution of wealth.

Question from Sustainable Canada Dialogues:

What can we do to ensure that a transition to a low-carbon economy does not negatively impact workers?

Erik Bouchard-Boulianne: It's really important for us all to be concerned about the effect of the transition to a low-carbon economy on workers. All provinces will experience major changes. There will be winning sectors and losing sectors. We must realize the transition will create many jobs (for example, in the fields of home renovation, improving energy efficiency of buildings or public transportation infrastructure). Some research has shown these sectors require a lot of labour and create more jobs than carbon-intensive sectors[3,4].

In Quebec, the transition would be advantageous because oil imports represent a very large share of the deficit in our trade balance. In 2014, we imported about C$18 billion in petroleum products. Reducing such imports in Quebec would be beneficial to the overall economy. Nevertheless, still using Quebec as an example, there will be winning sectors and losing sectors, so it is important to take into account the effects of the transition, especially on workers.

1 http://www.evb.lacsq.org/accueil/

2 http://www.un-documents.net/our-common-future.pdf

3 Lee, M. and Card, A. (2012). A Green Industrial Revolution: Climate Justice, Green Jobs and Sustainable Production in Canada. Canadian Centre for Policy Alternatives, pp. 63, https://www.policyalternatives.ca/sites/default/files/uploads/publications/National%20Office/2012/06/Green%20Industrial%20Revolution.pdf

4 Blue Green Canada (2012). More Bang for our Buck: How Canada Can Create More Energy Jobs and Less Pollution, pp. 26, http://bluegreencanada.ca/sites/default/files/resources/More%20Bang%20for%20Buck%20Nov%202012%20FINAL%20WEB.pdf

The transition will be more complex where scaling back is geographically clustered. I think of Alberta, an oil-producing province, where the effects of transitioning could be greater. Significant support will need to be brought to the regions hardest hit. Otherwise, it will be impossible for the people of these provinces to support the transition to a greener economy. Just an anecdote: when I went to study in Calgary, I went to buy things for my apartment. Everyone from whom we purchased furniture worked in oil production: an engineer who built depots for trucks in the oil sands, a subcontractor in the oil sector, and so on. These people would obviously be hard hit by the transition to a low-carbon economy.

The question is: What can be done to ensure that a transition to a low-carbon economy does not negatively impact workers? It's simple: we have to implement support programs for workers who will be affected – those who lose their jobs, for example. And so, we'll need strong, well-developed re-qualification, training, and unemployment insurance measures that are very strong and very developed.

The latest federal government reforms have reduced the capacity of the system that assists workers, the generosity of benefits and access to employment insurance. These reforms do not go—at all—in the direction to support the transition to a low-carbon economy. People who lose their jobs must be assisted as much as possible to find work in other sectors. Assistance measures needed are twofold: training, but also benefits that allow workers to live during the transition period.

Another element of the transition to a low-carbon economy affects perhaps less specifically workers, but more generally the poorest segment of the population. The first key policy orientation of *Acting on Climate Change: Solutions from Canadian Scholars* is to "put a price on carbon." Pricing emissions through a tax or a cap-and-trade system is entirely justified from economic and environmental perspectives, but will inevitably have the effect of raising the price of gasoline or heating oil, which will affect most severely the poorest in society. We must find a way to support these people so they aren't negatively impacted and their quality of life is not affected (for example, needing to lower the temperature of the home to 10-15°C because heating has become too unaffordable).

We must take into account the effects of measures, including that of carbon pricing, on the most vulnerable. It's therefore important to consider not only workers, but the overall population. This is a key factor perhaps not sufficiently taken into account to date. I'm thinking of the carbon tax in British Columbia, for example, where support measures like tax credits for the poorer members of the population deserved to be a bit more generous. This would also have enabled an increase in the level of tax, thereby accelerating the transition.

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ABOUT THE ORGANIZATION

UNIFOR

LANA PAYNE AND JIM STANFORD

Unifor is Canada's largest union in the private sector, representing 310,000 members working in over two dozen sectors of the economy. It was formed Labour Day Weekend 2013 when the Canadian Auto Workers and the Communications, Energy and Paperworkers unions merged. Unifor works to protect its members and play a leadership role in building thriving, safe workplaces and a strong economy so all workers in Canada have a good job, a decent standard of living and greater equality.

Lana Payne is Atlantic Regional Director for Unifor, Canada's largest union in the private sector. Jim Stanford is an Economist in Unifor's national office.

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Protect the Environment

by Doing More Work, Not Less

Citizens of all countries are increasingly concerned, and rightly so, with environmental protection and sustainability. Of course, climate change is the most important of the many environmental challenges that human civilization must grapple with in coming years, but there are many others as well (destruction of habitat, water pollution, extinction of species, and more). For climate change, the question is no longer whether global temperatures will rise (with destructive impacts on rainfall patterns, sea levels, biodiversity, severe weather, and more). The question is now whether we can limit the scale of that rise (capping it at around 2°C) and thus avoid the most cataclysmic and self-reinforcing effects of climate change. We also must prepare for a hotter climate, through enormous investments in adaptation and amelioration to moderate the impacts on civilization and nature.

Canada was once considered a global leader in environmental policy-making. Our pioneering policies in the areas of chlorofluorocarbon (CFC) pollution, acid rain, and rigorous environmental assessment showed other countries that sensible, incremental environmental progress was indeed possible. And we played a generally constructive role in international environmental diplomacy, which enhanced our global reputation and contributed to confidence that the world could rise to the challenge posed by pressing environmental problems.

Now, however, that good reputation is in tatters. More recently, Canada has played an unconscionable role. Not only have we failed to accept our own significant share of responsibility (as a major polluter, and as a rich country—one that benefited from years of carbon pollution) to address climate change, even more lamentable has been Canada's disruptive role in the international process to regulate climate change. Canada is the first and only country to renounce commitments it made under the Kyoto Protocol. And our representatives continue to block meaningful progress in globally reducing greenhouse gas (GHG) pollution.

Indeed the Africa Progress Panel, a United Nations group co-chaired by former Secretary-General Kofi Annan and former U.S. Treasury Secretary Robert Rubin said that Canada "appears to have withdrawn entirely from constructive international engagement on climate"[1].

1 http://www.africaprogresspanel.org/wp-content/uploads/2015/06/APP_REPORT_2015_FINAL_low1.pdf

Canadians expect more from our leaders. We want to be part of the global solution. We want to build a world that is hospitable and sustainable for our children and grandchildren, and their children and grandchildren. We thus welcome the invitation of the Sustainable Canada Dialogues to comment on their position paper, *Acting on Climate Change: Solutions from Canadian Scholars*.

Resource Industries and the Environment

Canada's traditional reliance on natural resource industries has certainly complicated both the politics and the economics of our response to climate change. Naturally, resource industries face a special challenge, and bear a special responsibility, in the effort to build a sustainable economy. By definition they relate to nature more closely and immediately than other parts of the economy, and they depend completely on a continuing ability to harvest natural wealth. Resource production and processing will always be essential activities in Canada's economy. But how we harvest and process those resources must change to become sustainable, fair, and more socially beneficial.

Unifor rejects the false conflict often established between "jobs" and the "environment". Many companies in the resource sector have traditionally tried to block environmental regulations, often claiming that resource jobs will disappear if environmental goals are taken seriously. This is not true; in fact, in many instances stronger environmental standards can lead to *more* work (and more *stable* work) in the long run. After all, a carefully managed, sustainable approach to resource production is much better than the short-run boom-and-bust employment cycles so typical of resource industries. (Canadians have been reminded of that boom-and-bust pattern once again, in the wake of the recent downturn in oil prices.)

Addressing climate change (and other environmental challenges) certainly does not and cannot entail shutting down production in resource sectors — whether that be petroleum, forestry, mining, or fisheries. That would impose enormous economic and social dislocation on resource communities, most of which are in relatively remote parts of Canada, with few economic alternatives. To the contrary, by investing in sustainability, by regulating the pace and quality of development (rather than fostering an all-or-nothing "gold rush" mentality), and by pushing resource industries to better internalize the environmental costs of their activities, we can attain a healthier and sustainable balance between the economy and the environment, and produce more lasting and stable employment opportunities in the process.

The best approach involves challenging resources industries to improve environmental performance (through direct regulations, and through economic incentives like carbon pricing); limiting new developments in line with environmental targets; and making major investments (both private and public) in pollution-reducing technologies and green infrastructure.

Another dimension to a more sustainable resource economy involves focusing on maximizing the Canadian value-added spin-offs from resource projects. If the amount of pure extraction must be constrained for environmental reasons, then it is a "no-brainer" that we should enhance the employment and production opportunities associated with whatever resources we do extract. This involves more attention to fostering "downstream" value-added opportunities (like refining and petrochemicals in the petroleum sector, wood products manufacturing in forestry, and value-added processing in fisheries). It also involves identifying opportunities to increase value-added "upstream" inputs for

resource production: including Canadian-made machinery and equipment, specialized services, and training. These value-added links do not happen spontaneously or automatically. They can only be optimized through pro-active policy and strategy – but the goal of enhancing those macroeconomic and supply-chain spin-offs has been overwhelmed in recent years by the single-minded rush to accelerate pure extraction.

A National Energy and Environmental Strategy

The unregulated, profit-driven expansion in Canada's petroleum industry (and new bitumen developments, in particular) has caused many economic, social, and environmental problems. To be sure, jobs are created by this "gold rush" development model – but not enough good, secure, Canadian jobs. The potential to use our petroleum wealth more carefully to maximize employment has been squandered in the rush to extract and export as much raw product as quickly and as cheaply as possible. Even in resource communities, the exploitation of workers (including temporary foreign workers), rampant inflation in living costs, and chronic job insecurity as the whole industry lurches from boom to bust and back again have all undermined the potential economic benefits that *could* be generated through the petroleum industry.

The bitumen industry, presently oriented so heavily around extracting the raw resource and exporting it to other countries, has been by far the largest single Canadian source of new GHG emissions – more than offsetting emission reductions from other measures (such as the phase-out of coal-fired electricity generation in Ontario). Bitumen production generates more GHG emissions per barrel of final output than conventional oil, so it is essential that the industry's overall scale be carefully controlled in line with the implementation of national targets. Without a national strategy to regulate and reduce GHG emissions, the unbridled expansion of bitumen production will more than offset all other emission reduction efforts in other parts of Canada (such as the important phase-out of coal-fired electricity generation), and hence defeat our overall goal of slowing and controlling climate change.

Even the petroleum industry itself has begun to recognize that implementing a credible climate change plan for Canada is an essential precondition for its continued expansion. Canada's reputation as an environmental laggard has clearly undermined the industry's ability to market its products internationally and attract capital investment. Major producing companies are now pressing government to move ahead with a framework for regulating GHG emissions. The federal government, with its stubborn refusal to even contemplate such measures (the Prime Minister calling them "crazy"), is increasingly isolated; its approach is not doing the petroleum industry any favours.

As put forth in *Acting on Climate Change: Solutions from Canadian Scholars*' policy orientation #4, Canada desperately needs a national energy strategy – not just to regulate the bitumen industry, but to sensibly integrate all our energy sources, meet the energy needs of Canadian consumers and industries, create good jobs, and protect the environment. Ensuring greater use of Canadian-made inputs, Canadian processing and refining, and benefits for Canadian consumers must be top priorities of a national energy strategy – instead of leaving all these decisions in the hands of profit-seeking (often foreign-owned) corporations. Total bitumen output should be regulated and limited within environmental targets. And whatever we do produce should be directed first to Canadian consumers – requi-

ring maximum Canadian value-added at all stages of the supply chain (including inputs, services, upgrading, and refining). The bulk export of raw petroleum must be limited: it is destructive and wasteful, both economically and environmentally. And the contributions of all energy forms (including conventional petroleum production in both Western and Atlantic Canada, hydro, coal, and renewable sources) must be planned and coordinated.

Unifor has called for a process involving all stakeholders to develop and implement a comprehensive national energy and environmental strategy. This process must involve the federal and provincial governments, the energy industry, consumer groups, organized labour, the environmental community, First Nations and aboriginal groups, and others. The goal is to develop and implement a strategy to utilize Canadian energy wealth, first and foremost to meet the energy needs of Canadians, in a manner that is environmentally responsible and socially beneficial.

Our current federal government is fully committed to the unregulated expansion of export-dominated extraction; for them, even the phrase "national energy strategy" is a dangerous notion. But most Canadians instinctively reject the vision that Canada should become solely a supplier of raw energy to other nations (whether that is the U.S. or Asia). We know our country can, and must, aim higher. We know that our resource wealth can and must be used to spur a broader, more diversified, and more lasting economic development.

Building Alliances

As a union fully committed to a progressive social and environmental agenda, Unifor works to build strong alliances with the environmental movement at all levels. This includes our efforts to advance environmental goals in our own workplaces, even using collective bargaining to make progress where possible. For example, our local bargaining committees have negotiated the establishment of joint environment committees in our workplaces; initiatives to reduce energy consumption and waste; and better controls on hazardous chemicals and other pollutants[2]. Our network of workplace and local environment activists constitutes an environmental movement in its own right: mobilizing to advance a green agenda in our workplaces, inside our union, and in society at large.

From the founding of our union in 2013, Unifor also explicitly recognizes the collective debt we owe to First Nations, and pledges its full solidarity with their struggle for economic and social justice – including their efforts to wrest control over resource developments on their own lands. Unifor locals and activists support initiatives like Idle No More, the movement for justice for murdered and missing aboriginal women, employment equity and training opportunities for aboriginal workers, the reconciliation process, and more.

Doing More Work, Not Less

The simple fact is that working people need *both* good and secure jobs, *and* a healthy, sustainable environment. The two must go together. There would be enormous benefits generated by a green economic strategy, based on initiatives such as energy conservation and retrofits; expansion of public transit; development and production of energy-efficient vehicles; clean-up of environmental damage; and more. We imagine an expansive agenda of private and public investment – all

2 The origins and experience of these local committees is described more fully in a comprehensive policy document adopted by one of Unifor's predecessor unions, the Canadian Auto Workers: see Canadian Auto Workers Canada Council (2007). Climate Change and our Jobs: Finding the Right Balance, Toronto, http://53.15.200-74.q9.net/en/3532.htm

aimed at protecting the environment by doing more work, not less. Mobilizing economic resources to address pollution and protect the environment would be a powerful source of future growth, job creation, and prosperity.

It is simply a myth that it is impossible to protect the environment without sacrificing economic growth and destroying jobs. This false choice is wrong on many counts. Most directly, of course, the quality of the environment immediately affects our standard of living: we can't live well, no matter how "rich" we are, if the natural environment around us is being degraded and depleted.

But even in more narrowly economic terms, the counterposing of sustainability and growth is short-sighted and mistaken. Economic "growth" is nothing other than an increase in the value of goods and services we collectively produce with our labour. Growth's impact on the environment therefore depends entirely on what *kinds* of goods and services are being produced, and *how*.

Some forms of work and production can certainly harm the environment – through resource depletion or pollution. Some forms of work and production are largely benign in environmental terms: such as improvements in the quality of goods (rather than their quantity), and increased services production (especially human and caring services). But some forms of work and production are environmentally beneficial: building and operating public transit, developing sustainable energy sources, investing in energy conservation measures, and cleaning up polluted areas. These are all forms of economic activity that create jobs, generate incomes, and – yes – add to our GDP. But they are also activities that leave the environment in better shape.

As pointed out in A*cting on Climate Change: Solutions from Canadian Scholars*, long overdue measures to enhance environmental protection in Canada, and to strengthen Canada's role in global environmental policy should be seen as an economic opportunity, rather than a burden. It will require pro-active policy measures to realize that positive potential: including substantial public investments in green energy and infrastructure, direct regulations limiting pollution and enhancing energy efficiency, and fiscal tools such as a price on carbon (in either the form of a tax, or a cap-and-trade regime). Private market decisions alone will not shift the economy onto a more sustainable track: it will require a conscious and collective strategy to get us there. But putting that strategy into effect would unleash powerful new sources of growth. Indeed, the spin-off jobs and incomes from an ambitious program of green public investment could be the engine that powers a whole new expansive chapter in Canada's economic history.

In essence, there is much work to be done, to build the framework for sustainable growth and green jobs. And work, after all, is the driving force behind production, GDP, and prosperity. We can and should protect the environment by doing *more* work – not less. And in so doing, we can generate the jobs and incomes that Canadians so urgently need.

Local Implementation
Through Partnerships

Regroupement national
des conseils régionaux
de l'environnement

ABOUT THE ORGANIZATION

REGROUPEMENT NATIONAL DES CONSEILS RÉGIONAUX DE L'ENVIRONNEMENT DU QUÉBEC

PHILIPPE BOURKE AND CEDRIC CHAPERON

RNCREQ: A unique network of influential players in the environmental field in Quebec

The 16 regional environmental councils of Quebec (C*onseils régionaux de l'environnement* or "CREs") are non-profit organizations involved in protection of the environment and promotion of sustainable development in every region of Quebec (except the Far North). They are known for their operational approach centred on consultation and solution-orientation.

The Regroupement national des conseils régionaux de l'environnement (RNCREQ) has the task of representing all the CREs and issuing public opinions on their behalf. The RNCREQ works on most major environmental issues and is known for its rigorous actions.

The CREs and their associated groups are particularly engaged in the fight against climate change. Their actions, research and stances in the field have helped advance Quebec society, fuel debate and influence decisions.

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OPENING PANEL OF THE QUEBEC ENERGY FORUM HELD IN SHAWINIGAN IN NOVEMBER 2011. MORE THAN 150 ORGANIZATIONS HAVE SIGNED THE *DECLARATION OF COMMITMENT FOR AN OIL DEPENDENCE REDUCTION STRATEGY*.

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IN NOVEMBER 2014 RNCREQ RELEASED ITS FIRST STUDY ON THE ECONOMIC BENEFITS OF REDUCING OIL CONSUMPTION IN QUEBEC, CALLED *VINGT MILLIARDS DE DOLLARS DE PLUS EN SIX ANS*.

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THE EXHIBIT HALL OF THE *QUEBEC ENERGY FORUM* HELPED HIGHLIGHT SPECIFIC OIL CONSUMPTION REDUCTION INITIATIVES.

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PHILIPPE BOURKE, CEO OF RNCREQ, UNVEILING THE STUDY ON THE ECONOMIC IMPACT OF REDUCING OIL CONSUMPTION IN QUEBEC DURING THE PRESS CONFERENCE.

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RNCREQ

At the Crossroads

Contribution of the RNCREQ to Sustainable Canada Dialogue's Consensus Paper, *Acting on Climate Change: Solutions from Canadian Scholars*

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

***Par notre PROPRE énergie*: An original and effective strategic approach to fighting climate change**

Climate change is unfortunately not a cause for which people are willing to make major sacrifices. To mobilize people to action, they must be brought "to see the reduction of greenhouse gases as an opportunity to make a better life, without emissions, by means of a societal project"[1].

This is the strategy CREs have put into practice since 2010: fight climate change without framing the challenge in terms of emissions. Thanks to support from the Government of Quebec and many other partners, the CREs have coordinated a regional approach to reducing oil dependence: first with *Les Rendez-vous de l'énergie*[2], then with *Par notre PROPRE énergie*[3]. Because oil consumption in Quebec constitutes the province's main source of greenhouse gas (GHG) emissions, the original strategy of CREs helps effectively fight climate change.

Par notre propre énergie

Regional actors involved in this strategy have quickly understood that oil dependence is worrisome, and that it's possible to act quickly and effectively to reduce that dependence. Rather than focussing on long-term benefits for the climate, this approach is more concrete and immediate economic, social and environmental benefits are put forward. Additionally, this territorial approach is based on local players' need to opt for actions that are adapted to reflect their own

1 Bérubé, C. (2010). Changements climatiques et distorsion de la perception des Québécois : de la communication à l'action), Essai pour la maîtrise en environnement (M. Env.), sous la direction de Maria del Rosario Ortiz Quijan, Université de Sherbrooke, page i. Texte original en français : (*la population à voir en la réduction de gaz à effet de serre (GES) une opportunité de faire une meilleure vie, sans émissions, par l'entremise d'un projet de société*).

2 http://www.rncreq.org/projets/archives?projet=9

3 http://www.par-notre-propre-energie.com

regional reality, both geographically and socio-economically.

More concretely, *Par notre PROPRE énergie* is a unique approach to national mobilization that unfolds at the regional level. It aims to create the conditions to engage Quebec toward significantly reducing its oil use, allowing the Province to profit from the economic, social and environmental benefits that result.

The approach relies on the commitment of organizations and individuals who are empowered to act and exert influence in their fields, and who have development of their region at heart. The CREs bring them together in "regional tables" that allow cross-sectoral exchanges, a common understanding of the issues and identification and implementation of the most promising actions.

In short, *Par notre PROPRE énergie* is a structured long-term planning approach based on regional variation, consultation and participation.

It should be noted that this type of territorial approach to fighting climate change is increasingly recognized and promoted, as evidenced by the final declaration[4] of the World Summit Climate and Territories[5], held in Lyon July 1-2, 2015.

Objectives:

- To mobilize stakeholders
- To promote and encourage initiatives that propose concrete alternatives to the use of oil
- To promote integration of oil consumption issues into local and regional development processes
- To implement actions conducive to reducing oil consumption

In every region of Quebec, *Par notre PROPRE énergie* is:

- a "regional table" for reduction of oil consumption
- a regional energy diagnostic behind…
- … a regional action plan for reducing oil consumption
- implementation of projects conducive to reducing oil consumption in a number of sectors including transport, land use planning, industry, agriculture, buildings, and others.

Deployment of the Approach

Over 300 organizations are represented at the regional tables. From action plans they have devised for each region, more than 60 strategic projects of oil consumption reduction have already been initiated throughout Quebec in several sectors: transport of people and goods, land use planning, industry, agriculture, buildings, and more (see Figure 1).

Encourage Action by Highlighting the Collateral Benefits - Particularly on the Economy

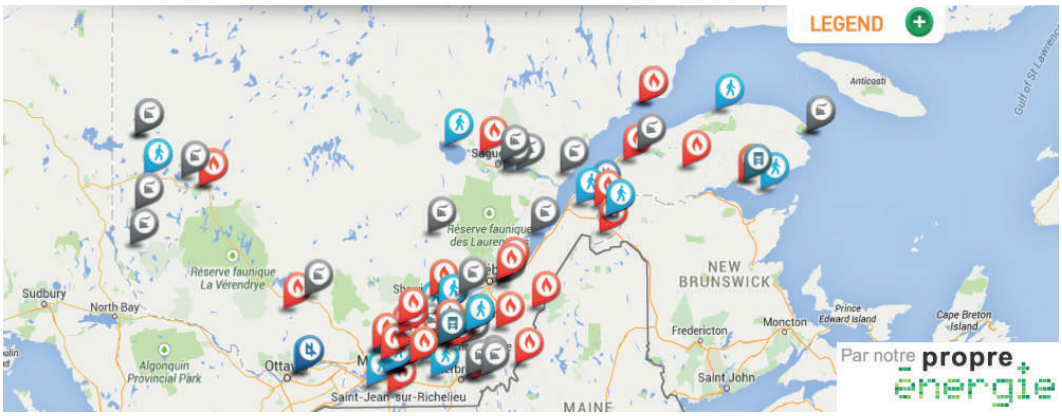
The RNCREQ commissioned an economic study[6] that evaluates benefits to the Quebec economy of an oil consumption reduction strategy, and measures the impact of such a strategy on public finances and household

4 http://www.uclg.org/sites/default/files/declaration_world_summit_climate_territories.pdf

5 http://en.rhonealpes.fr/1197-world-climate-summit-2015-en.htm

6 http://www.par-notre-propre-energie.com/etude.php

Figure 1. Quebec's oil consumption reduction initiatives by region or sector (map available at *www.par-notre-propre-energie.com*)



An interactive map at www.par-notre-propre-energie.com *lets users discover Quebec's oil consumption reduction initiatives by region or sector. In each case, a textbox links to a project description and quantification of its energy savings and GHG reductions, as well as other social and environmental benefits.*

budgets. The objective is to reinforce other generally recognized benefits of reduced oil consumption such as energy security, health or the fight against climate change.

The study shows that a moderate approach to oil consumption reduction would generate gains of about $2.3 billion in 2015 on the trade balance, which would gradually increase to $4.3 billion in 2020. For the six years covered by the study, these gains would total $19.7 billion. Over the same period, it would result in 130 000 direct and indirect jobs annually.

In terms of Quebec's public finances, even taking into account the decrease in revenues from gasoline tax, a moderate approach would clear a total revenue of $900 million over six years.

Finally, from a household perspective, reducing oil consumption by choosing more efficient vehicles would generate savings of around $2100 to $4300 per household per year, enough to almost double the average household budget for leisure activities.

Time for Canada to Act

The RNCREQ generally endorses the policy orientations set out in *Acting on Climate Change: Solutions from Canadian Scholars*. According to the RNCREQ, these orientations gather the basic elements needed to develop a robust action plan to fight climate change. As Mr. Raphals and Mr. Hendriks of Helios Centre suggest in their contribution to *Acting on Climate Change: Extending the Dialogue Among Canadians*, however, the RNCREQ believes the report's commitment to the growth of hydropower generation should be analyzed with caution because of associated economic, social and environmental risks.

As a collective, the RNCREQ deems that Canada must quickly take action to significantly reduce global GHG emissions. This will require significant efforts.

Conditions for Successful Implementation of a Climate Change Action Plan

Drawing on its experience in the implementation of actions against climate change, the RNCREQ believes that achievement of objectives and targets set by *Acting on Climate Change: Solutions from Canadian Scholars* will depend in particular on our ability to meet the following three conditions:

1. Recognizing the extent of the challenges and opportunities

The changes in behaviour that such a plan should prompt are of unprecedented magnitude. All Canadians should be directly called upon to make necessary changes to their habits and behaviour: finding other ways to travel; modifying urban planning practices; designing more energy-efficient buildings; increasing efficiency of production; making responsible consumer choices, and so on.

Yet, as we know, it's not easy to change behaviour. Consequently, these issues should be tackled head-on. Practical ways to address behaviour should be proposed, for example, use of powerful deterrence messages such as those associated with campaigns against smoking, drunk-driving and speeding.

That said, Canada is fortunate to have invaluable assets that let us predict positive change – notably our potential for renewable energy production. This potential is what can inspire and mobilize the population and socio-economic actors.

2. Encouraging adherence

There must be a major communication and awareness campaign *before* implementing a climate change action plan so that the population understands the issues and adheres to the pursued objectives. We must succeed in showing citizens that these reforms are in their interest and they will reap many benefits, such as:

- they will be healthier
- they will have more money in their pocket
- it will be easier and more pleasant to travel
- public finances will be in a better state
- they will be proud of what they have accomplished.

This campaign should be designed to promote behaviours that will henceforth be perceived as smart and trendy by citizens: saving energy; relying less on cars; showing restraint; and participating in a collective effort. Complex issues will have to be communicated using simple and clear messages.

Furthermore, an awareness campaign would reduce resistance to the inevitable and necessary constraints that would have to be imposed to encourage behavioural changes (regulations, taxes, tolls, standards, etc.). This would also particularly help counter the tendency that some have to negatively perceive reductions in energy consumption (since this concept is economically counterintuitive).

This campaign should continue throughout the period of implementation of a climate change action plan.

3. Appropriate governance instruments

A shift as important as the one called for (increasing autonomy, reducing GHG emissions, making energy efficiency a cornerstone of Canada's economic development, facing the challenge of transport, and so on) is inconceivable without determining who will be responsible for implementing

these reforms and which governance structures need to be modified or put in place.

For the proposed reforms to be realized, we must constantly ensure the decisions taken by all relevant institutions (federal and provincial ministers, municipalities, producers and distributors of energy, and others) are in the desired direction. The roles, responsibilities and powers of each should be reviewed to ensure they act consistently and without creating interferences or unnecessary obstacles.

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United Nations
Organization for Education,
Science and Culture

Organisation des Nations
Unies pour l'éducation, la
science et la culture

Fundy Biosphere Reserve

Réserve de la biosphère
de Fundy

ABOUT THE ORGANIZATION

FUNDY BIOSPHERE RESERVE

MEGAN DE GRAAF

In September 2007, the Fundy Biosphere Reserve (FBR) was given UNESCO designation as a World Biosphere Reserve. The FBR is an area of over 430 000 hectares of the Upper Bay of Fundy coast, New Brunswick, stretching from St. Martins to the Tantramar Marsh, near Sackville, and inland to Moncton. It is a community-based initiative comprised of individuals and representatives of various stakeholder groups, organizations and local communities. It works to deliver projects that focus on conserving nature and culture, promoting sustainable economic development, and fostering capacity building.

Megan de Graaf is a Forest Ecologist, Executive Director of the Fundy Biosphere Reserve, and passionate supporter of sustainable rural living.

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A MATURE ACADIAN FOREST HARDWOOD STAND IN THE CALEDONIA HIGHLANDS OF THE FUNDY BIOSPHERE RESERVE.

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MEGAN DE GRAAF

Local Climate Change Knowledge

Solutions for Adaptation and Education in the Fundy Biosphere Reserve

Identifying the Issues

Four years ago, we realized there was an urgent need to develop the capacity of our communities in the face of a rapidly changing climate. Since then, we have been delivering projects in the FBR that are aimed to increase communities' and students' capacity to understand, react to, and adapt to climate change. As with solutions put forward in *Acting on Climate Change: Solutions from Canadian Scholars*, our projects emphasize realistic, on-the-ground activities to transition the communities of the FBR to a more resilient and low-carbon state.

Climate Change in Atlantic Canada Videos

As an example of such a project, in 2011 we began to gather local climate change knowledge by interviewing local climate knowledge-holders (e.g. beekeepers, farmers, snowplough drivers, fishers, gardeners, First Nations elders) and academic researchers. The project also included some climate data (such as temperature highs and lows, snow fall and melt dates, number of drought days, and rain event amounts and duration) analysis to explain trends in our weather.

The project rapidly evolved into an exciting collaboration between the FBR and Dr. Ian Mauro, who is also a member of Sustainable Canada Dialogues[1]. Working with Mauro's team, a year's worth of video footage was carefully assembled into seven short documentary films, which aim to increase awareness about the real world experiences of coastal communities throughout Atlantic Canada; how they are on the front lines of climate change and responding to it[2].

The Whitney Journals

Since 2011, the FBR has been collecting and analyzing citizen-sourced climate data such as family weather diaries, crop records, lighthouse logbooks, and wildlife records.

1 Dr. Mauro was then the Canada Research Chair in Human Dimensions of Environmental Change at Mount Allison University. He is now with the University of Winnipeg.

2 All the films, and related content, can be viewed on the project's website: http://www.climatechangeatlantic.com.

The *Climate Change Proxy Materials* project encourages people to become "citizen scientists" by regularly recording nature observations and sharing them with the FBR for analysis, thereby providing communities with knowledge of the effects of climate change at a local level.

The FBR wanted to incorporate the most interesting and relevant results from these data sources into short videos. A first video, *The Whitney Journals*[3], was launched in June 2013. The video explores nature observations collected by the Sussex-based Whitney family for nearly 40 years and the analysis of these observations as chronicling the effects of climate change on their local environment.

For example, according to the Whitneys' records, since the early 1970s the frost-free growing season is now 25 days longer, the breeding season for spring peepers has expanded an extra 29 days, robins are appearing a full one month earlier in the spring, and lilacs are showing a seven-day advance in their growing season.

Receiving much praise, *The Whitney Journals* was part of an exhibit at the Royal Ontario Museum and secured peer validation through the Phoenix Award by the New Brunswick Environmental Network.

Incorporating Local Climate Knowledge into Education Curricula

Students in New Brunswick classrooms tend to learn about complex or major scientific events in the context of other dynamic countries or ecosystems. We've thus adapted *The Whitney Journals* film, along with the seven Climate Change in Atlantic Canada videos, to be used in middle and high school classrooms to give students an opportunity to learn about climate change from locals with decades of first-hand experience.

The goal was to create resources that teachers can use, with lesson plans, to foster environmental awareness and scientific literacy among their students. We're currently planning a campaign to disseminate these materials as widely as possible throughout schools in the province, and eventually throughout the Maritimes[4].

Resilient Forest Corridors

Since 2013, the FBR has shifted its climate change work to focus on conservation and ensuring forest health in our region. Through our *Climate Change Resilient Forest Corridors Project*, we completed an analysis of which native tree species have the most chance to prosper under changing climatic conditions over the next 100 years, as well as those that will merely persevere, and which could even decline. We have identified eight "winners" under the changing climate: Black Cherry, Red Maple, Eastern Hemlock, Sugar Maple, Red Oak, White Pine, Ironwood, and American Beech.

As the climate changes and less-resilient species begin to decline and disappear, the Acadian Forest composition in southern New Brunswick (as well as throughout the Maritimes) will also change. This means that the forest as we know it today will later contain fewer boreal species, and probably more of these "winners". The forest will need help from residents of the region, notably in managing forests, to encourage these resilient species.

3 https://www.youtube.com/watch?v=hG5DDNmUIXQ

4 The videos and associated lesson plans are available through the project website http://www.climatechangeatlantic.com (go to the Education tab, password is climateeducation).

To that end, in the summer of 2014, we planted 2 500 climate resilient trees in key areas in the reserve to create forest corridors between the region's protected areas. These corridors will allow wildlife to pass through more easily and also ensure that the forests continue to thrive as the climate changes. We also hosted free outdoor workshops encouraging communities and local landowners to plant resilient tree species on their own land.

We also created a public pamphlet and a technical report, as well as a series of highly informative maps that depict the projected forest stand composition, projected distributions of tree species that will persevere or proliferate, and forest corridors for wildlife migration[5].

Future Avenues of Solution-Building

For the coming years, we have identified two important areas in which to work on climate change adaptation, mitigation and education in the FBR. First, we know that our communities are largely under-prepared for the various effects of climate change. We will begin working with individual communities in the FBR to develop climate change action plans, or at least to incorporate climate change adaptation and mitigation in their Integrated Community Sustainability Plans (ICSPs), and to stage outreach events to the general public. These ICSPs will include plans for adapting to climate change (e.g. standards for constructing or renovating homes in flood-risk areas, raising roads, dykes, and other infrastructure along the coast, using ecosystem-based adaptation methods, etc.) and mitigating the effects of climate change (e.g. including goals for reducing corporate greenhouse gas (GHG) emissions by a target date, reducing community emissions, decreasing per cent of energy use from non-renewable sources, etc.). We have also begun participating in a large multi-organization project aimed at developing tools for, and collating data on, ecosystem-based climate change adaptation planning.

Second, communities in the FBR are facing a whole host of challenges associated with the effects of climate change on water – coastal erosion, sea level rise, storm surges, more frequent and more intense weather events, inland flooding, etc. We will play a linking role among the different communities and organizations in the FBR, to facilitate greater climate change adaptation planning with regards to the critical issue of water.

5 All of these materials are available on our website: http://www.fundy-biosphere.ca/en/home/forests-of-the-future.html.

ABOUT THE ORGANIZATION

RÉSEAU ENVIRONNEMENT

CAROLINE SANCHEZ VALERO

Réseau Environnement represents over 2700 members including 350 companies and 250 municipalities in five main areas of activity: biodiversity; drinking water and wastewater; soil and groundwater; air and climate change; and solid waste. Its mission is to *promote good practices and innovation in environment*. The association achieves its mission by bringing together professionnals from the public, semi-public, education, business, industrial and municipal sectors in Quebec, to ensure technological and scientific advances, promotion of expertise and support for environmental activities, from a sustainable development perspective.

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SUSTAINABLE DEVELOPMENT THROUGH INNOVATION AND STAKEHOLDER MOBILISATION

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RÉSEAU ENVIRONNEMENT

Building On Expertise and Innovation

by Supporting Businesses and Municipalities

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

Today, societies face many environmental problems related to waste management, air and water pollution, biodiversity and ecosystem service loss, unsustainable exploitation of natural resources, and more. These challenges are not systematically related to climate change, but will nevertheless be exacerbated as the climate evolves at a pace that is too fast to allow for adaptation. As individuals, these challenges affect us one way or another every day according to our social, economic and environmental context but, as a society, they will irreversibly change the way we live and grow.

In this context, Réseau Environnement supports Sustainable Canada Dialogues and, in direct association with its mission, wishes to stress the important role of expertise and innovation in the private sector and in municipalities. The role of governments is fundamental to integrate the fight against climate change into policies and regulations that govern societies. The political context serves in particular to establish a supportive and enabling environment towards development of clean technologies and expertise. Thus, key policy orientations # 1, 2, 3, 4 and 5 of *Acting on Climate Change: Solutions from Canadian Scholars* are needed for a transition to a low-carbon economy (where we take "carbon" to include carbon equivalents, thereby including all greenhouse gases [GHGs]). Once the political context is established in a clear and consistent way, it is essential to involve and support businesses and municipalities who are leaders in implementing sustainable development. These on-the-ground actors can ensure concrete implementation of the transition to an economy that favours reduced GHG emissions.

Réseau Environnement regularly publishes position papers based on the expertise of its members. Its recent interventions include a statement on the Quebec Energy Strategy[1] (Mémoire sur la stratégie énergétique du Québec) and a statement on the hydrocarbons sector (Mémoire sur la filière hydrocarbures; to be published in fall 2015). Based

1 Réseau Environnement. (2013). Mémoire sur la Stratégie énergétique du Québec, http://www.reseau-environnement.com/UCtrl/scripts/kcfinder/upload/files/M%C3%A9moire%20RE_Strat%C3%A9gie%20%C3%A9nerg%C3%A9tique%20du%20Qu%C3%A9bec_Version%20finale%281%29.pdf

on the recommendations of these position papers, Réseau Environnement would like to contribute to the discussions launched by Sustainable Canada Dialogues, highlighting the following points.

Valorizing Residual Biomass

Canada is fortunate to have many innovative companies or organizations, whether through the expertise they have developed or the clean technologies they market. This diversity of innovative companies is combined with a wealth of natural resources that favour production of renewable energy, such as residual biomass (which can be forest-based, agricultural or even urban waste). Canada should therefore promote conversion of residual biomass.

Ensuring diversity in Canada's energy supplies should be encouraged by developing renewable energies. Biomass could be called upon to play a more important role given potential resources in Quebec. Two factors predict this:

1. The current regulatory and legislative environment is relatively strong or being developed (e.g. regulation of energy recovery from waste[2]); and

2. Considerable availability of biomass that is forest-based and agricultural and also urban, whether in large urban or surrounding areas.

As for biomethanisation of organic matter, it is clear that the economic context of low energy costs makes it difficult to monetize the production and buying of biogas, despite significant subsidies in infrastructure. However, it is important to remember that, in addition to the benefit of producing renewable energy, biomethanisation also recycles waste. It is therefore essential to continue efforts to convert waste materials through biomethanisation. Some countries that have succeeded in developing this sector have created a favourable context by creating electricity buy-back programs from biogas produced at higher costs, and/or by introducing a requirement to inject a minimum amount of biogas into the gas grid and/or by offering a discount for using biogas heating. These three approaches would enhance the appeal of this highly relevant energy system.

It is equally important to build on the use of residual forest biomass, which offers considerable harvesting potential in some provinces. In Quebec, while the potential annual harvest is estimated at 6.4 million oven dry metric tonnes[3], exploitation across the province is in its infancy. Whether in Quebec or Canada, we must encourage conversion of residual biomass energy (or bioenergy) as an ecological and renewable alternative to energy from fossil fuels. It would therefore be beneficial to invest more in cogeneration technology (simultaneous production of electricity and heat from biomass), as many organizations and institutions such as hospitals, schools or resorts, as well as the manufacturing industry, already use this technology. We must also move forward with the various processes that transform residual biomass into solid, liquid or gas biofuels, given that such methods have high energy efficiency. For example, we should harmonize and accelerate scientific research to encourage technological development that will enable commercialization of advanced biofuels. Increased use of wood-based

2 Réseau Environnement. (2014). Mémoire sur le projet de Règlement sur la valorisation énergétique à partir de matières résiduelles, http://www.reseau-environnement.com/fr/services/publications/memoires/memoire-sur-le-projet-de-reglement-sur-la-valorisation-energetique-a-partir-de-matieres-residuelles

3 Ministère des Forêts, de la Faune et des Parcs (2013). Le nouveau régime forestier : Biomasse forestière. Fiche d'information, http://www.mffp.gouv.qc.ca/publications/forets/comprendre/fiche-biomasse.pdf

biofuels could reduce society's dependence on fossil fuels and, thereby, contribute to reducing GHG emissions and improving Quebec and Canada's energy balance. In addition, it is important to note that the use of residual forest biomass enables creation of new economic activity in the regions.

In light of this important potential, and the fact that use of biomass offers the double benefit of renewable energy production and waste treatment, Réseau Environnement recommends promoting development of this energy sector. Development choices must be made by favouring the highest value added to the biomass used (whether forest-based, agricultural or from waste), including its energy conversion when the regional context is suitable.

Develop Electrification of Transport Nationally

Electrification of transport is a clear way forward for Canada given its hydroelectric potential. Quebec has begun its shift to electric transportation[4]; Canada should do the same and develop a concrete action plan to this end. By taking advantage of existing expertise, particularly in Quebec, more room can be made for countrywide electric transportation. Obviously, a significant charging station deployment program across the country should accompany this conversion.

Moreover, Réseau Environnement believes efforts to make private cars electric should be conditional on an investment first aimed at increasing and diversifying the supply of urban and interurban public transit. Indeed, we must not put aside efforts to counter the mentality of the "single occupant car" – cars that, even if electric, generate environmental impacts. The key objective is an overall reduction in the environmental footprint of the transport sector. To this end, it would be desirable for government to adopt zero-emissions legislation in the transport sector to increase the supply of hybrid and electric vehicles and facilitate their purchase by Canadians. This would help to make low-pollution cars more popular. Finally, regarding the development of electric public transport, it is important to highlight the different pilot projects of electric buses that have already begun[5] and show potential issues for large-scale application (e.g., special permissions are required for buses to run, given the surplus weight of the batteries). It is therefore necessary to continue to promote research and development in this area.

Réseau Environnement suggests that Canada develop a concrete strategy for electrification of transport, focusing primarily on public transport and encouraging research and development. The association recommends aiming for an overall reduction in the transport sector's environmental footprint and adopting a zero-emissions law.

Support Municipalities as Local Experts and Change Agents

Canadian municipalities have front row seats to the impacts of climate change. They not only have the power, but also the duty, to develop mitigation and even adaptation plans to respond effectively to these changes while maintaining a space for an acceptable and sustainable life for their residents. Municipalities, as local governments, are best placed to implement policies developed by subnational and national governments. It is therefore crucial to support them financially on this path.

4 Gouvernement du Québec (2013). Priorité Emploi : Stratégie d'électrification des transports 2013-2017, http://www.ledevoir.com/documents/pdf/strategie_electrification.pdf

5 http://www.stm.info/fr/a-propos/grands-projets/electrification-du-reseau-de-surface

It is necessary for Canadian cities to put climate change at the heart of land planning and urban development. Indeed, as local governments, municipalities have direct or indirect control over many types of emissions, such as those from transport, residential parks, industries, businesses and institutions and landfill sites. It is first necessary that all Canadian municipalities establish an inventory of their GHG emissions and develop action plans to reduce these emissions. The role of municipalities in raising awareness is also crucial, as they have a special relationship with citizens. Municipalities therefore have a great role to play, and it is essential to support them in these efforts.

The *Climat municipalités* program introduced by the Quebec government in 2012[6] is a very useful tool to help municipalities contribute to climate change mitigation. The program objectives were: to ensure that municipal bodies have an inventory of GHG emissions produced on their territory; to establish an action plan to reduce emissions in a sustainable way; and to support municipal agencies in raising the awareness of all stakeholders (for example, citizens, NGOs, public institutions and private enterprises). Similarly, Partners for Climate Protection (PCP)[7], set up by the Federation of Canadian Municipalities with ICLEI – Local Governments for Sustainability, has enabled promotion of more than 800 GHG reduction initiatives in municipalities, saving 1.8 Mt of GHG between 2008 and 2012[8]. It would be beneficial to increase the presence of such programs across Canada and financially support implementation of mitigation and adaptation plans put forward by municipal actors.

Réseau Environnement recommends that Canadian municipalities, as on-the-ground agents of change, be better recognized and supported in their efforts to mitigate climate change.

6 http://www.mddelcc.gouv.qc.ca/programmes/climat-municipalites/

7 http://www.fcm.ca/home/programs/partners-for-climate-protection.htm

8 http://www.fcm.ca/home/programs/partners-for-climate-protection/demonstrating-results.htm

Reinventing
Cities

Fondation familiale Trottier Family Foundation

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L'ACADÉMIE CANADIENNE DU GÉNIE

David Suzuki Foundation

ABOUT THE ORGANIZATION

TROTTIER ENERGY FUTURES PROJECT

ALEX BOSTON

The Trottier Energy Futures Project (TEFP) is a research and modeling effort to determine how Canada can dramatically reduce its emissions of the greenhouse gases (GHG) that are the primary cause of global climate change.

Alex Boston is Principal of Boston Consulting. He advises local and senior governments, utilities and real estate developers on climate and energy. The Trottier Energy Futures Project is dedicated to charting a course for deep emission reductions.

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TROTTIER ENERGY FUTURES PROJECT

Local Low-carbon Agenda

for National Prosperity[1]

Dateline: December 31, 2099

At the dawn of the 22nd century, we can gain insight into today's prosperity by exploring major chapters in the history of Canada's deep carbon-reduction path. Almost 100 years ago, Canada's prime minister convened the country's foremost political leadership at a Solutions Summit to guide the way forward. The impetus was a commitment by industrial countries at the historical Paris Climate Summit in 2015 to reduce carbon emissions to zero by 2100.

Local agenda for national prosperity

At the Solutions Summit, leaders shared a sense of urgency to move down the decarbonization path. Obstructing progress, however, were scarce resources and competing priorities.

Municipalities were invited as key contributors, the Prime Minister recognizing that they held significant influence over half of the country's emissions[2]. Transportation and urban form, in particular, held great potential, as emissions from road-based transportation had risen 25% between 1990 and 2012 and freight emissions had surged 65%. Two-thirds of Canadians lived in thinly populated, car-dependent neighbourhoods with few, if any, walkable destinations[3]. Furthermore, the industrial world's think tank had determined that urban policies provided attractive low-carbon options that reduced the transaction costs of mitigation across the entire economy, and the deeper the targets, the greater the benefits of local action[4].

Nationally, the country was confronting hefty deficits. Canadians were accruing mounting financial deficits for municipal infrastructure. Steadily mounting social deficits were borne of congestion, inadequate housing and preventable disease. Environmental deficits were spiralling out of control, notably forest and farmland loss. Although the largest problem was the carbon deficit, these other frustrations could not be forgotten.

At the whiteboard, the Prime Minister outlined a foundation of "Climate Change

1 This article is based on a paper by Alex Boston for the Trottier Energy Futures Project.

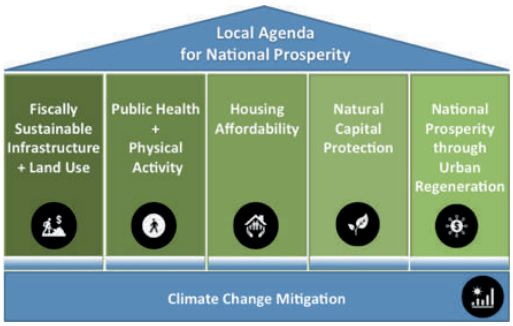
2 Analysis by the author of Canada's latest inventory submission to the United Nations Framework Convention on Climate Change.

3 Population distribution extrapolated on archetyping by Gordon, D. and Shirikoff, I. (2014). Suburban Nation? Population Growth in Canadian Suburbs, 2006-2011. Council for Canadian Urbanism Working Paper I.

4 OECD (2010). Cities and Climate Change. OECD Publishing.

Mitigation" and sketched five pillars supporting a "Local Agenda for National Prosperity." Summit delegates constructed strategies to accentuate synergies, minimize costs and maximize benefits.

The five pillars



1. Fiscally Sustainable Infrastructure + Land Use

In the early 21st century, municipalities were bowed under mounting costs for delivering municipal services across thinly populated residential neighbourhoods. Municipalities discovered servicing costs to support this form of development were as much as threefold those of complete, compact areas[5]. This development model was contributing to rising municipal infrastructure deficits, then pegged at $125 billion[6].

Transportation spending was fuelling the auto-oriented model. Collectively, governments spent $29 billion annually on roads — quadruple transit budgets[7]. That total excluded the land value of roads, let alone parking spaces, the single largest land use in many communities. Nor did it include social and environmental costs, estimated at $27 billion annually[8].

This growth model was eventually overturned due to two competing principles: **1.** Segregation of activities in people's lives (working, shopping and living) and; **2.** Connecting people to these dispersed activities by personal automobile.

The costs of state-financed roads, bridges, parking, sewage and water infrastructure, accidents, pollution and environmental damages were internalized into the costs of transportation and land-use activities. Sound fiscal policy was supplemented by supportive municipal zoning. Within two decades, greenfield development tapered off, and suburban areas modernized.

Suburban superblocks were opened up with cross streets and greenways, linking homes and shops. Cul-de-sacs were connected. Mega-multi-lane arterials from century-old residential areas acquired sidewalks, bike lanes and bus stops along mixed-use frontages.

Cycling rates swelled in suburban areas. Suburban town centres became important employment hubs connected across urban regions by rapid transit. Transit investments were conditional on municipalities meeting growth-intensification targets. As a result municipal service and utility costs were cut 30%. Household transportation costs dropped 50%[9].

Focused growth laid the groundwork for district energy. By increasing the density of hot-water

5 Based on a literature review of municipal infrastructure spending in a half dozen municipalities by Thompson, D. (2013). Suburban Sprawl: Exposing the Hidden Costs, Identifying Innovations. Sustainable Prosperity.

6 Mirza, S. (2007). Danger Ahead: The Coming Collapse of Canada's Municipal Infrastructure. Federation of Canadian Municipalities.

7 Transport Canada (2011). Transportation in Canada, Appendix A.

8 Thompson, D. (2013). Suburban Sprawl: Exposing the Hidden Costs, Identifying Innovations. Sustainable Prosperity.

9 Based on a U.S. study by Todd Litman for the Global Commission on Economy and Climate: Litman, T. (2014). Better Growth, Better Climate: The New Climate Economy. Global Commission on Economy and Climate.

and space-heating services (70% of building energy demand at the time) in nodes and corridors, district energy was made possible. Thousands of high-efficiency mini energy plants driven by renewables propagated in neighbourhoods across the country, displacing millions of inefficient furnaces and boilers. Renewable heat cut building power demand by 50% in parts of Canada.

2. Public Health + Physical Activity

In the mid-20th century, Canadians learned the average 60-year-old Swede was fitter than a 30-year-old Canadian because of his regular walks to work and cycling trips to the bakery[10]. More than 40% of trips in Sweden were by foot or bike, one-third by car. In Canada, only 8% of trips were by active transportation, and more than three-quarters by car.

Higher rates of inactivity, obesity and diabetes were correlated with lower-density neighbourhoods[11]. Physicians began writing prescriptions to citizens, cities and senior governments for better land use and urban design — top determinants of physical activity levels[12].

At the time, obesity cost $6.4 billion in annual economic output losses due to disability and premature death[13]. Young Canadians' life expectancies were shorter than their parents'.

Under a Neighbourhood ParticipACTION Infrastructure Plan, senior governments invested in retrofitting existing residential areas with cycling and walking infrastructure conditional on municipalities hardwiring this infrastructure into transit corridors, financed by new development. Today, most doorsteps are within a five-minute walk of key destinations — corner stores, transit stops, car shares, cafés and parks.

3. Housing Affordability

In the early 21st century, housing affordability was in a crisis. One in four Canadians spent more than 30% of their income on housing, the country's affordability threshold. Among people under 25, the figure was one in two.

Paradoxically, the most costly housing to build – single detached homes and high-rise condominiums – dominated new construction. These housing types were also the most greenhouse gas (GHG) intensive, the latter in part because of concrete construction, but also because of inefficient glass walls and other cost-cutting measures.

All levels of government modernized housing and development policy, updating regulations and fiscal tools, and reforming subsidies that constrained housing choice. Multiplexes, row and townhouses and, wood-frame low-rises flourished in this fertile policy environment. The latter was the least carbon-intensive form of housing and 25% less expensive per square foot to build than concrete buildings[14].

10 ParticipACTION (2004). The Mouse That Roared: A Marketing and Health Communications Success Story. http://scaa.sk.ca/gallery/participaction/english/media/PDF/CJPH_95_Suppl_2_e.pdf

11 Glazier, R. et al. (2014). Density, Destinations or Both? A Comparison of Measures of Walkability in Relation to Transportation Behaviors, Obesity and Diabetes in Toronto, Canada. PLOS ONE, 9(3).

12 "Lifestyle" interventions that require physical activity as a course of daily routine are more likely to produce longer-term increases in activity levels relative to "facility-dependent" ones; e.g., gym, pool. Dunn, A.L., Andersen, R.E. and Jakicic, J.M. (1998). Lifestyle physical activity interventions: History, short and long-term effects, and recommendations. American Journal of Preventive Medicine, 5(4): 398-412.

13 Katzmarzyk, P. and Janssen, I. (2004). The economic costs associated with physical inactivity and obesity in Canada update. Canadian Journal of Applied Physiology, 29(1): 90-115.

14 http://www.woodbywy.com/2014/01/07/wood-fra-

Canada became the single greatest hewer of high performance, pre-fabricated, wood-frame housing in the world. Production costs fell and construction rates soared, further increasing affordability. Energy performance rose, establishing Canada as the pre-eminent home for net-zero buildings.

Governments realized some of the affordability potential of existing housing. More than half of homes were single detached. Most were occupied by one- to two-person households. The largest share was empty nesters and seniors. Responding to tax incentives, many elected to downsize their own homes, establishing secondary suites and stratifying separate units, creating liquid retirement assets.

4. Protecting Natural Capital

The turn of the last millennium marked a period of unprecedented global volatility in renewable and non-renewable natural resource prices[15]. The World Economic Forum tabled a report concluding this volatility would continue if dominant expressions of urbanization, resource demand and supply constraints continued[16].

In Canada, 2% of agricultural land disappeared in the first decade of the 21st century[17]. Canada faced growing disruptions from U.S. food production — the U.S. being Canada's chief food-export destination. Water scarcity, drought, extreme weather and sea-level rise were among the factors reducing arable U.S. land, precipitating food price volatility. Canada and the world would benefit, because agricultural land in Canada was protected.

Canada's political leadership began to see what needed to be done. They focused growth in nodes and corridors and restored green space in cities. This sowed the seeds for today's extensive riparian forests alongside waterways that spread out across our cities. Not only has this reduced hard infrastructure costs, it has also provided today's extensive network of multi-use paths for pedestrians and cyclists.

Canada's reputation as the "Sharing Country" also has its origins in the early 21st century eco-industrial renaissance. At the time, most households possessed a private car, costing $10 000 a year to own and operate, despite sitting idle 95% of the time[18].

A shared car displaced four to 13 vehicles[19]. The federal government provided tax credits for car-sharing expenses, accelerating the car-share economy.

The government also saw car-sharing as the delivery model for the autonomous car. Autonomous vehicles were projected to displace car ownership rates by as much as 98%, according to PricewaterhouseCoopers. Canada opened its borders and Google, Apple, Tesla and Uber rolled in. There are fewer cars on the road in 2100 than in 2000, despite a doubling of the population.

med-six-story-condominium-saves-cost-boosts-sustainability-vancouver/

15 The McKinsey Commodity Index covers food and non-food agricultural items, metals + energy. McKinsey Global Institute (2011). Resource Revolution: Meeting the World's Energy, Material, Food, + Water Needs.

16 World Economic Forum and Ellen MacArthur Foundation (2014). Towards the Circular Economy: Accelerating the scale-up across global supply chains.

17 Statistics Canada (2014). Agriculture in Canada in Human Activity and the Environment. Government of Canada.

18 Shoup, D. (2005). The High Cost of Free Parking. Chicago: American Planning Association.

19 Metro Vancouver found each shared car displaced up to four personal ones. In Philadelphia 13 cars were displaced.

5. National Prosperity Through Urban Regeneration

In the 20th century, policymakers began to realize that major urban regions were the key social and economic organizing units for a country. They were the nexus where goods, people and ideas came together to connect with the rest of the country and the world. Economic growth in major urban regions resounded across the country, determining national prosperity.

PricewaterhouseCoopers and the Toronto Board of Trade found Canada's major urban centres scored low on transportation measures such as congestion, commute times and transit-fare prices. Transport Canada estimated that *personal* social, economic and environmental costs of congestion across Canada's nine largest urban centres were $12 billion annually. That total jumped to $20 billion when freight-hauling delays and other business-related costs were included[20].

Leading countries began focusing on energy productivity as a central competitive advantage. Energy had become a strategic factor for 40% of global revenue, meaning it was crucial for management to know the type, quantity and cost as key decision-making variables[21]. At the time, Canada was the industrial world's largest per capita energy consumer. Canada's low-density residential neighbourhoods made it difficult to make progress in energy productivity.

Canada's political leadership was determined not to be left behind and laid out the world's most ambitious electrified transportation agenda. Inspired by Montreal Transit's unprecedented 100% electrified transit commitment, Canada became the world's first fully electrified transit country. Provinces were North America's first jurisdictions to require electric vehicle (EV) charging infrastructure in new buildings.

Canada overtook its industrial rivals in energy productivity primarily because EVs were more than four times as efficient at converting energy to momentum as internal combustion engines.

Good governments to good governance

The magnitude of Canada's financial, social and environmental deficits 100 years ago may suggest a federation administered by bad governments. Canada's governments, however, scored good grades on most tests. Good was not good enough.

Early 21st century challenges were more complex than the challenges of the 19th and 20th centuries when governments' essential institutions were conceived. A growing number of foresighted countries — Denmark, Sweden, South Korea, the U.K., Netherlands and China — had national urban agendas.

To support the pillars and lay the foundation of the Local Agenda for National Prosperity, Canada created a national-subnational-local governance institution that strengthened horizontal and vertical stickhandling.

Canada, the Sharing Country, imparted technical and institutional innovations to the rest of the world that have contributed to the relative climatic stability we all enjoy today.

20 This additional $8 billion is an extrapolation of a 2008 Metrolinx study calculating business-related congestion costs in Greater Toronto-Hamilton.

21 McKinsey + Company (2009). Energy - A Key to Competitive Advantage: New sources of growth and productivity.

ABOUT THE ORGANIZATION

RENEWABLE CITIES

MICHAEL SMALL AND CLAIRE HAVENS

Renewable Cities is a new five-year program of Simon Fraser University's Centre for Dialogue. From May 13th to 15th, 2015, we convened a Global Learning Forum in Vancouver that brought together over 300 participants representing 43 municipalities from North America, Europe, Africa, Asia and Australasia. Together, they discussed in small group dialogues the opportunities and challenges of making an ambitious transition to renewable energy in cities. The following report is a synthesis of the key findings and take-aways from the Global Learning Forum from the perspective of the Renewable Cities team. It reflects the major ideas we heard during the Forum that we think should inform cities and citizens that aim to transition their cities to 100% renewable energy[1].

Michael Small is the Executive Director and Claire Havens is the Program Manager of Renewable Cities, a program of Simon Fraser University's Centre for Dialogue.

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renewablecities.ca

DIALOGUE FROM THE RENEWABLE CITIES *GLOBAL LEARNING* FORUM

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RENEWABLE CITIES

Transitioning Cities

to 100% Renewable Energy

Converging Trends

The Global Learning Forum highlighted the convergence of three global trends:

- The rapid fall in the cost of new renewable energy technologies, especially solar photovoltaic (PV) panels, that are now making renewables cost-competitive with fossil fuel and nuclear energy sources in many places around the world;

- The desire of many cities to play a leadership role in confronting the threat of climate change by setting their own targets for reducing greenhouse gas (GHG) emissions, which are often more ambitious than the targets set by their national governments;

- The desire of many cities and towns to have greater energy security, in terms of stable, reliable and resilient access for all their citizens to energy at a predictable cost from sources that do not pose a health risk to their populations.

Renewable energy offers cities the means of achieving all three of these goals at the same time.

Cities are now adopting strategies to dramatically increase their use of renewable energy and a small but growing number are setting targets to reach 100% renewable energy in one or more sectors of urban energy use (electricity, transportation and/or heating and cooling). We call such cities renewable cities.

The goal of reaching 100% renewable energy use by cities – which seemed far-fetched even a few years ago – now seems within our grasp. This was the overarching and compelling insight that energized everyone at the Global Learning Forum.

Positive Findings

- The benefits of renewable energy and energy efficiency apply to developed and developing economies and to local governments of all sizes and scales. The global 100% renewable energy movement provides a vision of an optimistic future: one based on practical solutions, rooted in community

1 Summaries of all 32 dialogues held at the Forum, plus reports on the plenary sessions, speaker presentations and related video clips have been posted in the Final Report of the Forum available on our website www.renewablecities.ca. These materials go into much greater depth on the following points.

experience, using proven technology and inspired by non-partisan collaboration.

- Climate change is too often associated with dire predictions and untenable scenarios. Renewable energy inverts the discussion to one of opportunity. There is broad, positive political appeal of renewable energy, versus the often negative political energy around reducing fossil fuel driven emissions.

- Renewable energy, including energy efficiency, is not tied to an ideology – it can be embraced by conservative and liberal communities alike. Conservative values of self-reliance and independence, conserving heritage and traditional land uses, and strengthening local community ties are all reflected in many renewable energy plans of smaller cities and towns. Similarly, liberal values can be found in renewable energy's promise of democratization of resources, reducing energy poverty, driving technological and social innovation, and mitigating GHG emissions. The potential for consumers to lower and stabilize their energy costs by investment in energy efficiency and renewables appeals across the board.

- It is technically feasible to provide 100% of the energy needs of advanced economies from renewable sources and to balance the load from wind, water and solar resources by 2050. Additionally, the land area requirements to satisfy the energy demand are minimal compared to the benefits.

- When communicating to the public the benefits of renewable energy, climate change mitigation does not have to be the primary message. There are many other more immediate benefits to municipalities from investing in renewable energy. These include: greater control over their sources of energy; protection against cost volatility; system resilience in the face of extreme weather; better health outcomes; and more local jobs and investment.

- Stakeholder and citizen engagement on renewables is crucial and must clearly communicate co-benefits for health, jobs, the urban environment and local decision-making. When citizens can see the personal economic benefits of switching to renewable energy, the transition can occur rapidly.

- Smaller towns and rural municipalities can often be the first in their region to make the shift to 100% renewable energy. This happens when rural landowners in the municipality can see the economic benefits of becoming renewable energy producers for their community. Rural communities that become net energy producers through renewables can enable larger nearby cities to plan their own shift to renewable energy.

- Energy efficiency is the first fuel for any transition towards renewable energy implementation in all three sectors of urban energy use (electricity, heating and cooling, and transportation). In North America, up to a 40% improvement in energy efficiency is estimated as necessary to complete the transition.

- Strict green building codes for new buildings can promote much greater efficiency for heating and cooling, making it possible to use lower temperature district energy systems.

- A rapid transition to renewable energy has often been made possible by stable, supportive national and sub-national policies. Feed-in tariffs have been very successful in jurisdictions such as Germany and Ontario. These policy frameworks have allowed for citizens, farmers, small businesses and cooperatives to enter the energy market through distributed technologies. Never-

theless, even in the absence of supportive policies at the national or sub-national level, local governments can make their own decisions to switch to 100% renewable energy.

- Municipalities that control their own utilities can combine renewable energy and energy efficiency targets with social equity objectives and integrate both into their business models.

- Municipalities that do not control their own utilities can still promote the transition to renewable energy by demonstrating leadership in their own energy use, through their procurement practices, and through creative incentive programs, such as verifying voluntary initiatives or creating municipal revolving funds.

- Even in jurisdictions that are not supportive of municipal energy initiatives, opportunities exist for citizens to become consumer-owners through the creation of local energy cooperatives. Small renewable projects can be developed with strong community support and a multitude of benefits for low-income residents.

- The transition to renewable energy requires long-term planning and investment in new infrastructure. This includes: continuous expansion of cost-efficient and sustainably developed renewable energy sources; reduced energy consumption and dramatic gains in end-use efficiency; and future electrical grids that are flexible, powerful, and can integrate electricity from renewable sources.

- Against the backdrop of historically low interest rates, the renewable energy industry is attractive to capital providers because it is clean, long-term, and predictable over project life spans. Cities do not necessarily need to provide the capital required for renewable energy, energy efficiency and climate resilience projects; what they need to establish are the policy frameworks to attract the private sector investment.

- Financial markets, specifically through green bond issuance, could provide necessary capital for such projects. There is a demonstrated market for green bonds, whether these are issued by private sector actors or municipalities, projected to be $100 billion in 2015. It is less inherently risky for municipalities to access international finance markets through relatively low-risk products like bonds, than it is to not build infrastructure necessary for liveable and climate resilient cities.

Remaining Challenges

- While municipal governments have some of the authority and policy levers to transition their communities towards 100% renewable energy, they certainly do not have all the powers required to mandate the job. Thus urban leaders have to engage their local utilities to switch to renewables, they have to encourage sub-national and national governments to enact supportive policies, and they have to build an enduring foundation of support with the public and the private sector to realize this goal.

- The renewable energy revolution can compound social equity issues between richer citizens, who can afford to become energy producer-consumers (prosumers) by installing solar PV panels on their homes, and poorer citizens and renters, who lack the means or the incentives to do so. These kinds of trade-offs cannot be solved just through rate-setting by the local utility. There has to be some larger community vision about what is fair and who should pay for the costs of integrating new sources of renewable energy into the grid.

- It is a challenge to come up with ways of retrofitting old building stock to meet new green energy and heating efficiency standards. Many cities greatly underuse their abundant geothermal resources for heating, despite availability of simple heat pump systems. Further use of renewable energy as the heat source in district energy systems and combined heat and power systems also requires increased deployment and support from local governments.

- The transition to 100% renewable energy in the transportation sector will require a major overhaul in the way people and goods move around cities. This will be very challenging. It includes: electrification of all public transportation; community-wide adoption of personal electric vehicles (EVs); commercial fleets powered by renewable fuels such as electricity, hydrogen or bioethanol; and a significant shift to active forms of personal transportation (walking or biking) to reduce vehicle-kilometres travelled.

- In most countries fossil fuels are still heavily subsidized, directly or indirectly, and the energy market is highly regulated. Despite the rapid uptake of renewables in many areas of the world, a level playing field that would spark dramatic growth in renewables generation worldwide does not yet exist.

Areas for Further Research and Dialogue

- How will the sharing economy, social networks and disruptive technologies affect citizen participation in the urban energy economy?

- How can urban consumers influence their local energy utility – especially if it is not owned by the city – to shift to renewables, especially when the utility has ready access to existing fossil fuel sources?

- How can the political will to achieve 100% renewable energy be enhanced by informal political and business alliances between large cities and their surrounding regions? Could such models of cooperation apply to potential new energy producers (e.g., First Nations communities) in rural or more remote areas who could supply a city with renewable electricity?

- What strategies can promote the transition to renewable energy in poor communities – in either the developed or developing world – where most citizens do not yet have secure access to reliable, affordable energy?

- How can we be sure that renewable energy fits within the long-term framework of sustainability? How do we take into account the ecological impact of new technologies, and assess the full life cycle of these products?

- Are there significant policy gaps or inconsistencies between cities adopting ambitious GHG reduction strategies, with carbon neutrality as the ultimate goal, and cities adopting 100% renewable energy targets?

- How can international city networks and members of the Global 100% RE campaign best support cities in transitioning to 100% renewable energy in all sectors?

- How can city-level initiatives be scaled up to achieve more ambitious climate change mitigation and adaptation goals at the sub-national, national and international levels?

Renewable Energy
Challenge

ABOUT THE ORGANIZATION

SOLAR GLOBAL SOLUTIONS

ADAM DAY AND SEAN FLEMING

Solar Global Solutions (SGS) is a manufacturer of micro-grid systems specializing in the design, supply, and construction of high quality solar photovoltaics (PV), combined heat and power generators, and battery-based energy storage. The team at SGS delivers turnkey Engineering, Procurement, and Construction (EPC) services for both grid-tied and off-grid projects. SGS is a privately held corporation founded in 1988 in Halifax, Nova Scotia, Canada, and has over 25 years of experience successfully developing projects for residential, commercial, government and utility clients. To date, SGS has supplied over 500 solar systems globally including projects throughout North America, the Caribbean, and the Middle East.

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A 12.2 KW COMMERCIAL SOLAR PHOTOVOLTAIC SYSTEM DESIGNED AND INSTALLED BY SOLAR GLOBAL SOLUTIONS FOR THE CITY OF HALIFAX, AS PART OF THEIR CORPORATE EFFORTS TO ADOPT SOLAR AND REDUCE THE CARBON FOOTPRINT OF THEIR FACILITIES

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SOLAR GLOBAL SOLUTIONS

Distributed Generation Micro-Grid Systems:

Advancing Renewable Energy Adoption and the Evolution of Our Electrical Grid

SGS values the importance of environmental sustainability in Canada's Atlantic region, and across the country. As a solar energy and micro-grid company, SGS promotes, designs, and installs solutions that minimize the use of fossil fuels and reduce the carbon footprint of its clients around the world. SGS is proud to support the work of Sustainable Canada Dialogues in developing its *Acting on Climate Change: Solutions from Canadian Scholars* paper and renewable energy map for Canada. Multi-stakeholder planning, like that being implemented by Sustainable Canada Dialogues, is key to the long-term environmental and economic sustainability of Canada's energy system.

As of 2013, approximately 20% of Canada's electricity was generated by fossil-fuel-based sources[1]. Due to favourable geography where over 60% of the country's electricity needs can be met with clean hydroelectricity, and existing infrastructure that supports nuclear and large scale renewable energy sources, Canada's electrical grid is less reliant on fossil-fuel-based energy than other nations. However, producing 20% of our electricity from fossil-fuel-based sources produces 12% of Canada's greenhouse gas (GHG) emissions (90 Mt CO_2e per year as of 2011), which are contributing to the degradation of our climate[2]. Action must be therefore taken to minimize the carbon footprint of our electricity production.

In recent years strides have been made across Canada to develop the renewables industry, with the aid of tariffs and other incentive-based programs. Canada's installed capacity of solar PV in particular increased from 13.9 MW in 2004 to 1210 MW in 2013[3]. The correlation between government incentives and renewables adoption can be clearly seen in Ontario, where a progressive feed-in-tariff program has allowed the province to develop more than 99% of all of the installed solar PV capacity in Canada[4].

1 http://powerforthefuture.ca/electricity-411/data-world/

2 https://ec.gc.ca/ges-ghg/985F05FB-4744-4269-8C1A-D443F8A86814/1001-Canada%27s%20Emissions%20Trends%202013_e.pdf

3 http://cansia.ca/sites/default/files/20140403_cansia_white_paper_final_0.pdf

4 http://cansia.ca/sites/default/files/cansia_roadmap_2020_final.pdf

Similar trends can be observed globally where government-sponsored subsidies and incentives have been proven to drive adoption rates and subsequently reduce the cost of solar PV technologies and installation. In the last six years alone, the global cost of solar PV modules has dropped by 80%, and the full cost of solar PV systems has dropped by more than 60%[5]. With rapidly decreasing costs and innovative technological breakthroughs, it is forecasted that by 2050 solar energy will be the world's largest source of electricity — ahead of fossil fuels, wind, hydroelectric, and nuclear[6].

These rapid cost reductions are causing electricity produced by solar PV to become competitive with grid electricity in many jurisdictions, even without government incentives. Of particular note is the effect this has on the rapid growth rates of small-scale residential and commercial decentralized PV systems. For example, in Nova Scotia, residential and commercial solar PV installations have seen an average annual growth rate of over 75% for the last five years. The Levelized Cost of Electricity (LCOE) from recent installations in Nova Scotia is currently in the range of $0.196 - $0.291/kWh in comparison to a residential electricity rate of about $0.15/kWh from the utility[7]. This increasing cost competitiveness means that decentralized solar adoption will continue to rise rapidly, regardless of government incentives. The adoption rates of solar PV on both the utility and distributed scale mean that PV is projected to be a large contributor to the electrical mix of the future.

While the rapid deployment of solar PV is a positive step to less carbon intensive electricity generation, rising penetration rates for decentralized PV systems can have a significant impact on our aging grid infrastructure. In particular, the intermittency of solar energy creates challenges for the utility as traditional generating stations and control systems are not designed to compensate for the fluctuations caused by intermittent energy sources.

As more solar PV systems are added to the grid, the challenge of meeting electricity demand peaks is amplified by the fact that the time of day when solar generation reaches its maximum output (midday) does not match the time of day with the greatest user demand (late-afternoon/early-evening). A good example of the challenges this creates can be seen in geographical areas currently experiencing higher rates of solar technology penetration. In California for example, it is estimated that by 2020 the utilities will need to be capable of ramping up 13 000 MW of generation capacity within three hours to offset a daily imbalance on the grid as solar power production falls and demand increases[8].

The intermittency of existing demand profiles of end users coupled with variable renewable energy power generation is currently balanced by utility providers' traditional generating services. These usually include on-line generators (including oil, gas, coal and hydroelectric) and off-line generators (normally gas-turbine peaking plants), which can be brought on-line quickly as required, yet are costly to operate and maintain, and typically produce considerable GHG emissions.

It is unsustainable from an environmental and economic perspective to rely on fossil-

5 https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapSolarPhotovoltaicEnergy_2014edition.pdf

6 Ibid.

7 http://www.questcanada.org/sites/all/sites/default/files/private/files/QUESTNS%20Submission%20No%202.pdf

8 https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf

fuel-based peaking plants and centralized ancillary services to compensate for the intermittency of renewable assets. As consumer adoption of renewables continues to climb, a new grid model must be developed. While *Acting on Climate Change: Solutions from Canadian Scholars* proposes to combine hydropower with solar and wind energy, solar PV needs to be deployed with complementary micro-grid technologies such as battery based energy storage, micro combined heat and power (CHP) generators, and grid-interactive controls. This new decentralized energy system will consist of large traditional utility generating assets working in conjunction with these networked micro-grid systems.

Integrating solar PV with energy storage technology allows end users to gain increased control over when the electricity produced is consumed. This optimizes the impact of a solar PV system and is creating disruptive forces for traditional utility providers. In conjunction with solar PV technology, the cost of energy storage technology is also currently reaching historic new lows and, for the first time, small scale decentralized solar with storage systems is making economic sense for end users.

By utilizing energy storage, grid stability can be improved by storing the solar energy produced during the day and shifting for use during peak demand times. Furthermore, adding a low-emissions backup generator such as a micro-CHP system to decentralized PV arrays allows end users to run off-grid during peak demand hours, or to act as a net-exporter of energy to the grid despite what the output of the solar system may be. This is especially beneficial in Canada's northern climate where the peak demand on the electrical grid is experienced in the evening during the winter months. During these times, after the sun has set, there is no support for peak load reduction from the solar system alone. With a cogeneration system, the battery bank and micro-CHP system can work in tandem to reduce the load on the grid and allow the utility to minimize its dependence on the highest marginal cost generating assets, which can be two to three times as expensive as solar PV energy generation[9].

Integrating battery storage and micro-CHP with solar PV further enhances environmental benefits by minimizing the grid power consumed by the user, and minimizing the utility's need to generate power from fossil-fuel-based power stations. A conventional fossil fuel power plant is only about 35-40% efficient in its conversion of fuel to electrical energy[10]. By combining a small electrical generator with a heat recovery system, micro-CHP units have a combined thermal and electric efficiency in the range of 85-95%. Furthermore, concentrating the energy generation (PV and micro-CHP) at the end user also eliminates power losses due to distribution from a large generating station. These distribution losses can be up to 10%[11]. A study published by researchers from two Canadian universities has demonstrated that a combined system of solar PV, battery energy storage, and CHP can reduce GHG emissions by 50-90% in comparison to traditional fossil-fuel-based power plants[12]. The environmental benefits of integrating solar PV with backup generation and energy storage to end users are quite clear. And as cost erosion of these new technologies continues, the integration of decentralized energy generation with the

9 http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf

10 http://www.c2es.org/technology/factsheet/natural-gas

11 http://www.hydroone.com/RegulatoryAffairs/Documents/EB-2007-0681/Exhibit%20A/Tab_15_Schedule_3_Distribution_Line_Losses_Study.pdf

12 Nosrat, A.H., Swan, L.G. and Pearce, J.M. (2013). Improved performance of hybrid photovoltaic-trigeneration systems over photovoltaic-cogen systems including effects of battery storage. Energy, 49: 366-374.

grid is going to come regardless of subsidies or other incentive programs.

Decentralized micro-grid systems and the threat of "load defection" (when residential and commercial clients move off-grid with the majority of their energy needs (primarily through batteries and storage) and use the grid as a back-up when needed) can be seen as a risk for utility providers under traditional utility business models. It is forecasted that by 2030 parts of the U.S. will see sales erosion of 50-60% across both residential and commercial users as energy generation shifts to decentralized renewable sources[13]. In the Northeastern region of the U.S. alone, this erosion will account for a loss of US$34 billion in revenue for utilities each year. This lost revenue is particularly concerning given the required costs to maintain existing electrical grid infrastructure. For reference, in the U.S. it is estimated that the electrical grid will require US$100 billion in investment each year between 2010 and 2030 just to maintain operations[14]. With future maintenance costs in mind and the potential losses in revenue that decentralized energy generation facilitates, it's unsurprising that many utility providers see decentralized renewable energy assets as a threat to the existing system. While this may encourage utility providers to reduce incentives for adopting renewable energy, or abolish structures such as net metering all together, these types of short-term solutions will only delay the inevitable evolution of our energy system in an economically painful way.

The unidirectional grid model is becoming outdated, and regulatory changes are needed that treat decentralized micro-grids as an opportunity rather than a risk. Decentralized renewable assets with energy storage can offer a wide variety of benefits to the electrical grid including: increased renewable integration, variability management, peak management, voltage and frequency regulation, and grid resiliency. By intelligently integrating more renewable assets to the grid, our electrical grid can reduce its dependence on GHG-emitting energy generation. Additionally, the development of renewable assets will usher in many new and exciting economic opportunities including high-tech jobs in engineering, technology development, installation, and maintenance. These trends are already becoming apparent in our economy. In 2013, 37% more Canadians worked in the renewable energy sector than in 2009 and the renewable energy industry in Canada currently accounts for more direct Canadian jobs than the oil industry[15].

Decentralized micro-grids are leading a shift to where the centralized electrical grid serves a backup role while onsite generation and storage serve end users' primary energy needs. For this transition to occur smoothly, utility business models need to evolve. Now is the time to begin experimenting with new rate structures and regulations that will support the development of tomorrow's electrical grid to a more environmentally sustainable system.

By not taking proactive steps to establish the proper regulatory structure for distributed energy resources while the micro-grid system is still in its infancy stages, utility providers will likely experience significant challenges as mass consumer adoption comes regardless of government subsidies. The economic benefits of generating one's own energy will become apparent with or without utility support as technological advances

13 http://www.rmi.org/Knowledge-Center/Library/2015-05_RMI-TheEconomicsOfLoadDefection-FullReport

14 Ibid.

15 http://cleanenergycanada.org/wp-content/uploads/2014/12/Tracking-the-Energy-Revolution-Canada-.pdf

further drive down the cost for renewable energy. Consumers are demanding clean energy as our current electrical grid induces further strain on our planet's climate, and these needs can be met through the aid of renewable technology. The existing grid model can either evolve to establish barriers that isolate end users and further erode the existing integrity of our electrical system, or provide the means for a decentralized system that is resilient and interconnected.

By embracing decentralized renewable microgrids with new business models and rate structures, (1) governments and utility providers can help prevent climate change while leveraging the inherent benefits of distributed energy resources, and (2) the foundation for a reliable, affordable, low-emissions integrated grid can be developed.

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A CREE FISHERMAN ON ONE OF THE LA GRANDE COMPLEX RESERVOIRS. THIS PHOTO ILLUSTRATES OUR STATEMENT ON THE NEED FOR MULTIPURPOSE HYDROELECTRIC RESERVOIRS.

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MATHIEU CANTON & MARC LUCOTTE

Hydropower:

Energy Production Par Excellence in Canada, But Not Quite Green

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

Hydroelectricity: a major form of energy production in Canada

According to the Canadian Hydropower Association[1], hydropower enables Canada to meet its energy needs while simultaneously reducing air pollution and greenhouse gas (GHG) emissions. Major investments and improvements have taken place from 1950 - 1990, making Canada the third largest producer of hydroelectricity in the world, with an average production of 376 million megawatt hours and more than 10 000 dams with 511 major works[2]. In Canada, more than 63% of electricity production is hydroelectric and, in the provinces of Quebec, Manitoba, Yukon, British Columbia, Newfoundland and Labrador, hydroelectricity accounts for 90% of electricity production (Table 1). In anticipation of the growing energy needs of Canadian society, interest in hydropower generation remains strong, and several large dam projects are underway (Romaine River in Quebec) or under study (Conawapa in Manitoba).

In the most productive provinces (Quebec and Manitoba), it is interesting to note the considerable length of transmission lines, with large dams being located several hundred kilometres from urban areas. The remoteness of the resource inevitably leads to energy losses during transport, estimated at about 5% over the entire Hydro Québec transmission network. Many interconnections between provinces and between Canada and the United States enable the export of hydroelectricity at a relatively low cost outside of the most productive provinces (Manitoba and Quebec, in particular).

Large dams built for energy purposes accounted for 67% of total Canadian dams constructed from 1969 - 2002. Large dams are also used for irrigation (Alberta, British Columbia and Saskatchewan), suppressing floods, and production of drinking water. Each of these uses unrelated to hydropower represents 4-7% of all built dams.

1 Canadian Hydropower Association (2008). Hydropower in Canada: Past, Present and Future, https://canadahydro.ca/pages/cha-reports-and-publications

2 http://www.imis100ca1.ca/cda/Main/Dams_in_Canada/CDA/Dams_In_Canada.aspx?hkey=63e199b2-d0e3-4eaf-b8ad-436d9415ad62

Replace a terrestrial boreal ecosystem by an aquatic ecosystem?

Flooded forest ecosystems

Reservoirs are located in relatively preserved continental ecosystems, since they are most often far from urban areas. The shield coniferous forest and the boreal shield ecozones are the most affected by dams, with 20 311 km^2 (1.42% of the surface) and 27 690 km^2 (1.46% of the surface) flooded, respectively[3]. The continental ecosystem is thus lost under water and, with it, all the continental biomass (soil and plants). Wildlife is doubly impacted by both the disappearance of resources under water, which forces migration, as well as by division of the territory. For example, the ancient lake Michikamau in Labrador saw its surface triple after it was dyked. Flooding of 4000 km^2 of caribou calving areas has contributed to the decline of the caribou population[4]. Besides the effects of flooding, these enlarged lakes also create an insurmountable obstacle of several thousand km^2 that can divide the territory, as well as block managed access roads leading to the heart of the forest.

Altered riparian ecosystems

The ecosystem that is characterized by running water suffers from two alterations: it is divided by the dams, and it is partially replaced by a system of artificial lakes characterized by water that is stagnant, deep, and seasonally stratified. This dual alteration results in decreased biodiversity[3], due to the introduction of invasive species by diversion facilities and especially due to the disruption of the river continuum. Splitting the river continuum limits the movement of fish species, for example leading to high mortalities in wild salmon in British Columbia[5]. Division of the river also isolates each species present in the continuum into smaller communities that are therefore more vulnerable[6]. Finally, the artificial management of flow also disrupts aquatic ecosystems in the reservoir and especially downstream. A natural river in Canada sees its flow rates increase sharply during the snowmelt, while flow rates are normally near zero in winter[3]. Conversely, the flow of a river exploited for hydroelectricity sees its rates increase in winter during peaks in electricity demand. The spring flood is maintained but at a reduced intensity, as was shown in a study on the Peace River in British Columbia[7]. This artificial flow has major consequences downstream, including on wetlands that dry up in the summer, on decreases in salinity in estuaries in periods of high electricity production, and on biological productivity in general. For example, an imbalance of the coastal ecosystem has been clearly observed in the Peace-Athabasca delta downstream of the Bennett dam in Alberta, which saw stocks of muskrats and fish collapse, depriving indigenous communities of an important resource[8]. A total length of 130 000 km of river has been artificialized in Canada[9].

3 Rosenberg, D. M., Bodaly, R. A. and Usher, P. J. (1995). Environmental and social impacts of large scale hydroelectric development: who is listening? Global Environmental Change, 5: 127-148.

4 Hummel, M. and Ray, J. C. (2008). Caribou and the North: A Shared Future. D. Press, Ed., pp. 288.

5 Wissmar, R. C., Smith, J. E., McIntosh, B. A., Li, H. W., Reeves, G. H. and Sedell, J. R. (1994). A history of resource use and disturbance in riverine basins of eastern Oregon and Washington (early 1800s-1990s). Northwest Science, 68: 1-35.

6 Humpesch, U. H. (1992). Ecosystem study Altenwörth: impacts of a hydroelectric power-station on the River Danube in Austria. Freshwater Forum, 2: 33-58.

7 Shelast, B.M., Luoma, M.E., Brayford, K.T. and Tarpey, T. (1997). Environmental effects monitoring of the Peace River for Daishowa-Marubeni International Ltd., Peace River, Alberta. Canadian technical report of fisheries and aquatic sciences.

8 Rosenberg, D. M. , Bodaly, R. A. and Usher, P. J. (1995). Environmental and social impacts of large scale hydroelectric development: who is listening? Global Environmental Change, 5: 127-148.

9 MacAllister, D. (2000). In Biodiversity in Canada: Ecology, Ideas, and Action, B. Stephen, Ed. University of Toronto Press, pp. 426.

Unstable lake ecosystems

Finally, the reservoirs are characterized by amplitudes between high and low water levels of several meters over a few years, since exceptionally heavy rainfall is stored and, conversely, deficits in precipitation lower the lake level. This "drawdown" range, coupled with ice action, erodes the riparian zone and reduces its biological support capabilities. Thus, in a sample of 17 lakes in Quebec, researchers observed only 8% of banks were biologically active[10]. The high mobility of the shoreline of shallow lakes keeps banks relatively unproductive and susceptible to erosion. Modification of biogeochemical cycles will favour some fish species at the expense of diversity; pike and whitefish will come to represent the majority[11].

Necessary adaptation of local populations

Although major Canadian hydroelectric reservoirs are almost all located in sparsely populated areas, they still cause significant displacement, as occurred with the Cree population in Fort George Island, northern Quebec. This community of Chisasibi was entirely relocated in 1981 following the creation of the La Grande Complex, which resulted in erosion on the Island and loss of winter ice cover, limiting mobility. In addition, the flooding of traditional hunting territories has either forced communities affected by the creation of dams to turn to fishing, an activity that has generated a worrisome exposure to mercury, or discouraged some members of these communities from practicing traditional land use activities.

Aquatic biogeochemical cycles disrupted in reservoirs and downstream

Eutrophication of artificial lakes is a common alteration of the aquatic ecosystem. Flooding of terrestrial ecosystems generates a massive influx of organic matter that will be partially preserved at the bottom of lakes in ancient soils and will partially accumulate in the form of surface debris. The process follows the classic chain reaction of eutrophication, namely: organic matter accumulation, increased remineralization, decreased oxygenation of water, water acidification and intensification of primary production with declining biodiversity.

Disruption of the mercury biogeochemical cycle is certainly the best documented form of pollution in Canadian reservoirs. Flooding of soils and forests facilitates transformation of a portion of non-toxic inorganic mercury stocks in soils into an organic form (mercury methylation) that is highly neurotoxic and bioaccumulates throughout the aquatic food web. Anaerobic conditions in flooded soils thus promote the bacterial process of mercury methylation. In addition, bank erosion contributes to re-suspension of sediment enriched with methylmercury[12]. In the La Grande Complex (Quebec), mercury methylation was still observed 20-30 years after impoundment of the dam, and the flesh of high trophic level fish still contains concentrations higher than those measured before development of the river[13].

Although less studied than mercury methylation, artificial management of water resources could affect nutrient cycling, as evidenced in other coastal areas[14]. Lengthening of

10 Denis, R., Foisy, M., Desmarais, M., Marcoux, J. and Côté, P. (1991). Érosion des berges des réservoirs hydroélectriques. Tome I : Rapport final – Tome II : Dossier cartographique. Montréal, Consultants SOGEAM, 2: 107.

11 Astrade, L. (1998). La gestion des barrages-réservoirs au Québec : exemples d'enjeux environnementaux. Annales de Géographie, 107(604): 590-609.

12 Lucotte, M., Shelagh, M. and Bégin, M. (1999). In Mercury in the Biogeochemical Cycle. Springer, pp. 165-189.

13 Schetagne, R. and Verdon, R. (1999). In Mercury in the Biogeochemical Cycle. Springer, pp. 235-258.

14 Ludwig, W., Dumont, E., Meybeck, M. and Heussner,

water residence time compared to a natural river, sediment trapping of organic matter produced in the lake, and "artificialization" of flow all disrupt the transfer of nutrients downstream, including the coastline area. In the Canadian context, this could be particularly significant since 51% of managed watersheds are drained into Hudson Bay[15]. The average freshwater flow to Hudson Bay has dropped by 13% from 1964 - 2000 and the winter snowmelt is less intense[16]. However consequences on the primary production of Hudson Bay have not yet been well evaluated.

Hydropower: limited GHG emissions relative to other sources of energy production

The notable advantage of hydroelectricity compared to thermal electricity is that it does not emit GHGs by burning carbon or "fossil" energy. However, degradation of organic matter will also produce GHGs. The GHG production of a reservoir is difficult to quantify because of its spatial and temporal variability, but there is qualitative scientific consensus on three elements: the flooding of large areas of boreal forest will (1) stimulate degradation of the most unstable organic matter and (2) typically generate a flow of GHGs (CO_2 and CH_4) for 5-20 years, according to the Global Forest Watch report[17]. Yet even after depletion of the flooded unstable organic matter, (3) GHG emissions from a reservoir are higher than those of natural lakes and continue to be so for decades, due to the large tidal range that erodes organic matter in the banks and due to *in situ* production of more unstable organic matter in reservoirs[18]. Recent quantitative work across Canada suggests gross emissions range from 0.5-48 kg of CO_2 per MW/h produced[19]. It must therefore be noted that these emissions are about 10-15 times lower than those of conventional coal power plants, per unit of energy produced.

Dialogue for green hydropower in Canada

Most of the socio-environmental imbalances caused by hydroelectricity generation in Canada are due to: impoundment of large boreal land areas flooded solely to produce energy; the mercury contamination of commonly eaten fish populations; and production and emission of GHGs. These imbalances are magnified by the exclusive industrial management of the reservoir, which produces irregular drawdown ranges of several meters' amplitude. Implementation and management of environmentally sustainable and socially acceptable reservoirs should be considered. Hydroelectric reservoirs should not only be regarded as single mega-volumes of water solely driving turbines according to energy needs, but also as artificial aquatic ecosystems requiring appropriate management to achieve socio-ecological balance. Turbining should be achieved in a manner that minimizes abrupt fluctuations in water levels and simulates natural flows as much as possible. For all existing hydroelectric dams, as well as those yet to be built, multiple uses of water reser-

S. (2009). River discharges of water and nutrients to the Mediterranean and Black Sea: Major drivers for ecosystem changes during past and future decades? Progress in Oceanography, 80: 199-217.

15 Lee, P. G., Hanneman, M. and Cheng, R. (2012). Hydropower Developments in Canada: Number, Size and Jurisdictional and Ecological Distribution, Global Forest Watch, Edmonton, Alberta.

16 Déry, S. J., Stieglitz, M., McKenna, E. C. and Wood, E. F. (2005). Characteristics and trends of river discharge into Hudson, James, and Ungava Bays, 1964-2000. Journal of Climate, 18: 2540-2557.

17 Lee, P. G., Hanneman, M. and Cheng, R. (2012). Hydropower Developments in Canada: Greenhouse Gas Emissions, Energy Outputs and Review of Environmental Impacts, Global Forest Watch, Edmonton, Alberta.

18 Weissenberger, S., Lucotte, M., Houel, S., Soumis, N., Duchemin, E. and Canuel, R. (2010). Modeling the carbon dynamics of the La Grande hydroelectric complex in northern Québec. Ecological Modelling, 221: 610-620.

19 Environment Canada (2011). National Inventory Report 1990-2009: Greenhouse Gas Sources and Sinks in Canada - Executive Summary, http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=a07097EF-8EE1-4FF0-9aFB-6c392078d1a9

voirs should be considered, whether related to energy, recreation, transport of goods or fishery resources. Moreover, planning of new hydroelectric dams should consider, over the period of decades, minimizing GHG productions from their reservoirs by minimizing the ratio of surface flooded to unit of energy produced (for example, by having reservoirs in steep valleys or run-of-the-river dams). These are some of the objectives of Hydro Québec's 2009-2013 Strategic Plan, realized with the construction of four dams along the Romaine River. The flooded area (279 km^2) is relatively modest, which will limit the impact on GHGs and mercury methylation. However, the project's detractors rightly criticize the loss of riparian wetlands and the inevitable fragmentation of the river continuum. Finally, the large open bodies of water of hydroelectric reservoirs could also be used for wind energy production, which can be channelled through existing transmission lines.

Table 1. Inventory of hydroelectric generation in each province in Canada

	Number of large dams[20]	Surface area of hydroelectric reservoirs (km^2) [20]	Share of hydropower in total electricity production (%)	Export	Import	Length of transmission lines (km)	Potential and planned sites [21]
Alberta	57	166	6 [21]	-	3% [22]	-	2
British Columbia	93	4 589	22.3 [22]	Yes[22]	Occasional[23]	-	9
Prince Edward Island	0	0	0	0	-	-	-
Manitoba	40	7 136	96 [23]	31,3% [23]	-	12 800 [23]	11
New Brunswick	16	97	22 [24]	Occasional[24]	Occasional[24]	6 849 [24]	-
Nova Scotia	34	240	9 [25]	-	5% [25]	5 300 [25]	-
Ontario	114	7 370	23 [26]	-	Yes[26]	-	85
Quebec	325	24 108	96 [27]	12% [27]	Occasional[27]	33 900 [27]	20
Saskatchewan	44	6 348	20 [28]	0 [28]	Yes[28]	-	1
Newfoundland & Labrador	85	7 500	80 [29]	0 [29]	20% [29]	3 700 [29]	2
Nunavut	0	0	0	-	-	-	-
Northwest Territories	5	162	76 [30]	-	-	-	-
Yukon	4	5	94 [31]	-	-	-	-
TOTAL	**817**	**58 015**	**63** [20]	**Yes**	**-**	**-**	**130**

20 Lee, P. G., Hanneman, M. and Cheng, R. (2012). Hydropower Developments in Canada: Number, Size and Jurisdictional and Ecological Distribution, Global Forest Watch, Edmonton, Alberta.

21 Energy Alberta, http://www.energy.alberta.ca

22 BC Hydro https://www.bchydro.com

23 Manitoba Hydro http://www.hydro.mb.ca

24 Energie NB Power http://www.nbpower.com

25 Nova Scotia Power http://www.nspower.ca

26 Ontario Ministry of Energy http://www.energy.gov.on.ca/en/

27 Hydro Québec http://www.hydroquebec.com/about-hydro-quebec/

28 Sask Power http://www.saskpower.com/

29 Newfoundland Power https://www.newfoundlandpower.com/

30 Northwest Territories Power Corporation https://www.ntpc.com/

31 Yukon Government http://www.energy.gov.yk.ca/index.html

ABOUT THE ORGANIZATION

WWF-CANADA

DAVID MILLER, SUSAN EVANS AND FARID SHARIFI

WWF (World Wildlife Fund) is Canada's largest international conservation organization with the active support of more than 150 000 Canadians. We connect the power of a strong global network to on-the-ground conservation efforts across Canada, with offices in Vancouver, Prince Rupert, Toronto, Ottawa, Montreal, Halifax, St. John's, Iqaluit and Inuvik. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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DESCRIPTION: SOLAR PANELS AT STUDENTS ON ICE BASE CAMP, LABRADOR, CANADA

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WWF-CANADA

Transitioning to a Renewable Energy Economy

That Respects Nature and Supports Community Well-being

WWF-Canada supports the policy recommendations in the Sustainable Canada Dialogues *Acting on Climate Change: Solutions from Canadian Scholars* report, which provide economically viable solutions for controlling climate change in Canada. To avoid the very worst impacts of climate change, the world needs to shift from an unsustainable energy paradigm to a future powered entirely by renewable energy. Global greenhouse gas (GHG) emissions need to be cut by at least 80% by 2050 as the world transitions to 100% renewable energy. Making such a transition is not only achievable, technically and economically, but will be instrumental in reducing risk and the costs of adaptation to climate change[1].

Energy is a key driver of any economy, and renewable energy is a fundamental component of a low-carbon economy. At WWF-Canada we fully support the transition to a low-carbon economy and are intent on identifying and supporting renewable energy options that have the least possible impact on natural systems. Moving away from fossil fuels presents an opportunity to ensure that renewable energy installations not only drastically reduce carbon emissions but also support the ecological integrity of freshwater, terrestrial and marine systems in Canada from coast, to coast, to coast. This approach is referred to as "habitat-friendly renewables".

Three operational requirements should shape the transition to a low-carbon economy based on the transition to 100% renewable sources of energy.

1. Making the essential shift to habitat-friendly renewable energy in Canada

It is counterproductive and misleading to assume that safeguarding nature and building economic prosperity are mutually exclusive objectives. Investing in development pathways that protect nature and secure a resilient supply of ecological goods and services contributes to social and econo-

1 WWF International (2011). The Energy Report: 100% Renewable by 2050, http://wwf.panda.org/what_we_do/footprint/climate_carbon_energy/energy_solutions22/renewable_energy/sustainable_energy_report/

mic stability. It does this by increasing the range of response options society has when change and uncertainty require adaptive action to the threats of climate change.

Due to the relatively low density of renewable energy sources compared to fossil fuels, the area of land and water required to generate equivalent energy production is much greater. Potential landscape effects of renewable energy development should be a primary consideration when planning where and how new energy projects should proceed. Additionally, how we protect nature and retain elements such as ecosystem services, community needs, and cultural values are important factors that need to be considered.

Many jurisdictions around the world have already begun to make significant gains in renewable energy capacity, and through that progression have developed decision-making frameworks to guide where such projects should be located, including criteria to protect ecological values. Best practices for integrating biodiversity considerations in renewable energy development have been demonstrated in Scotland[2,3], Rhode Island[4] (United States) and the Six Southwestern States initiative conducted by the Bureau of Land Management[5] in the United States. These jurisdictions have the most robust frameworks for identifying relevant wildlife and ecosystem values, as well as associated mapping exercises to identify areas of avoidance or concern due to overlapping values.

Another approach is the application of spatial planning using the High Conservation Value (HCV) framework, which is best known from its application in the industry-led Forest Stewardship Council (FSC) certification process for responsible management of forest resources. The HCV framework can provide a consistent methodology that addresses many of the shortfalls in current industry practice, and can defensibly be used to identify areas of significant ecological value that should be avoided by renewable energy development. Essentially this is about ensuring that renewable energy installations occur in the right place, with minimal impacts to species diversity, habitats, ecosystem services, community needs, and cultural values. For example, near the village of Chaurikharka in Nepal, WWF installed a micro-hydroelectricity system as the demand for cooking and heating wood led to deforestation in the area. Water was diverted from a stream to run a generator and back into the stream, with minimal impact. More than 100 households in six villages now use hydroelectricity for cooking, refrigeration and heating. Four more similar schemes are now operating in the area, saving hundreds of tons of fuel wood and improving daily life. Well-planned renewable energy projects such as this can alleviate pressure on natural systems, conserving forests, the biodiversity they hold and their value as carbon sinks, all while making life better for people[6].

2. Continue to reduce Canada's economic dependence on fossil fuel export

Canada has benefited economically from the development of its abundant oil and gas resources, including the controversial oil sands. The oil and gas sector, including extraction, refining and transportation, accounts

2 Scottish Natural Heritage (2014). Planning for development: What to consider and include in Habitat Management Plans, http://www.snh.gov.uk/docs/A1187660.pdf

3 Scottish Natural Heritage (2009). Strategic Locational Guidance for Onshore Wind Farms in respect of the Natural Heritage, http://www.snh.gov.uk/docs/A247182.pdf

4 Rhode Island Renewable Energy Siting Partnership (2012). Volume II - Technical Reports, http://www.crc.uri.edu/download/resp_volume_2_final.pdf

5 Bureau of Land Management (2012). Approved Resource Management Plan Amendments/Record of Decision (ROD) for Solar Energy Development in Six Southwestern States, http://solareis.anl.gov/documents/docs/Solar_PEIS_ROD.pdf

6 WWF International (2011). The Energy Report: 100% Renewable by 2050, http://wwf.panda.org/what_we_do/footprint/climate_carbon_energy/energy_solutions22/renewable_energy/sustainable_energy_report/

for 10% of Canada's GDP and a quarter of the country's exports[7]. Can Canada's economy cope with the loss of capital investment, jobs, royalties and taxes were we to move away from fossil fuels? It's a good question.

In fact, it's an urgent question. The sector's relative share of GDP fell by 20% between 1997 and 2011. Its shares of taxable corporate income, total taxes paid and royalties as a share of the Alberta government's income has fallen by as much as 55%[8]. And these trends appear likely to continue, because the industry is less profitable now than it was in the past. Statistics Canada figures show that profit margins in the sector fell from 21.5% to 8.5% between 2005 and 2011[9], well before the dramatic decline of the price of oil in 2014[10]. Canada's economy is already becoming less dependent on fossil fuels.

Fortunately, Canada is rich in renewable energy resources, and their contribution to the national economy is growing fast. Last year, for the first time, there were more direct jobs in renewable energy than in the oil sands. At the global level, the International Energy Agency (IEA) projected in 2013 that renewable energy will surpass energy generation from gas and nuclear by 2016. In fact, by 2018, renewables will comprise at least 25% of the world's energy mix[11].

Wind energy is one of the fastest growing major sources of new electricity around the world. Canada had an exceptional year in 2014 for wind energy development, ranking sixth globally in terms of new installed capacity. The Canadian Wind Energy Association (CanWEA) believes that at least 20% of Canada's energy production should come from wind power, which will generate $79 billion in investment, create over 52 000 good green jobs and deliver over $165 million annually to municipalities[12].

The Canadian Solar Industry Association (CanSIA) is equally optimistic about Canada's leadership in solar capacity. The solar sector globally is outpacing every other sector and the IEA predicts a 27% energy market share by 2050. CanSIA forecasts the Canadian solar industry by 2020 will employ around 10 000 per year with "the majority in construction and manufacturing, followed by operations and maintenance jobs"[13].

Accomplishments in Germany, Denmark, Norway, and other European countries provide examples of how Canada can scale up its current initiatives to meet the scale of the transition needed. For example, the energy technology sector in Denmark accounts for 11% of the country's total manufacturing economy. Design, manufacturing and service-based jobs in the country's wind sector were close to 30 000 in 2009. In Germany, renewable energy sector employment was placed at 381 600 in 2011, again in the direction of value-added design and manufacturing activities[14].

7 The Energy Sector [T016] accounted for $158 399 million of $1 653 690 million or just over 9.5% of the Canadian economy [T001] in February this year. It is just under 25% of exports: Statistics Canada. Table 379-0031. Exports of goods on a balance-of-payments basis, by product, http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/gblec04-eng.htm

8 These figures follow the analysis by Andrew Leach, University of Alberta, presented in Canada, the Failed Petrostate? Macleans, November 2013, http://www.macleans.ca/economy/economicanalysis/canada-the-failed-petrostate/

9 Statistics Canada. Table 179-0004. Corporations Returns Act (CRA), major financial variables, http://www5.statcan.gc.ca/cansim/a26?id=1790004&pattern=&p2=37&stByVal=1&p1=1&tabMode=dataTable&paSer=&csid=&retrLang=eng&lang=eng

10 West Texas Intermediate five-year price chart, http://www.nasdaq.com/markets/crude-oil.aspx?timeframe=5y

11 International Energy Agency (2012). Medium-Term Renewable Energy Market Report, http://www.iea.org/newsroomandevents/pressreleases/2013/june/renewables-to-surpass-gas-by-2016-in-the-global-power-mix.html

12 http://canwea.ca/wind-energy/national/

13 Canadian Solar Industry Association (2014). Roadmap 2020, Powering Canada's Future with Solar Electricity, http://cansia.ca/sites/default/files/cansia_roadmap_2020_final.pdf

14 Winfield, M. (2013). Understanding the Economic Impact of Renewable Energy Initiatives: Assessing Ontario's Expe-

Clearly, the inevitable transition to a low-carbon sustainable society will be a primary economic driver in Canada. For example, the province of Alberta's investment in wind energy has increased income for rural landowners, new tax revenues, and employment opportunities for trades people and contractors. These benefits increase the capacity of local communities to adapt to change by reducing their exposure to volatile fossil fuel prices as a result of demand issues, diversifying skills and knowledge of the local workforce, increasing access to local jobs (injecting local economic stability), and building family income and wealth through reduced costs to electricity consumers. In Paintearth County the area has benefited from the creation of 16-18 full time permanent jobs, and $40 million in tax revenue generated over the 25-year life of the project. At the peak of construction 270 jobs were required and local hiring was a priority. The municipal district of Pincher Creek injected $12 million into the local economy during construction, which contributed $1.2 million in annual tax revenue to help fund new community services and infrastructure, $500 000 per year in local landowner royalty payments, and eight full-time permanent jobs[15].

3. Replace aging and retiring fossil fuel electricity generation facilities with renewable options

According to the National Energy Board of Canada, between 2005 and 2035, close to 12 gigawatts of Canada's aging electricity generation facilities will come offline and more than 40 gigawatts of new generation capacity will come online. As expected, the bulk of the retirements will be coal-fired power plants. Natural gas (which is, on average, only 50% cleaner than coal) is currently projected to account for the bulk of new generation capacity over the next two decades, reaching 22% of Canada's installed capacity by 2035[16].

Replacing decommissioned coal-fired power plants with brand new natural gas plants will lock in fossil fuel electrical generation and carbon emissions for decades. The retirement of aging fossil fuel assets represents an exceptional opportunity for renewables. Since Canada's total electricity generation capacity is projected to increase by only 1% per year over the next two decades, it is a reasonable goal, particularly if we invest in energy conservation and efficiency.

Canada must become a model for demonstrating that it is possible to make the shift to 100% renewable. And we must do this in a way that preserves ecological integrity in freshwater, terrestrial and marine systems while maintaining economic prosperity and societal wellbeing. Canada has not made notable progress towards meeting emission reduction commitments. We now have an opportunity to take a leadership position and join other nations who are seeking a solution to climate change in Paris later this year at the World Climate Summit. Let's address this urgency and make every decision count!

rience in a Comparative Context, York University, http://sei.info.yorku.ca/files/2012/12/Green-Jobs-and-Renewable-Energy-July-28-20131.pdf

15 Canadian Wind Energy Association (2014). Wind. For My Community. Providing clean, affordable power, new local jobs and investments for Alberta, http://canwea.ca/wp-content/uploads/2014/01/canwea-AB-brochure-e-web-v1.pdf

16 National Energy Board (2013). Canada's Energy Future 2013 – Energy Supply and Demand Projections to 2035 – An Energy Market Assessment, https://www.neb-one.gc.ca/nrg/ntgrtd/ftr/2013/index-eng.html

ABOUT THE ORGANIZATION

HELIOS CENTRE

PHILIP RAPHALS AND RICK HENDRIKS

The Helios Centre is a non-profit research group based in Montreal that has provided independent expertise on a range of energy issues, including climate change policy, since 1997. Its clients have included environmental groups, consumer groups, First Nations, governments, and renewable energy producers.

The authors are Executive Director and Senior Analyst, respectively, at the Helios Centre. Mr. Raphals has appeared as an expert witness on various aspects of electricity policy before energy regulators and environmental assessment panels in four provinces. Mr. Hendriks provides management consulting services to Aboriginal communities and community-based organizations concerning the environmental, social and economic challenges and opportunities that accompany electricity generation and transmission developments, and he has testified in various fora across Canada in relation to these issues.

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THE MONTPARNASSE DERAILMENT (1895)

ON OCTOBER 22, 1895, THE GRANVILLE-PARIS EXPRESS ENTERED THE GARE DE L'OUEST TOO FAST, RAN THROUGH THE BUFFER STOP, CROSSED THE CONCOURSE, AND CRASHED THROUGH THE WALL, FALLING ON THE PLACE DE RENNES.

"THE BEST LAID SCHEMES O' MICE AN' MEN GANG AFT A-GLEY, [OFTEN GO AWRY] AN' LEA'E US NOUGHT BUT GRIEF AN' PAIN, FOR PROMISED JOY."
SAID ROBERT BURNS

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HELIOS CENTRE

Towards a Sustainable Low-carbon Electric System:

Challenges and Opportunities

Introduction

One of the key recommendations of A*cting on Climate Change: Solutions from Canadian Scholars* is the conversion of Canada's electricity system to 100% low-carbon resources within the next 20 years (p. 32).

> *Combining current hydroelectric production capacity with plentiful untapped renewable energy resources and east-west intelligent grid connections [57] between provinces... could allow Canada to adopt a target of 100 percent low-carbon electricity production by 2035.*
>
> ** Note 57. The Deep Decarbonization Canada chapter emphasizes the importance of an "enhanced transmission grid flexibility and energy storage technologies to allow more electricity generation from intermittent renewables" (p.14)*

This aspirational objective is commendable, but before adopting it as policy, some important and difficult questions need to be addressed. What existing high-carbon resources require replacement? What roles do these resources play in the electricity system? Can low-carbon resources fulfill those roles, and what economic, social and ecological impacts would they entail? How can we achieve a low-carbon electricity system while minimizing those impacts?

In this brief contribution we focus on the requirements and trade-offs inherent to meeting a goal of 100% low-carbon electricity.

Energy, capacity and load following: a multi-faceted problem

Currently, installed capacity of high-carbon electricity generation in Canada totals more than 33 000 MW, generating some 124 000 GWh of energy annually[1].

*(See **Table 1** on the next page)*

1 MW = megawatts = millions of watts; GWh = gigawatt-hours = millions of kilowatt-hours

Table 1. High-carbon electricity generation in Canada[2]

	Coal		Natural Gas		Other Fossils Fuels		TOTALS	
Region	MW	GWh / year	MW	Gwh / year	MW	GWh / year	MW	GWh / year
British Columbia	0	0	1464	3500	0	0	1464	3500
Alberta	6256	39 186	5812	29 028	12	40	12 082	68 254
Saskatchewan	1530	10 846	1567	6460	0	0	3097	17 306
Manitoba	105	811	412	3307	0	0	517	4118
Ontario	0	0	9920	14 800	0	0	9920	14 800
Quebec	0	0	411	211	0	0	411	211
New Brunswick[3]	467	818	378	662	1497	2623	2342	4103
Nova Scotia	1252	7098	500	1317	222	89	1974	8504
Prince-Edward-Island	0	0	0	0	134	876	134	876
Newfoundland	0	0	0	0	670	956	670	956
Territories and remote[4]	0	0	0	0	504	1104[5]	504	1104
TOTALS	**9612**	**58 759**	**20 464**	**59 285**	**3039**	**5688**	**33 115**	**123 732**

In comparison, wind and solar facilities in Canada generated just 7.4% of this amount: 9100 GWh[6]. Nonetheless, it may be possible to generate most of the *energy* required to achieve the 100% low-carbon objective from substantial increases in wind, solar and other renewables, combined with cost-effective energy-focused demand-side management[7]. However, the ecological and economic costs of this new infrastructure will not be trivial, and will be surprisingly large. Social acceptability cannot be presumed.

Furthermore, a power system requires not only energy, but also *dependable capacity* and *load-following capability*[8]. Intermittent renewables are suitable for producing low-carbon energy, but much less effective at meeting capacity and load-following requirements[9]. Capacity-focused demand-side management can reduce peak demand requirements, but utility efforts in this area are nascent. In Ontario, targets for peak demand reduction from time-of-use rates have yet to be met[10], and overall peak capacity reduc-

2 Sources: BC Hydro, Atco Power, Capital Power, Alberta Energy, SaskPower, Manitoba Hydro, IESO, Québec Énergie et Ressources naturelles, NB Power, NS Power, Maritime Electric, Newfoundland and Labrador Hydro, Natural Resources Canada.

3 Total high-carbon energy of 4103 GWh/year allocated based on installed capacity.

4 Includes off-grid and remote high-carbon generation in all provinces and territories.

5 Assumes 25% load factor to determine GWh/year.

6 Statistics Canada. CAMSIM Table 127-0002. Data from 2014.

7 Demand-side management (DSM) includes measures and programs designed to reduce the energy requirements an electric utility must meet.

8 Capacity, usually measured in megawatts (MW) refers to the maximum electrical output of a generator, and dependable capacity refers to the maximum output the system can produce during hours of peak demand. Load-following capability refers to the system's ability to adapt to rapidly changing demand.

9 In Canada, the capacity contribution of solar power to the summer peak has been estimated at 30% to 55% of installed capacity; for wind power in winter-peaking regions, figures ranging from 14% to 35% have been cited. Dewees, D.N. (2013). The Economics of Renewable Electricity Policy in Ontario, Working Paper 478, U. of Toronto, Dept. of Economics, p. 13.

10 Office of the Auditor General of Ontario. (2014). 2014 Annual Report – Section 3.11 Smart Metering Initiative, p. 373.

tions have been limited[11]. There are promising demand response pilot projects in Ontario[12] and BC[13], but progress toward full-scale implementation remains halting.

Nuclear generation could be expanded to provide low-carbon dependable capacity to displace baseload high-carbon coal and natural gas[14]. However, this remains unlikely given recent closures[15], difficulties siting nuclear facilities[16,17], high capital costs[18], legislation barring nuclear development[19] and ongoing waste management issues[20].

Low-carbon geothermal resources could also contribute several hundred MW of dependable capacity by 2035, but these resources remain uncertain[21]. To date, not a single geothermal project has been developed in Canada. Biomass can provide dependable capacity, but large-scale deployment remains limited by feedstock sustainability[22]. Carbon capture and storage could allow high-carbon generation facilities to produce much lower emissions, but there is only a single facility in operation in Canada[23] and no additional facilities are planned.

Energy storage could provide dependable capacity and load-following capability, supporting intermittent renewables in a low-carbon electricity system. The Ontario Independent Electricity System Operator (IESO) is currently procuring up to 50 MW of energy storage, including solid state and flow batteries, thermal storage, hydrogen storage and flywheels[24]. Costs of these technologies are projected to decline substantially over time but, even so, will remain high[25]. More importantly, today's storage systems are limited to levelling daily power requirements, and cannot meet annual peaks without a substantial overbuild of energy capability[26].

Large-scale hydro currently provides most of the dependable capacity and load-following capability in BC, Manitoba, Quebec, and Newfoundland and Labrador, and a considerable portion in Ontario. Moving to a 100% low-carbon electricity system would still mean replacing 33 000 MW of high-carbon capacity, as well as adding new capacity to meet load growth.

The emphasis on east-west transmission lines in *Acting on Climate Change: Solutions from Canadian Scholars* suggests that hydro

11 The Brattle Group (2013). Impact Evaluation of Ontario's Time-of-Use Rates: First Year Analysis: A Report Prepared for Ontario Power Authority, pp. v-vii.

12 IESO (2015). 18 Month Outlook: An Assessment of the Reliability and Operability of the Ontario Electricity System – From April 2015 to September 2016, p.8.

13 Enbala Power Networks (n.d). Capacity Focused Demand Side Management at BC Hydro: Industrial and Commercial Potential in the Kamloops Region.

14 GHG emissions lifecycle for nuclear energy is between 9 and 110 g CO_2e/kWh. Warner, E.S. and Heath, G.A. (2012). Life Cycle Greenhouse Gas Emissions of Nuclear Electricity Generation Systematic Review and Harmonization. Journal of Industrial Ecology, 16(S1): S73-S92.

15 http://nouvelles.hydroquebec.com/fr/communiques-de-presse/185/hydro-quebec-confirme-la-fermeture-de-la-centrale-de-gentilly-2-a-la-fin-2012/

16 Kuhn, R. G. (1998). Social political issues in siting a nuclear-fuel waste disposal facility in Ontario, Canada. The Canadian Geographer, 42(1): 14-28.

17 Price, L.L. and Rechard, R.P. (2014). Progress in Siting Nuclear Waste Facilities. Prepared for the U.S. Department of Energy.

18 United States EIA (2015). Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2015.

19 Clean Energy Act, SBC 2010 c22, s.2(o).

20 NWMO (2005). Choosing a Way Forward: The Future Management of Canada's Used Nuclear Fuel – Final Study.

21 BC Hydro (2013). BC Hydro Integrated Resource Plan: Chapter 3 Resource Options, p. 3-51.

22 IDDRI and SDSN (2014). Pathways to Deep Decarbonization: 2014 Report – Canada Chapter, p. 13.

23 SaskPower (n.d.). SaskPower CCS: Boundary Dam Carbon Capture Project.

24 IESO (2014). RFP for Energy Storage Service Backgrounder.

25 Viswanathan, V. et al. (2013). National Assessment of Energy Storage for Grid Balancing and Arbitrage, U.S. Dept. of Energy, Pacific Northwest National Laboratory.

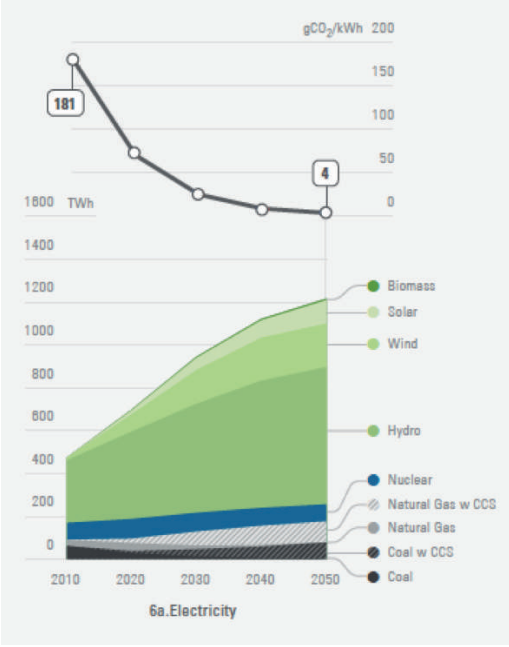
26 Because of their low contribution to peak per MW of installed capacity, a generation system based on wind and solar sufficiently large to meet capacity requirements would produce a great deal of surplus energy.

is expected to play an important role in replacing fossil-fuel capacity in neighbouring provinces[27]. Indeed, storage hydro and nuclear are the only low-carbon electricity resources available in meaningful quantities that, like thermal generation, are normally fully available at system peak. Of these, only storage hydro can be dispatched to follow rapidly changing loads.

Hydroelectric resources: limits to development

The 100% low-carbon electricity objective set out in *Acting on Climate Change: Solutions from Canadian Scholars* relies upon an important 2014 study, *Pathways to Deep Decarbonization*[28]. This influential study depicts the evolution of "energy supply pathways" for Canada from 2010 to 2050.

Figure 1. Energy Supply Pathways, by Resource[29]



As shown in Figure 1, hydroelectric resources are forecast to more than double over this 40-year period, increasing 80% by 2035, and comprising by far the largest block of new resources. The graph shows no expansion of nuclear generation.

Acting on Climate Change: Solutions from Canadian Scholars takes no explicit position regarding the expansion of large-scale hydroelectric (or nuclear) generation in Canada. That said, the hydropower future described in *Deep Decarbonization*, on which *Acting on Climate Change: Solutions from Canadian Scholars* relies, appears entirely unrealistic.

There are currently some 74 000 MW of hydroelectric capacity in Canada, producing about 350 000 GWh of energy annually[30]. Assuming comparable capacity factors, increasing capacity 80% by 2035 would require another **59 000 MW** of storage hydropower. This is far beyond the wildest dreams of even the hydro industry's most vigorous supporters.

For instance, the five largest hydroelectric projects likely to be commissioned in the upcoming decade together total 4600 MW[31]. The *Deep Decarbonization* scenario would reproduce this **13 times over** within the subsequent decade, 2025-2035. This level of hydroelectric development is, in our view, neither feasible – given the long lead times required for assessment, design and construction – nor desirable.

27 I.e., BC into Alberta; Manitoba into Saskatchewan; and Quebec/Labrador into the Maritimes and Ontario.

28 IDDRI and SDSN (2014). Pathways to Deep Decarbonization: 2014 Report – Canada Chapter. See also note 57 in the quotation at the beginning of this contribution.

29 Source: IDDRI and SDSN (2014). Pathways to Deep Decarbonization: 2014 Report – Canada Chapter, Figure 6, p. 9.

30 Canadian Hydropower Association – Association canadienne de l'hydroélectricité. (n.d.). Hydro in 5 Points: Five Things You Need to Know About Hydropower: Canada's Number One Electricity Source.

31 Composed of: Site C (BC Hydro), 1100 MW (under construction); Muskrat Falls (Nalcor Energy), 824 MW (under construction); La Romaine (Hydro-Québec), 1550 MW (partially completed); Keeyask (Manitoba Hydro), 695 MW (approved); Lower Mattagami (Ontario Power Generation), 438 MW (commissioned earlier this year).

Acting on Climate Change: Solutions from Canadian Scholars relies on a study by Global Forest Watch that describes Canada's hydropower potential[32]. However, many of these projects either are legally prohibited in order to protect other values[33], have significant ecological and social consequences[34], or are located where First Nations could veto (and have vetoed) development[35].

Furthermore, the energy from large storage hydro does not arrive incrementally to meet load growth but in large blocks, resulting in sudden and large energy surpluses. Until recently, Canadian utilities could depend on export markets for profitable sales of these surpluses. Today, revenue streams from surplus sales are far below the annual costs of new hydroelectric facilities, producing multi-year losses that must be absorbed by ratepayers. This phenomenon is the result of dramatic declines in the price of natural gas, the primary price-setting fuel in U.S. electricity markets. Forecasters believe these low-price conditions will continue for decades, rising only 18% in real dollars over the next 25 years[36], compared to 54% over the previous 25-year period[37].

As an example, BC Hydro's Site C hydro project (1100 MW) will produce a substantial energy surplus, to be exported for many years at a price well below the cost of production, costing ratepayers hundreds of millions of dollars annually[38]. Consequently, BC Hydro will not require any other new utility-scale renewable resources until at least 2034[39], and has even signalled its intention not to renew contracts for lower-cost renewable facilities already operating[40], in order to soak up the energy surplus resulting from Site C.

BC Hydro is not alone. Newfoundland and Labrador Hydro has indicated that it will not renew its two existing wind contracts in order to absorb the much more expensive energy surplus from the Muskrat Falls project[41].

This makes no environmental or economic sense. To reduce economic impacts and maximize climate-change mitigation efforts, low-cost mitigation must take precedence over high-cost mitigation.

Beyond the economic realities, additional large-scale hydroelectric projects fail the environmental effectiveness criterion set out in *Acting on Climate Change: Solutions from Canadian Scholars*: to meet greenhouse gas (GHG) reduction targets without causing other significant environmental impacts (p. 27).

Recent environmental reviews of many of the available storage hydro projects (i.e. Site C, Lower Churchill, and Eastmain 1A/Rupert Diversion) raised serious ecological and social sustainability concerns. The Joint Review Panel for Site C concluded that the project, if developed, would have significant, extensive,

32 Global Forest Watch Canada (2012). Hydropower Developments in Canada: Number, Size and Jurisdictional and Ecological Distribution. See Figure 10. Boreal and temperate forest regions with existing, proposed and potential large hydropower developments.

33 E.g. Schedule 2 of the BC's Clean Energy Act prohibits development at eleven potential large-scale hydroelectric sites in the province.

34 E.g. Site C on the Peace River in BC, and developments on the Lower Albany River in Ontario.

35 E.g. the Slave River Hydro Development in Alberta, http://www.cbc.ca/news/canada/north/slave-river-hydro-project-nixed-1.962503

36 United States EIA (2015). Annual Energy Outlook 2015, p. ES-7.

37 United States EIA (n.d). 1990-2013 Average Price by State by Provider (EIA-861).

38 Raphals, P. (2014). Need for, Purpose of and Alternatives to the Site C Hydroelectric Project, Helios Centre, Fig. 10, p. 26.

39 BC Hydro. (2013). Response to Working Group and Public Comments on the Site C Clean Energy Project Environmental Impact Statement: Technical Memo – Alternatives to the Project, p. 18.

40 BC Hydro (2013). BC Hydro Integrated Resource Plan: Chapter 4 Resource Planning Analysis Framework, p. 4-15.

41 Nalcor Energy (2011). Nalcor's Submission to the Board of Commissioners of Public Utilities with respect to the Reference from the Lieutenant-Governor in Council on the Muskrat Falls Project, p. 40.

and comprehensive residual environmental effects, including on traditional activities of the affected First Nations[42]. These effects are among the most severe ever identified in a federal environmental assessment, and more extensive even than those for the Jackpine (Oilsands) Mine Expansion Project[43] and the Prosperity Gold-Copper Mine Project[44].

An influential paper recently published in *Science* describes several "planetary boundaries" necessary to maintaining a habitable Earth, noting that four have already been crossed. These include not only climate change, but also loss of biosphere integrity, altered phosphorus and nitrogen cycles, and the biogeophysical processes in land systems that directly regulate climate. If our energy choices are determined by a unidimensional focus on climate change, the threats to the other planetary boundaries, including loss of biodiversity in the boreal regions of Canada, will continue unabated[45].

Low-carbon, not no-carbon: judicious use of natural gas

Adopting a policy of 100% low-carbon electricity resources excludes the most widely used technology for meeting capacity. While relying on natural gas to meet baseload energy needs results in very substantial GHG emissions, simple cycle gas turbines[46] can add many megawatts of peak capacity at relatively low economic and environmental cost. When operated only during the system peak (1% or 2% of the time), a 100-MW facility would have annual emissions of only 5.9 to 11.74 kTonne CO_2e, just 2-3% of a baseload combined cycle natural gas turbine of the same capacity[47], or similar to the annualized life-cycle CO_2e emissions of a 370 MW wind farm[48]. When used only to meet reserve requirements, their emissions can be near zero[49].

With low capital costs and the capacity to meet peak and reserve requirements while facilitating the integration of complementary low-carbon intermittent resources, gas turbines can contribute to an electricity system with low GHG emissions. This is coherent with an important policy recommendation in *Acting on Climate Change: Solutions from Canadian Scholars*: policies should achieve the necessary GHG reductions at the least possible cost (p. 27). This need not require a conversion to 100% low-carbon electricity to the exclusion of all carbon-based resources, a strategy that is likely to be economically and ecologically unacceptable.

Policy in this area should acknowledge the marked superiority of natural gas over other fossil fuels. Almost half of Canada's high-carbon baseload generation relies on coal, with GHG emissions per kWh more than

42 Review Panel established by the Federal Minister of the Environment and the British Columbia Minister of Environment (2014). Report of the Joint Review Panel: Site C Clean Energy Project, pp. 310-325.

43 Joint Review Panel established by the Federal Minister of the Environment and the Energy Resources Conservation Board (2013). Report of the Joint Review Panel: Shell Canada Energy Jackpine Mine Expansion Project, pp. 4-9.

44 Review Panel established by the Federal Minister of Environment (2010). Report of the Federal Review Panel Established by the Minister of the Environment: Taseko Mines Limited's Prosperity Gold-Copper Mine Project, pp. 237-240.

45 Steffen, W. et al. (2015). Planetary boundaries: Guiding human development on a changing planet. Science, 347(6223).

46 The word "gas" refers here to exhaust gases, not to fuel. A gas turbine can be fueled by many different hydrocarbons, including natural gas (methane).

47 O'Donoughue, P.R. et al. (2014). Life Cycle Greenhouse Gas Emissions of Electricity Generated from Conventionally Produced Natural Gas. Journal of Industrial Ecology. 18(1): 125-144.

48 Dolan, S.L. and Heath, G.A. (2012). Life Cycle Greenhouse Gas Emissions of Utility-Scale Wind Power. Journal of Industrial Ecology, 16(S1): S136-S154. Based on a 30% capacity factor.

49 Reserve requirements describe the amount of supply resources in excess of demand required to maintain reliability in the event of equipment failure. They vary depending on the nature of the system, and are often 15-20% of annual peak demand. IESO. (2014). Ontario Reserve Margin Requirements, 2015-2019.

twice[50] that of gas[51]. The potential emissions reductions from substituting coal with a combination of renewables and natural gas are therefore enormous. Judicious use of simple-cycle gas turbines to meet reserve and peaking requirements can displace the need for resources with much greater financial costs and ecological impacts.

Conclusion

Converting Canada's electricity system to 100% low-carbon resources is an admirable goal. However, barring major and rapid technological breakthroughs or a large-scale move to nuclear generation, meeting this goal would require an inadvisable and unrealistic expansion of hydropower. This would constitute a high-cost path in economic, ecological, and social terms, initiating and perpetuating conflicts with Aboriginal peoples, while driving out investment in other low-carbon renewables that are modular, incremental and declining in cost. Canadian ratepayers would find themselves unable to take advantage of these increasingly affordable alternatives, being locked into paying down the high-cost capital legacy of large-scale hydroelectric projects.

Policy efforts need to be directed at ensuring that the most cost-effective and environmentally benign measures for reducing GHG emissions from the electricity sector receive priority implementation. The considerable opportunities to displace high-carbon *energy* with low-carbon supply-side and demand-side alternatives constitute the "low-hanging fruit".

Displacing the *capacity* and *load-following* roles currently played by high-carbon resources will prove more difficult. While geothermal power, energy storage, carbon capture and storage, and even some additional storage hydro will play a role in supporting a transition to a low-carbon future, they will not be sufficient.

Difficult choices lie ahead. Trade-offs must be informed by thorough and transparent analysis. The scale of the challenge should not be underestimated.

50 O'Donoughue, P.R. et al. (2014). Life Cycle Greenhouse Gas Emissions of Electricity Generated from Conventionally Produced Natural Gas. Journal of Industrial Ecology, 18(1): 125-144, p.141. The harmonized median for combined cycle natural gas is 450 g CO_2e/kWh.

51 Whitaker, M. et al. (2012). Life-cycle Greenhouse Gas Emissions of Coal-Fired Electricity Generation: Systematic Review and Harmonization. Journal of Industrial Ecology, 16(S1): S53-S72, p. S62. The harmonized median for all coal technologies is 980 g CO_2e/kWh.

Science-based
Operationalization

CIRODD
Centre interdisciplinaire de recherche
en opérationnalisation du développement durable

ABOUT THE ORGANIZATION

CIRODD

The CIRODD (Centre interdisciplinaire de recherche en opérationnalisation du développement durable) is a strategic cluster funded by the Fonds de recherche du Québec – Nature et technologies and the Fonds de recherche du Québec – Société et culture. Over 90 researchers and staff members from 11 universities, three CEGEPs and two college centres for technology transfer in Quebec contribute to the projects and activities led by the CIRODD network. The network's mission is to conduct, coordinate, integrate and transfer research into sustainable development operationalization, to ultimately facilitate the emergence of a green economy. The CIRODD is focused on implementing sustainable development in major industrial sectors in Quebec, including: aerospace, forestry, mining, energy, information technology and telecommunications, buildings, transport and mobility, agriculture and food processing.

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OFFICIAL WEBSITE
cirodd.org

THE ARRANGEMENT OF THIS PHOTO ILLUSTRATES ACTIONS PERTAINING TO POLICY DEVELOPMENT, SUSTAINABLE FORESTRY, BUILDING AND LAND MANAGEMENT, AS WELL AS COMPREHENSIVE APPROACHES SUCH AS ECOSYSTEM THINKING IN HEALTH AND LIFE CYCLE ANALYSIS.

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CIRODD

Operationalizing the Key Policy Orientations

of *Acting on Climate Change: Solutions from Canadian Scholars*

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

1. CIRODD

This contribution was jointly written by CIRODD[1] members and employees and seeks to further consider certain key policy orientations outlined in the consensus paper *Acting on Climate Change: Solutions from Canadian Scholars* released by Sustainable Canada Dialogues. This contribution proposes actions pertaining to policy development, sustainable forestry, building and land management, as well as comprehensive approaches such as ecosystem thinking in health and life cycle analysis.

2. Designing policies differently

By Mohamed Benhaddadi, Jean-Francois Desgroseilliers and Erick Lachapelle

In Canada and around the world, electricity production is experiencing very rapid growth and recent technological progress supports a transition focused on energy efficiency. The sector therefore has the potential to contribute significantly to reducing the share of fossil fuels in the energy mix[2].

To achieve this, Canada must develop bold energy policies that include energy efficiency and low-carbon electricity production (hydro, wind and solar) targets. Certain provinces have already established carbon-pricing systems but it is essential for that price to reflect both direct and indirect costs of carbon and energy. A national approach would give rise to controversy (in terms of establishing hard caps for specific economic sectors, and issues of allocation mechanisms and revenue use), so it seems politically opportune to establish mechanisms to coordinate and strengthen these provincial systems.

As noted in *Acting on Climate Change: Solutions from Canadian Scholars*, distribution of income from carbon pricing is

1 http://www.cirodd.org

2 World Energy Council (2013). Time to get the real – The agenda for change. World Energy Council Report, http://www.mmc.com/content/dam/mmc-web/Files/GRC_2013-Time-to-Get-Real.pdf.

crucial to the measure's political legitimacy. Currently, politically acceptable carbon prices are still too low to create a substantial change in behaviour. A good way to strengthen public support for increased carbon pricing would be to earmark most of the revenue to greenhouse gas (GHG) reduction policies and incentives[3].

3. Developing sustainably

Policies and incentives to reduce GHG emissions communicate government plans, giving impetus to the next steps to operationalize sustainable development actions in different economic sectors such as forestry, buildings and urban development.

3.1 An integrated approach to forest management

By Jean-François Boucher and Claude Villeneuve

The Canadian forestry sector holds a wealth of opportunities for climate change mitigation and adaptation. These opportunities were listed by the Intergovernmental Panel on Climate Change (IPCC) as among the most efficient in terms of environmental and economic impacts, with multiple interfacing opportunities with the mining, agriculture, building and energy sectors[4].

Afforestation and reforestation opportunities (specifically, afforestation of boreal open woodlands, agroforestry, reforestation of fallow or unproductive lands and reforestation of degraded lands including mining sites) are available on different types of land and relate to other sectors. Urban reforestation also provides good mitigation opportunities that are in tandem with ecosystem thinking for health.

Acting on Climate Change: Solutions from Canadian Scholars only touches upon the topic of sustainable forest management activities, which also have significant mitigation potential to ensure better carbon stock and flux management on managed land. These activities include measures against natural disturbances and those that aim to increase bioenergy and long-lived wood product supply[5]. In this regard, the links with the energy (including negative emissions technologies) and buildings sectors are evident, especially when considering substitution of high-emission products.

The forestry sector and its interfaces with other sectors is promising in the fight against climate change because it provides real opportunities to operationalize sustainable development by increasing ecological (biodiversity), social and economic co-benefits.

3.2 Transition building

By Pierre Blanchet, Natalie Noël, André Potvin and Robert Beauregard

The construction industry is a dominant economic sector in Canada and accounts for 12.5% of GDP ($45 billion in building permits alone). When taking into account the entire life cycle of buildings, the sector is responsible for 33% of Canada's energy consumption and 35% of its GHG emissions. Buildings constitute both a key component of a low-carbon future and a global sustainable development integration challenge[6].

As discussed in *Acting on Climate Change: Solutions from Canadian Scholars* (policy orientation #7), the building sector has the most cost-efficient CO_2 mitigation potential

3 Ambdur, D., Rabe G. R. and Borick C.P. (2014). Public views on a carbon tax depend on the proposed use of revenue. Issues in Energy and Environmental Policy, 13: 1-9.

4 http://mitigation2014.org/report/publication

5 Smyth, C. E., Stinson, G., Neilson, E., Lemprière, T. C., Hafer, M., Rampley, G. J. and Kurz, W. A. (2014). Quantifying the biophysical climate change mitigation potential of Canada's forest sector. Biogeosciences, 11(13): 3515-3529.

6 http://mitigation2014.org/report/publication

across all sectors, including agriculture, forestry, energy production and industry[7]. The energy efficiency of buildings' mechanical and electrical systems has improved, and the sector is now responsible for just 35% of the total energy consumption to operate and 65% for the intrinsic energy of building materials.

It is important to continue to reinforce the most stringent standards to increase the energy efficiency of buildings and, more importantly, foster the selection of low-impact materials. When renovating and building, developers, designers, builders and legislators must support sustainable design options. These choices are especially significant since building materials and construction methods do not constrain occupant behaviour. Canada must view the building sector as a key tool in the transition to a green, low-carbon economy.

3.3 New urban planning to reduce car dependency

By Paul Lewis and Juan Torres

The spatial organization of our communities has made the car a very important — even essential — tool. The growing trend in car use fosters sprawl: low-density land use and the dispersal of activity spaces (housing, places of employment, businesses, services, and so on). In the late 20th century, this trend shaped urban development, increasing our dependency on cars[8] and hindering the use of other modes of travel, such as walking, cycling and public transit.

In keeping with policy orientation #6 of *Acting on Climate Change: Solutions from Canadian Scholars*, land use planning can reduce car dependency by fostering other modes of transportation and even their combined use in intermodal itineraries. More sustainable urban planning is dictated by several principles (such as functional and social diversity and density), that all converge in an effort to create compact and attractive urban structures connected by efficient public transit networks[9]. The aim is to contribute to a city's competitiveness at the metropolitan scale without compromising quality of life at the neighbourhood scale.

Yet densification constitutes a challenge, if only for the public resistance to which it may give rise. Urban design must therefore be well-thought-out and driven by access points to public transit networks to ensure the attractiveness of denser areas. Still, the densification trend has taken hold in city centres and suburbs. We must capitalize on this movement and use it as a vector for innovation.

4. Evaluating our actions from the global perspective

Sustainable development and climate change impacts must be understood as part of an approach to complexity that requires knowledge from several sectors. There are numerous means to evaluate this complexity, including ecosystem thinking and life cycle analysis.

4.1 Fostering ecosystem thinking for our health[10]

By Johanne Saint-Charles and Cathy Vaillancourt

Ecosystem approaches to health have helped put forward practices that support development of locally applicable and globally

7 Ibid.

8 Dupuy, G. (2006). La Dépendance à l'égard de l'automobile, Paris, Predit, La Documentation française, collection Le point sur, pp. 93.

9 Vivre en ville (2013). Retisser la ville. Réarticuler urbanisation, densification et transport en commun. Vivre en ville, Québec.

10 http://ecohealth-live.net/ecohealth-action/

relevant solutions[11]. Ecosystem approaches to health address key issues outlined in several studies and initiatives.

For example, vulnerability to climate change varies significantly according to context (i.e. geographic, socioeconomic, ethnic, etc.), and proposed solutions must account for these differences. Community transformation must take place by adopting a perspective that considers differences so as to avoid widening existing gaps. Civic participation, which sometimes equates to the participation of *leaders* and *public information*, can be analyzed from this angle. Similarly, sex and gender issues should be considered since they are an important variable in analyzing climate change causes and impacts.

Reflection on the close and complex connections between climate change and human, wildlife and ecosystem health will contribute to development of integrated and sustainable solutions. Linking climate change and local disturbances also provides another path to establish integrated solutions[12].

4.2 Supporting the life cycle assessment approach for our future

By Annie Levasseur and Valérie Patreau

Life cycle assessment (LCA) is a recognized multi-criteria method that is increasingly used to assess, quantify and communicate the environmental footprints of products and services[13,14]. The LCA approach makes it possible to anticipate the shift or creation of impacts in other life cycle stages. It provides a sound scientific rationale to support policies and strategic decisions related to climate change. The recent development of prospective and consequential LCA approaches makes it possible to consider indirect impacts of large-scale implementation of new technologies, development of new sectors following implementation of incentive policies, or any other climate change mitigation scenario, to avoid unintended negative effects[15].

For example, mass introduction of electric vehicles would impact the continental electricity market and the environmental footprint of this technological choice. In another sector, parameters must be established for forest development to produce energy and materials that emit less GHGs and ensure sustainability of carbon stocks and vitality of forest ecosystems. It is important to study the consequences of current climate change mitigation strategies to maximize the effectiveness of our actions and minimize other types of environmental impacts.

Finally, a decision-making approach driven by LCA requires continuous development of life cycle inventory databases with collaboration among different industrial sectors and levels of government.

5. Conclusion

The ideas outlined here by the CIRODD call for action on the following: I) send clear messages to businesses by setting out a consistent carbon pricing mechanism that fosters the decarbonisation of the economy; II) give impetus to change through informed policy choices in areas with high potential to

11 Saint-Charles, J., Webb, J., Sanchez, A. van Wendel de Joode, B., Nguyen-Viet, H. and Mallee, H. (2014). Ecohealth as a Field – Looking Forward. EcoHealth, 11(3): 300-307.

12 Parkes, M. (2011). Diversity, Emergence, Resilience: Guides for A New Generation of Ecohealth Research and Practice. EcoHealth, 8: 137-139.

13 ISO (2006a). ISO 14040: Management environnemental — Analyse du cycle de vie — Principes et cadre, Organisation internationale de normalisation, pp. 24.

14 ISO (2006b). ISO 14044: Management environnemental — Analyse du cycle de vie — Exigences et lignes directrices, Organisation internationale de normalisation, pp. 56.

15 NRTEE (2012). Canada's opportunity: adopting life cycle approaches for sustainable development National Round Table on the Environment and the Economy, http://publications.gc.ca/site/eng/9.696147/publication.html

reduce GHGs (buildings, forestry and urban development); III) foster the application of ecosystem approaches and life cycle assessment methods to account for the complexity of causes and impacts.

This contribution by the CIRODD is a non-exhaustive sampling of hundreds of potential actions that our members and employees wish to undertake with user groups. The CIRODD possesses extensive expertise to address sustainable development and climate change challenges. Governments, organizations and the private sector can count on the CIRODD's collaboration and knowledge of sustainable development operationalization as a catalyst to set our society on the path to prosperity, equity and sustainability.

ABOUT THE ORGANIZATION

EVIDENCE FOR DEMOCRACY

Evidence for Democracy (ED) is a national non-profit that promotes evidence-based decision-making. ED engages in research, education, and issue campaigns to engage and empower the scientific community, as well as cultivate public and political demand for evidence-based decision-making. ED consists of a team of staff members, Board of Directors, and Advisory Board. Our work is guided by engagement from our multidisciplinary Network of Experts as well as our community of volunteers and supporters. ED is funded by a mix of foundation grants and private donations.

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OVER 2500 SCIENTISTS MARCHED ON PARLIAMENT HILL IN SUMMER OF 2012, PROTESTING CUTBACKS AND RESTRICTIONS AFFECTING PUBLIC-SECTOR SCIENCE.

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EVIDENCE FOR DEMOCRACY

On the Role of Canada's Scientists

in Transitioning to a Low-carbon Future

For governments to make evidence-based decisions and policies, it is necessary to have robust support for science in the public interest. Furthermore, these decisions need to be transparently justified. The transition to a low-carbon economy in Canada will require both of these elements: scientific leadership to develop and implement sustainable alternatives, and political leadership to recognize and act on the well-substantiated threat of climate change. Sustainable Canada Dialogues' *Acting on Climate Change: Solutions from Canadian Scholars* report identifies 10 key policy orientations for transitioning Canada to a low-carbon economy. Integrity of science and evidence have an important role to play in not only facilitating this transition, but also providing the forecasting and monitoring skills necessary for adaptive management throughout the process.

Evidence for Democracy requested contributions from members of our Network of Experts, which consists of over 350 professionals nationwide. We bring the perspectives of four individuals from diverse disciplines, who highlight the imperative of such a transition and tackle practical considerations. In light of their responses, Evidence for Democracy's key recommendations for Canada's transition to a low-carbon future include:

- Federal government leadership on climate and emissions policies, with recognition of scientific evidence for both emissions scenarios projections and low-carbon alternatives;
- Increased funding support for federal scientific and monitoring institutions, particularly those engaged in data collection for air quality, water quality, and demographic information;
- Sufficient funding to academic researchers engaged in non-commercial science, such as basic science, environmental research, and health research;
- Climate and emissions policies and regulations that are transparent and informed by the best available evidence.

Our experts paint an optimistic picture: the transition to low-carbon economy is both imperative and possible. Below, they explore the necessity of this change, and how Canada can take leadership in this transition.

W.R. PELTIER, Professor of Physics, University of Toronto; Intergovernmental Panel on Climate Change (IPCC) author.

As I write these words, an entirely unprecedented flooding event has engulfed Texas[1], an extraordinary concentration of forest fires is once more threatening the towns of northern Alberta[2], and India is experiencing a heat wave that has driven temperatures close to 50°C[3]. Although we are unable to assert that any one of these events is a consequence of global warming, the response to this process is unfolding as expected on the basis of the best scientific evidence available. This evidence, produced by an international community of scholars that has been active in analyzing the present and projecting the future impacts for more than three decades, continues to accumulate. Observations and model projections agree that the severity of such extreme events and their frequency will only increase. Given the evidence, an appropriate policy response would appear to be required, both nationally and internationally.

In Canada, because the federal government has abrogated its responsibility to contribute to the required international response, individual provinces have taken the lead on a sub-national basis. The recently agreed-upon commitment by Ontario to join an existing "cap-and-trade" regime, which has united Quebec with the U.S. state of California, will bring approximately half of the Canadian population under an umbrella that is intended to markedly reduce greenhouse gas (GHG) emissions. In what could be an even more effective move towards this goal, British Columbia has implemented an explicitly revenue neutral carbon tax. The new government of Alberta is committed to equivalent sub-national action. Our national response would be much more coherent if the federal government were to provide the leadership that the country is insisting upon at a sub-national level.

In support of Canada's democracy we need policy that is firmly based upon the best evidence available, in all areas, not only those concerning the environment. It is in the area of the environment, however, that the stakes are continuing to rise at a rate that is a matter of grave concern. What we need, now, is strong leadership at the national level.

JOHN STONE, retired government science manager; IPCC author; adjunct Professor, Carleton University.

The science behind the threat of climate change is not new; it can be traced back to the work of scientists such as Arrhenius almost 150 years ago[4]. Neither is the issue of climate change a new addition to the public policy agenda; in Canada we can look back to the Changing Atmosphere conference held in Toronto in 1988. Likewise the solutions for tackling climate change are not new; there have been numerous policy papers discussing technologies for greater energy efficiency and for the transformation to more renewable energy sources[5], as well as policy papers discussing economic instruments such as putting a price on our emissions[6,7].

1 http://time.com/3895947/texas-houston-floods/

2 http://calgaryherald.com/news/local-news/southern-alberta-spared-as-forest-fires-burn-up-north

3 http://www.bbc.com/news/world-asia-india-32880180

4 Arrhenius, S. (1896). On the influence of carbonic acid in the air upon the temperature of the ground. Philosophical Magazine and Journal of Science, 41(5): 237-276.

5 Government of Canada (2000). Government of Canada Action Plan 2000 on Climate Change, http://publications.gc.ca/collections/Collection/M22-135-2000E.pdf

6 Stern, N.M. (2006). Stern Review on the Economics of Climate Change. Office of Climate Change, Government of the United Kingdom, http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf

7 Hansen, J.E. (2009). Carbon Tax & 100% Dividend vs. Tax & Trade. Testimony to Committee on Ways and Means, United States House of Representatives, http://www.columbia.edu/~jeh1/2009/WaysAndMeans_20090225.pdf

What has been missing is inspired leadership from the government, business and university communities. This contribution from a group of Canadian university scientists illustrates what is possible.

Time is running out. We can no longer deny the scientific evidence: the tested hypotheses, careful observations and validated models that have been accumulating over the past few decades. We cannot ignore the impacts that we are already seeing. Tackling climate change is going to require a determined and collaborative effort. It will require imagination; imagination to envisage a world where our lifestyles are different from today's but equally fulfilling, and where we nurture our planet for the benefit of all in the future. It will require that the scientific communities in universities, governments and the private sector work together in an open and transparent manner, sharing expertise, ideas and results.

The good news is that we are beginning to see change. Economic realities are driving renewable power developments; governments are beginning to put a price on emissions; and greater numbers of people are demanding a change to a more sustainable future. We are on the verge of a much-needed and well-informed national debate in this country on how to achieve a transition to a society and economy where our use of fossil fuels does not overwhelm the natural equilibrium of the planet. This document provides a good starting point.

TIM TAKARO, Professor of Health Sciences, Simon Fraser University; Clinical Professor of Environmental Health Sciences, University of Washington; Visiting Professor, University of British Columbia.

As a physician-scientist with a research program in the health effects of climate change and occupational and environmental respiratory disease, I often approach problems with a clinical eye. In this matter, we can approach fossil fuels as a substance abuse issue.

We know this addiction is harming us and, more importantly, future generations, but we cannot stop ourselves. We have energy companies feeding us 'the cheap stuff' while funding junk-science to confuse the public about the risks of GHGs and the unstable future climate linked to our habit. We have a federal government with deep investments in the oil and gas industry that has drastically reduced Canada's preeminent public science capacity. The government scientists that have retained their jobs have had their communications limited by administrators.

Our children will witness accelerated trends of which we've already had glimpses: massive culling of sick and elderly from heat waves; increased superstorm activity; history-making forest fires; and disappearing arctic sea ice and subsistence culture, among other startling changes. As fossil fuel addicts, it is hard for us to accommodate these truths.

The economic value of protecting our health and ecosystems with appropriate tax for polluting the world 'commons' is clearly laid out by Marc Lee[8,9], in a series of publications from the Canadian Centre for Policy Alternatives, and by others[10]. Part of these economics includes significant cardio-respiratory co-benefits of reducing air pollution, or using

8 Lee, M. (2012). BC's natural gas strategy is bad for economics and bad for climate. Canadian Centre for Policy Alternatives, https://www.policyalternatives.ca/publications/commentary/bc%E2%80%99s-natural-gas-strategy-bad-economics-and-bad-climate

9 Lee, M. (2012). Clean Electricity, Conservation and Climate justice in BC. Canadian Centre for Policy Alternatives,, https://www.policyalternatives.ca/electricity-justice

10 Griffiths, M. and Kikul, J. (2013). The tragedy of the commons. Ivey Business Journal, http://iveybusinessjournal.com/publication/the-tragedy-of-the-commons/

person-powered transport, or growing local, organic healthy food[11]. A recent analysis from Boston University's School of Public Health found that the 51 dirtiest U.S. coal-fired power plants caused 2 700 to 5 700 premature deaths from fine particulate emissions in 2011 alone. If you need to monetize this tragedy, it is equivalent to $23-47 billion using the Environmental Protection Agency's valuation on human life[12] - a dollar figure that exceeds the market value of the electricity generated. The late Paul Epstein from Harvard School of Public Health calculated that the life-cycle effects of coal power and the industry's waste stream, including the burden of illness from heart and lung diseases and cancer caused by coal-plant particulate, cost U.S. taxpayers up to half a trillion dollars a year[13]. U.S. coal burning is decreasing rapidly in the face of these realities.

It is morally repugnant when industries push harmful products on consumers, and tobacco companies are beginning to pay the price in North America and Europe with multi-billion dollar penalties. Yes, the world needs energy sources. Energy in the developing world relieves considerable suffering. But companies and governments that insist fossil fuels are the only future are deceitful, obfuscate the science, and rely increasingly on emerging markets for their products as more wealthy societies (e.g. Scandinavia, Germany) have curbed their habit. We can too.

11 Thurston, G.D. (2013). Mitigation policy: Health co-benefits. Nature Climate Change, 3: 863-864.

12 Levy, J.I., Baxter, L.K. and Schwartz, J. (2009). Uncertainty and variability in health-related damages from coal-fired power plants in the United States. Risk Analysis, 29(7): 1000-1014.

13 Epstein, P.R., Buonocore, J.J., Eckerle, K. et al. (2011). Full cost accounting for the life cycle of coal. Annals of the New York Academy of Science, 1219: 73-98.

ALANA WESTWOOD, Research Coordinator, Evidence for Democracy

As my colleagues have stated, Canada's transition to a low-carbon economy requires an acknowledgement of scientific consensus by federal leadership, and subsequent policy action. A successful and speedy transition will also require robust research and monitoring from federal and academic bodies, both of which have received significant cutbacks in recent years. In 2012 and 2013, almost 1 900 federal government scientists were laid off[14], and at least 157 federal scientific institutions have received staff cuts, funding reductions, or have been completely eliminated[15]. Nearly every federal scientific and monitoring institution has been affected. This has been followed by closures of dozens of federal libraries, their materials destroyed. Academic research has been cut back as well[16] - funding was re-oriented with an explicit shift towards short-term commerce-driven innovation, and industry partnership, and away from basic science[17].

There is a necessary role for federal science and monitoring in the transition to a low-carbon economy. It is important to continue to collect good baseline data, build effective forecasting models, and monitor effects on human and environmental health and welfare throughout the transition. There is also an essential role of federal and university researchers in developing solutions to climate change, both technological and by evaluating the impacts of policy options. Climate change is a cross-jurisdictional issue, and necessa-

14 http://www.macleans.ca/news/canada/when-science-goes-silent/

15 http://www.cbc.ca/fifth/blog/federal-programs-and-research-facilities-that-have-been-shut-down-or-had-th

16 http://www.cbc.ca/news/technology/federal-government-reducing-science-and-tech-spending-1.1398479

17 http://www.theglobeandmail.com/news/national/federal-budget-ignites-debate-over-what-science-is-for/article10274702/

rily needs to be addressed as such. Many of the institutions that were positioned to tackle climate change (e.g. The National Round Table on Environment and Economy, the Polar Environment Arctic Research Laboratory) have been eliminated or have lost a great deal of their capacity.

There are rare cases where provinces and communities have attempted to fill the void left by federal cutbacks (e.g. the transfer of the Experimental Lakes Area to provincial/ NGO management). This is a similar situation to emissions policy, where provinces and communities seem left to fend for themselves. However, for the most part, provinces, municipalities, universities and individuals simply do not have the capacity to adopt large-scale, long-term monitoring and research projects.

More importantly, it is not efficient or effective for cross-jurisdictional problems like climate change to be addressed at lower levels of government only. Unified policies and regulations will not only ensure consistency and quality, but also save costs. Federal leadership on climate change is a must, and it needs to go hand in hand with federal support for scientific research and monitoring. Canada's university researchers will need assured financial support to both provide good data and train the talented personnel who can provide advice and leadership through the transition. This financial support should not be confined to short-term, innovation-driven projects. Instead, it needs to be used to collect the data necessary to guide Canada through the transition to a low-carbon economy, allowing adaptive management in response to evidence.

Social Acceptability:
What Do People Want?

ABOUT THE AUTHORS

NATALIE RICHARDS, MARK STODDART, ASHLEE CUNSOLO WILLOX, CATHERINE POTVIN AND THE SCD VISIONING TEAM

« *À l'annonce de grands vents certains construisent des murs, d'autres des moulins.* »

"*Upon hearing of high winds some people build walls, others windmills.*"[1]

Since November 2013, Sustainable Canada Dialogues has built a network of 60+ scholars representing a broad knowledge base across the country. The network has proposed transition pathways to encourage Canada to act on its sustainability deficit[2] in relation to other developed countries that are taking leadership on responding to climate change and moving towards low-carbon futures.

Sustainable Canada Dialogues proposes that the long-term goal of helping Canada in a sustainable transformation must be pursued in the context of a long-term vision for the country; a vision that should be informed by the hopes people living in Canada have for the future. Therefore, the initiative adopts a twofold approach: sharing science-based sustainability solutions to contribute to the design of a low-carbon society, and fostering discussions across the country about the future.

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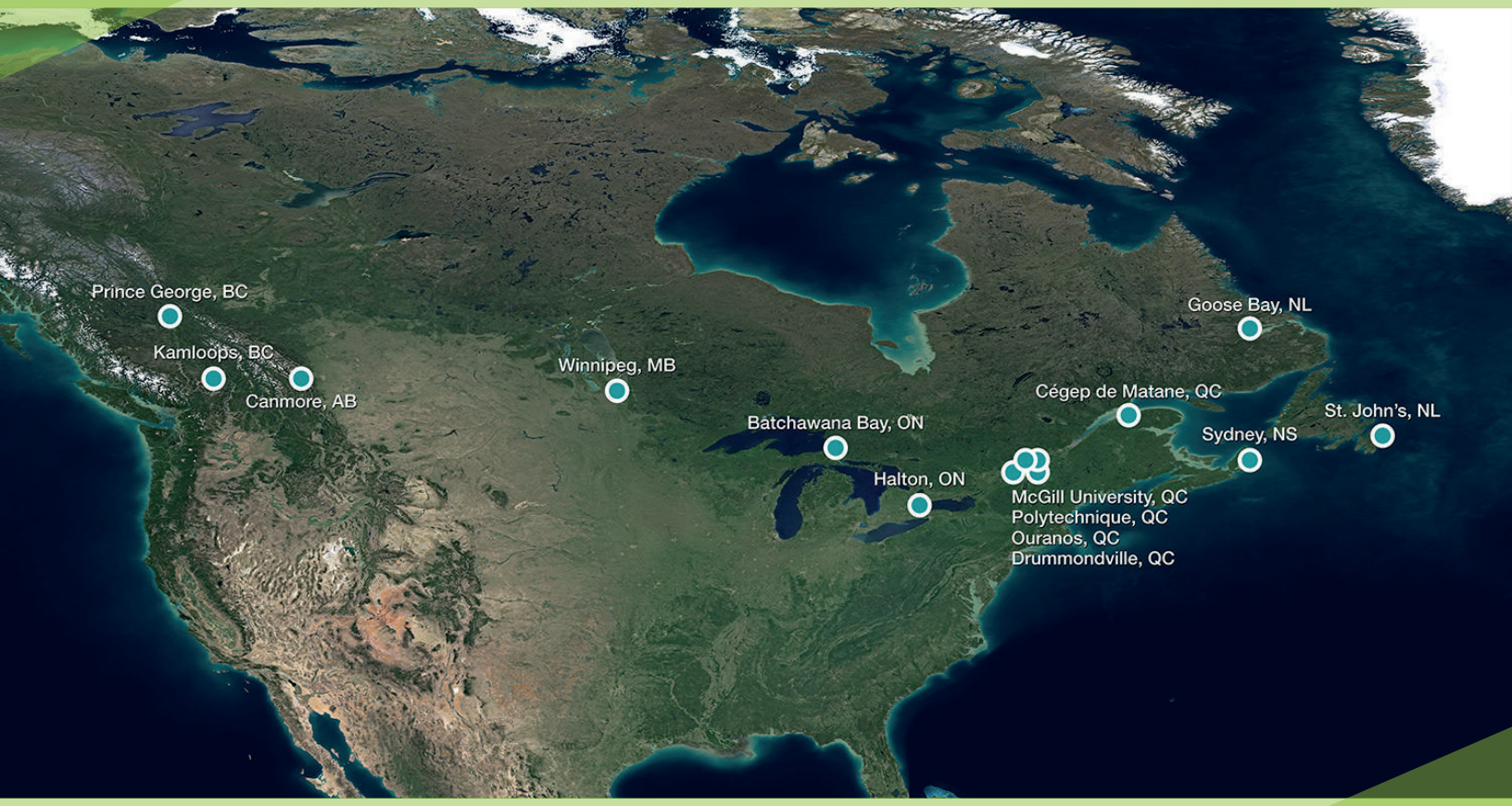

THE SCD VISIONING TEAM HELD 14 VISIONING WORKSHOPS BETWEEN MAY 2014 AND JANUARY 2015 TO FACILITATE DISCUSSION WITH CANADIANS ON THEIR IDEALS FOR CANADA'S FUTURE.

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SCD VISIONING TEAM

Imagining Canada:

An Exploration of Desired Futures From a Countrywide Visioning Approach

Here we present early results of visioning exercises carried out in the context of the second objective of Sustainable Canada Dialogues listed above. These results suggest that people hope for a future that is founded on an integrated approach to the wellbeing of society, the environment, and the economy – where the health of each contributes to that of the others.

Why a Canada-wide visioning approach?

Sustainable Canada Dialogues mobilized visioning to engage a wide variety of stakeholders from across geographies, sectors, and demographics in Canada to learn what people want for their futures, and to discover strategies for moving forward in a more sustainable way. This method is particularly effective for synthesizing individual aspirations into a common vision that articulates group consensus.

Visioning is a participatory research and engagement method geared towards collaborative future thinking. It is commonly used to involve communities in planning and goal setting for the future of shared spaces through the development of vision statements[3,4,5]. Depending on the context, a range of different strategies can be employed. In many cases, visioning has been successful in helping communities to systematically consider and prepare for change, particularly in complex or controversial settings concerning issues of conservation, development, land and resources[6]. By encouraging cooperative and open dialogue, visioning is an empowering tool for stakeholders to inform decision-makers and planners of their values, particularly in contexts involving divergent interests[7].

1 Drummondville, QC session participant, November 17th, 2014.

2 Potvin, C. and Richards, N. (2015). Let's Talk: Opening the dialogue on our sustainable future. Alternatives Journal, 41(1): 16-19.

3 Shipley, R., Newkirk, R. (1998). Visioning: did anybody see where it came from? Journal of Planning Literature, 12(4): 407-416.

4 Helling, A. (1998). Collaborative Visioning: Proceed With Caution!: Results From Evaluating Atlanta's Vision 2020 Project. Journal of the American Planning Association, 64(3): 335-349.

5 Shipley, R. (2002). Visioning in planning: is the practice based on sound theory? Environment and Planning A, 34: 7-22.

6 Evans, K., Velarde, S.J., Prieto, R., Rao, S.N., Sertzen, S., Dávila, K., Cronkleton P. and de Jong, W. (2006). Field guide to the future: Four ways for communities to think ahead. Bennett E. and Zurek M. (Eds.). Center for International Forestry Research (CIFOR), ASB, World Agroforestry Centre, Nairobi, pp. 87, http://www.asb.cgiar.org/ma/scenarios

7 Hopkins, L.D., Zapata, M. (2007). Engaging the Future: Forecasts, Scenarios, Plans, and Projects. Lincoln Institute of Land Policy, Mass, Cambridge.

Between May 2014 and January 2015, the Sustainable Canada Dialogues team facilitated 14 visioning sessions from coast to coast with a wide range of people living in Canada. On average 15 to 20 participants per session engaged in daylong dialogues, where they were asked to consider the hopes they hold for the future. Throughout the course of each session, participants cooperatively worked towards articulating a communal narrative of an ideal future built upon the desires represented in their group. This contribution presents early analysis of some of the key common elements emerging from the visioning sessions.

The Sustainable Canada Dialogues visioning method

A regional host was assigned to each visioning session to recruit participants from a range of community voices, reaching beyond academic and environmental or activist groups. For example, the group of participants in Kamloops, B.C., included consultants, small business owners, workers in agriculture and mining sectors, local government representatives, as well as economic, environmental and community planners. Across the country a total of 173 participants engaged in the conversation. The methodology (Figure 1) was collaboratively developed in discussion with Sustainable Canada Dialogues scholars, and incorporated feedback from participants of the first pilot visioning session at McGill University in May 2014. Considering the diversity of communities involved, the methodology intentionally remained flexible in order to adapt to the needs of different groups and how they best approached the research question. The consensus statement articulated by participants was returned to each group after the session.

The visioning sessions are currently being transcribed and coded for analysis in order to identify prominent themes and ideas, and to identify notable differences across the

Figure 1. Methodology employed to facilitate the Sustainable Canada Dialogues visioning sessions

	Activity	Purpose
Step 1	*Object narratives*	Share an object, photo or story representing a personal concern for the future.
Step 2	*Personal imagining*	Reflect individually on the future.
Step 3	*Look for commonalities*	Identify features common to the personal visions.
Step 4	*Discuss common features*	Discuss those features, consider important gaps and agree on a final representative list.
Step 5	*Compose the narrative*	Draft statements describing the future based on the previous characteristics.
Step 6	*Synthesize the narrative*	Share, combine and edit the statements into one narrative that represents the hopes of the group.

sessions[8]. To date, we have identified four prominent emerging themes: c*ommunity, shift toward renewables*, "*true democracy*", and *transformed mindset*[9]. Preliminary results were shared with all participants, who were also given the opportunity to comment on the findings.

Exploring imagined futures

Community: Living together, working together, and celebrating diversity

Many participants identify a pervasive sense of loneliness and isolation that is built into the organization of Canadian society. To counter it, they believe we need a structural reformation of our communities in order to enable people to live together, work together, and celebrate diversity. *Living together* refers to the desire for more shared spaces, such as green areas and cultural or public activity centres; participants in Kamloops, B.C., use the phrase "belly to belly interaction"[10] to describe this theme. Creating better active transportation systems and cooperative or multi-generational housing would support interaction and familiarity between families and within communities. In many cases, *living together* also refers to the desire for human-environment interaction. Most participants show concern for the health of local and regional environments. For example, a participant in St. John's, Newfoundland, expresses the importance of interacting with healthy landscapes and seascapes for "human refreshment"[11]. Northern stakeholders also express a particular emphasis on the land being a place "where the animals know they are valued" and "where people, animals, plants, and the environment thrive"[12].

Communities *working together* are described as those in which individuals look out for the wellbeing of one another and take care of each other. This includes increased sharing between community members, and creative recycling and upcycling practices in order to work together towards zero-waste communities. Overwhelmingly, there is a strong desire to see a widely embraced shared social responsibility that shapes the way that individuals work, live, and act on a daily basis. Participants in Winnipeg, Manitoba communicate high hopes for the future health of their communities by suggesting that "social service case-loads [will be] almost non-existent because we [will] have learned to take care of each other within the community"[13]. In Cape Breton, Nova Scotia, this desire is defined as "[working] ourselves out of a job"[14].

Discussions on *diversity* revolve around the reality that communities are places comprised of many different types of people. Often these differences create division; however, there is a strong appeal for communities to become inclusive places where differences can be safely shared and welcomed as points of pride. To illustrate, participants in Halton, Ontario use the phrase "unity without uniformity"[15] to express the belief that despite differences between people, it is possible to live together – even though we are not the

8 Data consist of participants' personal notes, the final vision statement and audio-recordings from each session.

9 Preliminary results are taken from the ongoing analysis. At the time this paper was written 7 of the 14 visioning sessions had been fully transcribed (Kamloops, BC; Canmore, AB; Winnipeg, MB; Halton, ON; Drummondville QC; Sydney, NS; St. John's, NL), involving 102 of the 173 who engaged in one of the sessions.

10 Participant notes, Kamloops, BC session, May 23rd, 2014.

11 Participant notes, St. John's, NL session, November 8th, 2014.

12 See the Goose Bay, NL session vision statement at: http://www.sustainablecanadadialogues.ca/en/scd/fostering-public-discussion-through/scd-visioning-workshops

13 See the Winnipeg, MB session vision statement at: http://www.sustainablecanadadialogues.ca/en/scd/fostering-public-discussion-through/scd-visioning-workshops

14 Participant notes, Cape Breton, NS session, November 10th, 2014.

15 Participant notes, Halton, ON session, January 10th, 2015.

same we are capable of working collectively towards common goals for the good of all.

Shift toward renewables

Another strong emergent theme is the desire to transition away from a dependency on fossil fuels and towards the dominance of renewable energies. Participants call for abundant and diverse renewable energy options that contribute to the integrity of the natural environment, and for the provision of incentives to encourage efficient energy use. As articulated in the St. John's session, the phasing-in of renewable energies should involve "viable alternatives [to fossil fuels] which are tailored to local environments"[16], allowing communities to develop according to their local or regional clean-energy strengths. Participants feel that government can be a decisive force in the successful phasing-out of fossil fuels, through the appropriate use of legislative guidelines to structure pro-sustainable options and choices. Additionally, the data indicate a general willingness to make sustainable lifestyle changes in response to effective government policies that would "level the playing field"[17], as one Halton participant put it, by imposing penalties on non-conformers. The Halton group's vision suggests that an "Economic-Environmental Carbon Incentive Plan" that "rewards manufacturers for good environmental stewardship in the way they harvest and produce" could give a competitive market edge to sustainable producers by "equalizing the cost of goods"[18]. Participants believe that we already possess the necessary technology and know-how required to make the transition from fossil-fuel dependence to a society based on renewable resources. Most feel that strategically redirecting government fossil fuel industry subsidies towards renewables is an important strategy for reducing and/or eliminating this dependence.

"True democracy"

A critique of the current state of democracy in Canada is common to 11 of the 14 visioning sessions; about one third employ the terms "real" or "true democracy", used to juxtapose current practices that are often seen as undemocratic. Meaningful citizen engagement, which incorporates reciprocity between decision-makers and the public, is highly valued. People desire the space and agency to speak and to know that their voices are genuinely being taken into account. They would like to see politicians take seriously the role of representing the public will, in addition to creating effective measures for ensuring transparent decision-making and accountability to the public. Alongside meaningful reciprocity in this relationship, participants also aspire to be part of an informed, politically-engaged citizenry. In their consensus statement, participants in Kamloops envision voter-turnouts averaging over 75%[19].

Results indicate a general lack of confidence in the first-past-the-post (FPP) system, accompanied by numerous requests for electoral reform towards increased public representation. In addition to not accurately reflecting the population politically, participants also critique FPP for inhibiting long-term coherence in decision-making. Specifically, participants express frustration at the inability to legislate positive environmental policies or lasting sustainable change that may carry short-term costs and is therefore damaging to electoral campaigns. Drummondville participants insist, « le

16 Participant notes, St. John's, NL session, November 8th, 2014.

17 Participant notes, Halton, ON session, January 10th, 2015.

18 See the Halton, ON session vision statement at: http://www.sustainablecanadadialogues.ca/en/scd/fostering-public-discussion-through/scd-visioning-workshops

19 See the Kamloops, BC session vision statement at: http://www.sustainablecanadadialogues.ca/en/scd/fostering-public-discussion-through/scd-visioning-workshops

Canada doit avoir une vision pour diriger ses efforts au lieu de perdre ses énergies dans les politiques contradictoires »[20]. A long-term mandate based on the public will would contribute to circumventing short-term thinking by politicians concerned with re-election. Participants repeatedly suggest that greater public representation, increased transparency and accountability to citizens, and meaningful citizen engagement would encourage the government to make decisions based on long-term planning that is informed by and accountable to an involved public.

Transformed mindset: reimagining society, environment and economy

Participants repeatedly articulate the need for an overall transformation of the ways in which we understand the relationships between society, the environment, and our economy. They express strong desires to change indicators of progress away from the demand for continuous growth and consumption. Participants hope that this renewed understanding will lead to changes in how the economy functions, and how the environment is valued. Most participants articulate the need for economic reform where the economy becomes a tool to serve the wellbeing of society. One of the most notable recurring items in this theme is the need for a better work-life balance. Participants suggest that a society-serving economy is one driven by a diverse range of small, local enterprises, where local jobs are created through a value-added economy. Living wages are also highly prioritized, and, particularly in Canmore, Alberta, linked to the idea of "inclusive economies" where "everyone has the means to live well – not to live excessively – but [where] there is a base level of standards of living" attainable by all[21].

There is also a strong desire for a communal shift away from materialism and towards living more simply. While this idea may hint at an environmentalist bias, the concept is frequently used by individuals representing varying degrees of environmental interest or activism, and from a range of different living circumstances. In Drummondville, it is paired with the need to « faire la différence entre nos besoins et nos désirs, parce que nos besoins sont effectivement limités, mais nos désirs sont illimités »[22]. In Halton, it accompanies an appeal to transition away from our current "disposable philosophy" towards "quality manufacturing to increase the longevity of products"[23]. Many participants agree that re-evaluating the cost of goods so that prices reflect the social and environmental costs of production would encourage this transition away from the current narrative of disposability.

Indigenous participants from the Prince George, Goose Bay, Batchawana Bay, and Unama'ki/Cape Breton sessions express a strong desire to move away from the commodification of resources and profit-driven models towards more sustainable and small-scale development. One participant in Cape Breton, Nova Scotia, articulates that in the ideal future "people are humble enough to acknowledge the rights of nature, and the responsibilities of humanity. This [leads] to a transformed mindset from exploiter to responsible"[24].

20 Canada must have a vision to guide its efforts instead of wasting energy through contradictory policies - Participant notes, Drummondville, QC session, November 17th, 2014.

21 Participant notes, Canmore, AB session, September 22nd, 2014.

22 Differentiate between our needs and our desires, because, our needs are actually limited, but our desires are not. - Participant notes, Drummondville, QC session, November 17th, 2014.

23 Participant notes, Halton, ON session, January 10th, 2015.

24 Participant notes, Cape Breton, NS session, November 10th, 2014.

In Halton, participants generally believe:

> "[e]conomics and environmental stewardship… are not in direct opposition. We can still be successful as a society – as individuals, as companies, as corporations, as manufacturers – without destroying the environment. It just means that we have to change the way we think. The mentality has to become one of stewardship – of society, of the environment, and it all ties economically"[25].

Overwhelmingly, results indicate a widespread desire for the economy (including producer and consumer behaviours) to serve the goals of social and environmental wellbeing.

Conclusion

The conversations that Sustainable Canada Dialogues has held across the country demonstrate that people living in Canada desire the opportunity to live well, and that this requires thinking beyond the economy to social and environmental dimensions of community wellbeing. A parallel look into past visioning work across Canada uncovers similar themes. In a review surveying 31 community visioning reports independent of Sustainable Canada Dialogues, ideals for the future of Canada emphasize community and other social features, followed by ecological then economic characteristics[26]. These visions express the desire for social features including community engagement and integration, safety, accessible shared public spaces and social inclusion. In the ecological dimension, high value is placed on the integrity and natural diversity of local landscapes in addition to having access to clean water. There is also a widespread eagerness for more sustainable approaches to development and transportation in general. When asked to imagine the ideal future, people request that it be built upon a connected and engaged society, a flourishing natural environment, and a diverse and sustainable economy.

These findings resonate with the concept of regenerative sustainability[27], an emerging idea adopted by Sustainable Canada Dialogues' *Acting on Climate Change: Solutions from Canadian Scholars* report, which emphasizes a positive approach to sustainability. Regenerative sustainability prioritizes social wellbeing alongside economic and ecological health, favouring environmentally sound solutions that improve people's welfare. This is well-illustrated by the issues surrounding urban transportation, which produces greenhouse gases, decreases air quality and causes traffic congestion. A regenerative sustainability approach would seek to improve quality of life while also addressing the economic and environmental issues in transportation.

We change the sustainability story from one of sacrifice to one of possibility when we invite people's diverse perspectives and experiences into the conversation of the ideal future. Rather than focusing on what we stand to lose through steps to mitigate climate change, we fix our sights on what we hope for the future and pursue pathways that bring us closer to those aspirations. Extending this dialogue creates an inclusive space where, despite our differences, people can cooperatively work towards the design of a future that is both desirable and ecologically, economically and socially sustainable[28].

25 Participant notes, Halton, ON session, January 10th, 2015.

26 Cameron, L. and Potvin, C. (2015). "Characterizing desired futures of Canadian communities." Honours thesis, McGill University.

27 Robinson, J. and Cole, R. (2015). Theoretical Underpinnings of Regenerative Sustainability. Building Research and Information, 43(2): 133-143.

28 Krauss, W. and von Storch, H. (2012). Post-Normal Practices Between Regional Climate Services and Local Knowledge. Nature and Culture, 7(2): 213-230.

In their engagement with decision-makers, Sustainable Canada Dialogues scholars learned that social acceptability of change is at the heart of decision-makers' concerns regarding sustainability and climate change mitigation efforts in Canada. However, feedback from the visioning suggests that people are encouraged by the process of dreaming and planning for possible futures. Many participating groups also acknowledge that, although sustainable transformation will come with costs, it can be brought about in ways that contribute to the social and environmental wellbeing of all people living in Canada. This suggests that social resistance to change itself is not an obstacle to sustainability; rather, people are resistant to being left out of the discussion of what should change, how it should change, and planning for those changes. Meaningfully engaging the public would ensure that government-implemented change works in favour of the social, economic and environmental goals of society, consequently building social acceptability of those changes right into the design-process.

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ABOUT THE ORGANIZATION

ENVIRONMENTAL SUSTAINABILITY RESEARCH CENTRE

LIETTE VASSEUR AND GARY PICKERING

The Environmental Sustainability Research Centre is one of the five transdisciplinary hubs at Brock University, and pursues innovative research concerning the environment, sustainability and social-ecological resilience. The Environmental Sustainability Research Centre aims to: 1) resolve complex environmental/social problems by fostering transdisciplinary research at Brock, cultivating academic networks with other world-class institutions, and transforming scientific thinking into action; 2) create a vibrant learning community that enhances knowledge and develops skills through innovative teaching; and, 3) foster sustainable uses of our shared environments by engaging with communities of practitioners, policy-makers, artists, Indigenous Peoples and fostering knowledge mobilization at local through international levels.

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WORKSHOP OF THE GREATER SUDBURY CLIMATE CHANGE CONSORTIUM IN MAY 2012, IN CONJUNCTION WITH 350.ORG *FEELING DOTTY* GLOBAL EVENT

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ENVIRONMENTAL SUSTAINABILITY RESEARCH CENTRE

Feeding the Social Animal:

How to Engage Canadians in Climate Change Mitigation

Context

Despite hundreds of reports and peer-reviewed publications showing the trends related to global climate changes and their impacts, actions to reduce greenhouse gas (GHG) emissions remain limited in most countries. Political will is missing, especially in countries where the exploitation of fossil fuel remains a priority. Since the first United Nations Earth Summit in Rio de Janeiro in 1992 and the recognition of environmental degradation, nations have pursued an agenda for better human wellbeing by developing international conventions such as the United Nations Framework Convention on Climate Change (UNFCCC; 1992). The UNFCCC unfortunately has not been able to move forward on this agenda, as have some other conventions. The Montreal Protocol, for example, which sought to reduce the impact of chlorofluorocarbons (CFCs) on the ozone layer, has rallied countries to rapidly find solutions. Canada was a signatory of the UNFCCC's Kyoto Protocol, with the hope that mitigation would be integrated into the political agenda and lead to effective reduction of GHG emissions. This has not been the case and GHG emissions are still increasing in the country. Indeed, Canada is now at the bottom of the Climate Change Performance Index for both G8 and the Organisation for Economic Co-operation and Development (OECD) member countries (30th out of 30 in 2014), and has shown "... no intention of moving forward with climate policy and therefore remains the worst performer of all industrialised countries"[1].

As mentioned in the *Acting on Climate Change: Solutions from Canadian Scholars* report, urgent and sustained change is required at the individual, societal and political levels for our country to move ahead. Despite the polls showing that the world is concerned about the environment[2], attitudes have not changed or translated into action[3] either individually or politically. Identifying and understanding the obstacles that prevent Canadians from engaging in and sustaining effective mitigation and adaptive actions are critical steps in an integrated societal response to climate change.

1 Burck, J., Marten, F. and Bals, C. (2014). The Climate Change Performance Index 2014. A Comparison of the 58 Top CO_2 Emitting Nations, http://germanwatch.org, accessed on September 3rd, 2014.

2 http://www.theglobeandmail.com/news/national/canada-in-middle-of-the-pack-in-global-poll-on-environmental-concern/article24025494/

3 Speth, J. G. (2004). Red Sky at Morning: America and the Crisis of the Global Environment-A Citizen's Agenda for Action, Yale UP, New Haven.

Barriers to Change

Various psychological barriers preventing individual action on climate change have been identified by numerous authors[4,5,6]. Many of these barriers are difficult to overcome. For instance, our "ancient brains" have evolved to focus on immediate issues related to exploiting resources and the risks and needs of our immediate social group. This conflicts with the types of thinking and action needed to deal with the global scale and more complex effects of climate change. Similarly, worldviews such as belief in the capacity of free-market capitalism to solve all problems are strong predictors of climate change scepticism and inaction, but notoriously difficult to change. However, some obstacles to change are less ingrained and perhaps more easily overcome through smart and targeted policy, communication and social interventions; these are presented in Table 1.

4 Kollmuss, A. and Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? Environmental Education Research, 8: 239–260.

5 Lorenzoni, I., Nicholson-Cole, S. and Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. Global Environmental Change, 17: 445–459.

6 American Psychological Association (2009). Psychology and Global Climate Change: Addressing a Multi-faceted Phenomenon and Set of Challenges. Report of the American Psychological Association Task Force on the Interface Between Psychology and Global Climate Change, http://www.apa.org/science/about/publications/climate-change.aspx, accessed on September 9th, 2014.

Table 1. Psychosocial barriers to climate change mitigation and adaptation that may be most readily overcome (adapted from Gifford et al.)[7]

	Barriers	Characteristics/Example
Other people	*Social comparison & norms*	We compare our actions against others' to decide on what the "correct" response to climate change should be.
	Perceived inequity	"___ is not changing their behaviour, so why should I?"
	Psychosocial risk	We may be criticized or rebuked by others if we engage in mitigation behaviour, and this might damage our self-esteem.
Ideologies	*Salvation through technology*	Excessive trust that technology will solve the problems associated with climate change prevents us from acting ourselves.
Limited reasoning	*Ignorance*	Not being aware of climate change impacts or not knowing what actions we can take to mitigate/adapt.
	Uncertainty & scepticism	Doubt or denial regarding the existence of climate change, its anthropogenic causes, or the contribution of our own actions.
	Spatial discounting	When impacts are presumed to be worse elsewhere, we are less motivated to act on our local environments.
	Perceived powerlessness	We are less likely to act when we believe our actions will make no difference.
Limited behaviour	*Doing the bare minimum*	We make easy, but low-impact changes in our behaviour while avoiding higher-cost but more effective actions.
	The rebound effect	"Now I have this fuel-efficient car, I can drive further" may cancel out the mitigation benefits of having changed from the less fuel-efficient car.

7 Gifford, R., Kormos, C. and McIntyre, A. (2011). Behavioral dimensions of climate change: drivers, responses, barriers, and interventions. WIREs Climate Change, doi: 10.1002/wcc.143.

Investments	*Sunk costs*	"Why would I take public transit, now that I've spent all this money on a car?"
	Conflicting values, goals, & aspirations	Climate change is not high on the list of priorities in our lives, and may be incompatible with some goals (e.g. wealth generation).
	Lack of place attachment	We are more likely to look after a place we feel attached to than one we do not.
Mistrust and denial	*Mistrust*	We are less likely to engage in mitigation/adaptation if we do not trust the source of our information (e.g. government or scientists).
	Perceived program inadequacy	Most climate change mitigation programs are voluntary and we can choose not to participate.
	Reactance	Some of us react strongly against policy or advice that we think limits our freedom.
Perceived risk	*Financial risk*	The cost of investing in new adaptive technologies outweighs the benefits, or takes too long to recoup the initial financial outlay.
	Functional risk	Concern that new technologies (e.g. wind turbines) may not work or will be inconvenient.
	Physical risk	"Cycling is a good idea, but there are no bike lanes where I live – it's dangerous!"
	Temporal risk	We may spend significant amounts of time changing our behaviour to learn that it is unsuccessful; thus, our time has been wasted.

Scepticism – and at its extreme, denial – of climate change prevents action, and varies among countries, worldviews, cultures, religions, and political associations. In Canada[8], the U.S.[9] and the U.K.[10], scepticism is strongly predicted by conservative political values and low pro-environmental values. Overall levels of scepticism in Canada appear relatively low, compared to the U.S., with only 8% agreeing with the statement *I do not believe climate change is a real problem*[4]. However, up to 41% of Canadian respondents believe that climate change is a natural phenomenon[11]. This is significant, because belief in the human – rather than natural – origins of climate change is the single most important factor predicting the willingness of Canadians to engage in mitigation behaviour[12]. Several other barriers to acting, including powerlessness, uncertainty, the commons dilemma and perceived risk, have been identified in specific populations (e.g.[13]). Of these, perceived risk and the belief in human influence on climate change appear to be the most relevant for Canadian adults[7].

While many people may accept that there are changes happening, responding to them is another issue. In a project on Atlantic Canada coastal communities examining the perceptions of people facing extreme events, people did not feel that they learned lessons from recent storms and had no plans to change

8 Pickering, G. J. (2015a). Head in the (Oil) Sand? Climate Change Scepticism in Canada. Journal of Environmental and Social Sciences, 2(2): 117.

9 Maibach, E., Roser-Renouf, C. and Leiserowitz, A. (2009). Global warming's Six Americas 2009: an audience segmentation analysis. Yale University and George Mason University. Yale Project on Climate Change Communication, New Haven, CT.

10 Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. Global Environmental Change, 21(2): 690-700.

11 http://www.ipsosglobaltrends.com/environment.html

12 Pickering, G.J. (2015b). Psychological Barriers to Climate Change Mitigation in Canadians: the Importance of Powerlessness, Perceived Risk, Uncertainty, and the Commons Dilemma. 7th International Conference on Climate Change: Impacts and Responses, Vancouver, 10-11 April, 2015.

13 Aitken, C., Chapman, R. and McClure, J. (2011). Climate change, powerlessness and the commons dilemma: Assessing New Zealanders' preparedness to act. Global Environmental Change, 21: 752–760.

their actions[14]. If they were not personally affected, they did not have to change their way of thinking or acting now or in the future, saying they were environmentally conscious and already prepared. At the community level, storms may have increased people's awareness, but no change in behaviour was observed. Knowing about climate change and resulting extreme events does not always translate into actions. Members of resource-based communities may not separate climate change risks from other climatic variations they experience on a day-to-day basis[15]. This may also be true for many other communities.

Public resistance to climate change can also be anchored in the fear that the required actions will lead to drastic changes in behaviour and consumerism. This fear can further reduce the level of social acceptability of Canadians to act to reduce GHG emissions. Public awareness and education may not be sufficient to motivate people into action (as shown earlier for Atlantic coastal communities). The first step is not only acquiring knowledge of what climate change is, but also understanding it. Without a critical level of understanding, it is not possible for communities to socially accept the need to act. At the community level, to act means improved governance must take place, where all sectors of the population must be involved.

The Issue of Today and Pragmatism

People may not engage in climate change action because the issue seems too overwhelming for them to understand and act, and they believe that only governments can do something. This relates again to the issues of powerlessness and uncertainty introduced earlier, i.e. "what does a person like me do in a situation like this?" Part of the reason for this disengagement with higher scale issues is the lack of connection between various governmental levels from the local or municipal to provincial then national and international levels. The current short-term electoral and political systems lead governments to also be pragmatic and make decisions on urgent and popular issues like education, economic development and health, rather than looking at long-term and more global issues like climate change, where their decisions may have no impact on their desire to be re-elected. Government decisions are often made in proportion to the levels of immediate risk for the people and the political interests of the party in power[16].

Strategies For Change: Accepting That We Are All Part of the Solution

No one likes changes. Accepting change and the need to act to reduce the threats of climate change is challenging for both individuals and communities. It can be accomplished if attitudes towards our environment change. Attitudes can be defined as beliefs and feelings that people have regarding an object or an issue and how they react to it[17]. Environmental attitudes are often related to what people consider 'environmental concern'. Dunlap and Jones[18] have defined environmental concern as "the degree to

14 Vasseur, L., Znajda, S. and Plante, S. (2015). How Coastal Community Members Perceive Resilience: A Case from Canada's Atlantic Coast. Ecology and Society (in review).

15 McLeman, R.A., Brklacich, M., Woodrow, M., Vodden, K., Gallaugher, P. and Sander-Regier, R. (2011). Opportunities and Barriers for Adaptation and Local Adaptation Planning in Canadian Rural and Resourced-Based Communities. In Ford JD, Berrang-Ford L (Eds) Climate Change Adaptation in Developed Nations: from Theory to Practice. Springer, London, 449–459.

16 Hultman, N.E., Hassenzahl, D.M. and Rayner, S. (2010). Climate Risk. Annual Review of Environment and Resources, 35: 283–303.

17 Tarrant, M. A. and Cordell, H.K. (1997). The effect of respondent characteristics on general environmental attitude-behavior correspondence. Environment and Behavior, 29(5): 618-637.

18 Dunlap, R. E. and Jones, R.E. (2002). Environmental Concern: Conceptual and Measurement Issues. In R. E. Dunlap & W. Michelson (Eds.), Handbook of Environmental Sociology: 482-524.

which people are aware of problems regarding the environment and support efforts to solve them and/or indicate a willingness to contribute personally to their solution" (p. 365). However, moving from the step of awareness to the step of being involved in finding solutions and acting can be incredibly complex. Both the mental and moral motivations to change behaviours must be considered[16]. Mitigation relates to some changes in behaviour and this may be threatening for people in terms of their identity, lifestyle or wellbeing. For example, the attachment of people to their car is very strong in North America, and the idea of having to reduce its use can be a challenge[19]. Convincing people to not travel as much or even to rethink their travel may be an important step, but it remains complex as there may be perceived potential threats to connectivity among family members or friends, distinctiveness, and self-esteem[20].

But no one should be afraid of change. We all contribute to climate change and therefore we are all part of the solution. Social acceptability is the first positive step. Despite the current level of inaction at the federal level, we can all act. There are many small actions that can be immediately taken at home, such as making sure lights are off, reducing car idling (especially in winter or at Tim Hortons), walking to the corner store when possible (certainly healthier), and lowering the temperature of the house by one degree in the winter (for example, from 21 to 20°C). Many of these actions can be beneficial not only for the environment but also for people's wallet. Even businesses have many options that can also help save money. Inaction is not an excuse, and will ultimately cost taxpayers substantially more. Not acting now will result in a lot more struggle for the children of tomorrow. Have you ever talked to them about the legacy you will leave them?

Enhancing public awareness and engaging at the community level remain important[21]. By involving local communities in exercises such as round table discussion or participatory mapping[22], it is possible to achieve an interactive, collaborative environment where local viewpoints and concerns can be integrated. Such approaches can also help elevate the level of social acceptability of communities. Creating a milieu where climate change behaviour is increasingly seen as normative may be a productive strategy. For instance, Canadians report "*Looking foolish due to being the only one to change actions*" as an important factor in shaping decisions about actions that might affect climate change[7]. The fear of looking foolish is significantly correlated with a number of other barriers to behavioural change, including perceived powerlessness and the commons dilemma, perhaps suggesting that as climate change action is seen as increasingly "normal", rates of public participation may increase markedly. Engaging communities in the process of climate change mitigation and adaptation through simple local actions can help people, as a group, connect to the issues of climate change and make them understand that together they are part of the solutions. This increase in ownership of the problem through a process of social acceptability helps alleviate the sentiment behind "being foolish if I do something". Building support

19 Prillwitz, J. and Barr, S. (2009). Motivations and barriers to adopting sustainable travel behavior, ProST Working Paper, Department of Geography, University of Exeter.

20 Murtagh, N., Gatersleben, B. and Uzzell, D. (2012). Self-identity threat and resistance to change: Evidence on regular travel behaviour. Journal of Environmental Psychology, 32(4): 318–326.

21 Scyphers, S.B., Picou, J.S., Brumbaugh, R.D. and Powers, S.P. (2014). Integrating societal perspectives and values for improved stewardship of a coastal ecosystem engineer. Ecology and Society, 19(3): 38–55.

22 Frazier, T.G., Wood, N. and Yarnal, B. (2010). Stakeholder Perspectives on Land-Use Strategies for Adapting to Climate-Change-Enhanced Coastal Hazards: Sarasota, Florida. Applied Geography 30: 506–517. doi:10.1016/j.apgeog.2010.05.007.

at the community level can bring a positive atmosphere, and the feeling that everyone can contribute. Together people can feel more capable and empowered to be involved.

Multilevel governance is needed to bring the connection between what people can do at the local level and how it is matched at the national or provincial government level. Planning and decision-making must be well lubricated, with administrative bodies already in place wherever necessary to reach all levels of governance. Humans are both individualistic and pluralistic in nature, and to overcome the current challenges related to climate change we need to reconcile top-down national policies to the bottom-up (community) strategies by emphasizing issues such as livelihoods, wellbeing, environmental conservation, and good governance for now and the future[23]. This will require a dramatic shift in decision-making, and embracing adaptive governance as a stepping stone towards a more resilient country in the face of climate change.

To get there, a step-by-step process will be required. Making sure that climate change becomes a priority in Canadian lives is a first step, which can be followed by small incremental steps, such as gradually becoming more efficient with energy and learning about consumption habits. Soon, actions with more impact on climate change must be undertaken, but this will most likely require financial support or other types of incentives that target both the citizen and industry. Carbon taxes are only one of the many possible ways to encourage reduction of emissions. For citizens, direct incentives (e.g., tax breaks) may be more appealing. Finally, applied research is urgently needed around further elucidating the relationship between social representation and action, and optimal messaging/communication strategies to fully engage Canadians in taking the necessary action to address this wicked and existential challenge.

23 Vasseur, L. and Jones, M. (2015). Adaptation and resilience in the face of climate change: protecting the conditions of emergence through good governance. GSDR Brief, http://www.gsdr2015.wordpress.com.

Social Justice
Considerations

THE COUNCIL OF CANADIANS 30 LE CONSEIL DES CANADIENS

ACTING FOR SOCIAL JUSTICE AGIR POUR LA JUSTICE SOCIALE

ABOUT THE ORGANIZATION

THE COUNCIL OF CANADIANS

ANDREA HARDEN-DONAHUE

Founded in 1985, the Council of Canadians is Canada's leading social action organization, mobilizing a network of 60 chapters across the country. Through our campaigns we advocate for clean water, fair trade, green energy, public health care, and a vibrant democracy. We educate and empower people to hold our governments and corporations accountable.

Join us and be part of a global movement working for social and environmental justice. We believe a better Canada and a fairer world are possible. Together, we turn that belief into action. The Council of Canadians is a registered non-profit organization and does not accept money from corporations or governments. Our work is sustained by volunteer energy and donations.

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THIS PHOTO ILLUSTRATES THE IMPORTANT ROLE GRASSROOTS ACTIVISTS WILL NEED TO PLAY IN MAKING THE TRANSITION TO A LOW-CARBON SOCIETY POSSIBLE AND POLITICALLY VIABLE.

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THE COUNCIL OF CANADIANS

White Paper On Climate Change Actions in Canada

Council of Canadians' Comments

The Council of Canadians welcomes the work of 60 scholars outlining tangible and necessary next steps for Canada to begin addressing climate change in the *Acting on Climate Change: Solutions from Canadian Scholars* position paper.

Climate change is clearly one of the most serious crises we collectively face, yet Canada is failing to contribute meaningfully to reducing climate pollution.

While we have seen some progress at the local and provincial levels, the federal government and certain provinces remain committed to an energy superpower vision based on unfettered oil, gas and mineral extraction. This has come not only at the expense of climate pollution reduction targets, but has also seen Canada walk away from the Kyoto Protocol, gut federal environmental regulations, muzzle government scientists, attack environmental groups' charitable status and attempt to shut down civil society dissent[1].

We welcome the invitation for a dialogue responding to the position paper launched by Sustainable Canada Dialogues and believe this dialogue is best served by acknowledging and situating our comments in this context.

The Council of Canadians has long advocated for a Canadian energy strategy that meets people's needs, places meaningful regulatory limits on climate pollution and pursues a just transition to improved energy conservation, energy efficiency and renewable energy. We see this as intimately linked to our call to oppose the free trade agenda of the North American Free Trade Agreement (NAFTA), the Comprehensive Economic and Trade Agreement (CETA) and the World Trade Organization (WTO), which undermines all levels of governments to regulate the sale or extraction of fossil fuels and promote renewable energy. It is also connected to our demand for a national water policy that recognizes water as part of the commons, a public trust and a human right, ensuring it is considered in energy sector decision-making and beyond.

1 Barlow, M. (2015). Broken Covenant: How Stephen Harper Set out to Silence Dissent and Curtail Democratic Participation in Canada. Council of Canadians, http://canadians.org/broken-covenant, accessed on June 1st, 2015.

Our experiences campaigning in these areas offer insight to a number of the key policy orientations of the *Acting on Climate Change: Solutions from Canadian Scholars* position paper.

The Sustainable Canada Dialogues' key policy orientation (#3) of integrating the oil and gas sector into climate policies must be a priority. Canada's energy sector is our largest contributor to greenhouse gas (GHG) emissions.

The tar sands, or oil sands, are the fastest-growing source of GHG emissions in Canada. This unconventional source of oil, requiring higher energy and water use to extract the sticky bitumen, is the third-largest proven oil reserve in the world. Production currently sits at around two million barrels per day. In 10 years, production is projected to reach 3.8 million barrels per day. The Canadian Association of Petroleum Producers expects industry to surpass five million barrels per day by 2030[2]. Regulatory approval has already been granted for 5.8 million barrels per day.

If allowed to expand as predicted by industry and government, the tar sands will effectively block Canada's ability to meet even our weak 2020 federal climate target[3].

Pipelines are like the arteries that pump a heart; they are central to industry's ability to achieve planned expansion. Decisions being made in the coming months on infrastructure projects, such as Kinder Morgan's proposed 890 000 - barrels - per - day TransMountain pipeline expansion and TransCanada's 1.1 million-barrels-per-day Energy East pipeline, threaten to lock us into unsustainable tar sands expansion. Production is catching up to the capacity of transportation infrastructure. Decisions about major pipeline projects are linked to the ability of producers to achieve their expansion plans. Filling the Energy East pipeline alone would represent a close to 40% increase in tar sands production, or the climate pollution equivalent to adding seven million cars on the roads. This is an important reason why the Council of Canadians is actively campaigning to oppose projects like the TransMountain expansion and Energy East.

Despite the clear link between new pipeline infrastructure and the economic viability of tar sands expansion, the National Energy Board refuses to include upstream climate pollution impacts in their review of pipeline projects. With this in mind, we add to the recommendations, at minimum, **the inclusion of climate change considerations in the National Energy Board's review of pipeline projects. Any meaningful climate policy must put an end to tar sands expansion**. We advocate for all levels of government to recognize the risks involved in projects that facilitate further tar sands expansion, alongside other serious risks including concerns about pipeline safety[4] and the prospect of a diluted bitumen spill in waterways[5]. We call on governments to reject these risks, take a strong public position against pipeline projects like Energy East and the TransMountain expansion, and use whatever measures are available to them in opposing the projects[6].

2 Briefing note prepared for the Ontario Energy Board. Pembina Institute (2015). Energy East Consultation and Review: Submission on Final Technical Reports, pp. 3, accessed on June 1st, 2015.

3 Environmental Defence and Greenpeace (2015). Digging a Big Hole: How Tar Sands Expansion Undermines a Canadian Energy Strategy That Shows Climate Leadership, accessed on June 1st, 2015. http://environmentaldefence.ca/reports/digging-big-hole-how-tar-sands-expansion-undermines-canadian-energy-strategy-shows-climate-l

4 Council of Canadians (2014). Energy East: When the pipeline spills... , http://canadians.org/sites/default/files/publications/EE-Safety-Briefing.pdf, accessed on June 1st, 2015.

5 Council of Canadians (2014). Energy East: Where oil meets water, http://canadians.org/sites/default/files/publications/Waterways%20Report%20-%20final%20-%20web.pdf, accessed on June 1st, 2015.

6 This includes examples such as political representatives being publicly opposed to the project (for example, Vancouver and Burnaby Mayor's opposition to the TransMountain

On integrating the energy sector into climate policies, we also agree wholeheartedly that the **re-direct of fossil fuel subsidies to climate measures**, including improving energy conservation, energy efficiency, renewable energy expansion and public transit, is long overdue. We would add to the paper's recommendations that Canada should support **a financial transaction tax, or "Robin Hood tax"**[7]. This relatively simple measure has won support from diverse audiences[8]. It is a small tax on all financial market transactions that could generate significant funds towards ending poverty and addressing climate change.

We must also not forget about the role of direct regulation in achieving environmental goals. Too much focus in recent years has been on market-based solutions to the climate crisis. There can and should be room in our discussion for direct regulatory actions to reduce climate pollution and achieve broader environmental goals. Examples include **a moratorium on offshore drilling in the Arctic and the Gulf of St. Lawrence, federal regulation and oversight of fracking[9], hard caps and timelines for phasing out all coal fire power, better regulation and enforcement of fossil fuel industries[10], and a rejection of new nuclear developments**.

On including aggressive goals for low-carbon electricity production in federal and provincial climate action plans (Sustainable Canada Dialogues' key policy orientation #2), we add the importance of prioritizing **public and community ownership of renewable energy projects**. Public ownership models include crown corporations and public utilities. Community power models include local public ownership from municipalities and regional districts as well as First Nations and Indigenous ownership. It also includes consumer and member co-operative ownership models, and worker co-ops.

In a paper authored jointly with the Canadian Labour Congress, "Green, Decent and Public"[11], we outline a number of distinct advantages of public and community ownership, including retaining economic revenues, maximizing social benefits, prioritizing conservation and ensuring energy security.

When power is kept in public and community hands, the likelihood of revenues being redistributed for further public good is increased. Public and community ownership also provides opportunities to ensure that the expansion of renewable power generation is accountable to the public interest and contributes to job creation and reduced inequality. Government action through public employment programs is far more likely than the market to provide job opportunities that help reduce poverty and improve equity, building a fair and just green energy economy.

Government spending for training programs (associated both with renewable power and improving energy efficiency) can be directed towards workers who have lost their jobs (including those displaced in the transition

pipeline), withholding, or refusing needed permits that facilitate the project including on municipal and provincially owned land or needed hydro capacity for pumping stations, passing municipal resolutions and setting strict conditions the project needs to meet to get social licence from affected municipalities and provinces.

7 http://robinhoodtax.ca/howitworks, accessed on June 5th, 2015.

8 http://www.robinhoodtax.org/who, accessed on June 5th, 2015.

9 Lui, E. (2015). Members of Parliament Urged to Take Action on Fracking by Indigenous Lawyer and American Doctor. Blog. Council of Canadians, http://canadians.org/blog/members-parliament-urged-take-action-fracking-indigenous-lawyer-and-american-doctor, accessed on June 1st, 2015.

10 http://www.greenpeace.org/canada/en/Blogentry/alberta-where-we-only-prosecute-tarsands-viol/blog/46049/, accessed on June 1st, 2015.

11 Harden-Donahue, A. and Peart, A. (2009). Green, Decent and Public. Report of the Council of Canadians and the Canadian Labour Congress, http://canadians.org/sites/default/files/publications/Green%20Decent%20and%20Public%20-%20Exec%20-%20FR.pdf, accessed on June 1st, 2015.

away from fossil fuel industries) as well as towards people and communities facing poverty and systematic injustice or bearing the brunt of environmental and social impacts associated with the fossil fuel industry. For example, Columbia Hydro Constructors, the construction arm of B.C. Hydro, implemented employment equity programs in the late 1990s that provided training and opportunities for marginalized groups in the province.

Public and particularly community ownership models have also proven to be an important means to ensure that individual and collective concerns associated with potential renewable energy projects are heard. What better way to ensure local input is prioritized than to have the renewable energy project owned and run by community members? European cooperative models have clearly demonstrated this advantage[12].

In being held accountable and measuring success not only through profitability but also through achieving social, economic and political objectives, public and community owned power also provides the means to prioritize increased energy conservation. The cleanest energy is the energy we don't have to use.

Further, public and community ownership remains the best way to insulate public policy choices from conflict with trade rules, including challenges emerging from NAFTA.

"Green, Decent and Public" also examines the clear opportunities presented in improving energy efficiency measures — Sustainable Canada Dialogues' key policy orientation #4 in the *Acting on Climate Change: Solutions from Canadian Scholars* position paper. There is a clear opportunity to both reduce climate pollution as well as address social inequity by supporting energy efficiency measures.

12 Ibid.

Public funding towards **retrofitting programmes must prioritize areas that can reduce social inequity**, including communities facing the brunt of the environmental and social impacts of the fossil fuel industry, workers impacted by the shift to a low-carbon economy, and isolated and low-income areas.

"Green, Decent and Public" outlines a number of policy measures for various levels of government to support public and community ownership, and integrate social equity goals into energy efficiency measures. These include (but are not limited to):

- Provincial feed-in tariffs and other innovative policy mechanisms that reduce barriers connecting renewable power to provincial grids. This policy mechanism should be directed at supporting public and community power projects, as well as on-site renewables, small-scale renewable projects, and cogeneration on behalf of individual home or farm owners, businesses and industry.

- Government supports for lower-income households for housing retrofits and direct financing to acquire energy-efficient appliances and heating/cooling systems for low-income renters.

- Federal action to repeal the energy provisions of NAFTA and Chapter 11 and reject similar energy provisions in any future trade agreement.

- Federal, provincial and municipal government policies that implement energy efficiency retrofits at public institutions, thereby leading by example.

- Government measures that ensure Demand-Side Management (DSM) programs fostering greater energy conservation are prioritized.

- Financing support from federal and provincial governments for public and community renewable power projects. This includes access to low-interest or forgivable loans and grants.

- Establishment of a Just Transition Fund to assist workers and communities affected by the shift to a low-carbon economy. This includes funding for skills training and green job development.

As highlighted, we see the goal of shifting to a low-carbon economy as closely linked with the protection of water. This relationship reflects the proposed key policy orientation #8 to safeguard biodiversity and water quality during Canada's transition to a low-carbon society, while aiming for net positive approaches when possible.

Canada and the world are not only facing a climate crisis but also a water crisis. Water is being polluted and overused at an astounding and unsustainable rate[13]. Addressing this crisis requires a fundamental change in our relationship with water, which is essential to life itself.

Canada needs a **national water policy based on the principle that water is part of the commons, a public trust and a human right**[14]. The notion of the "commons" asserts that water is a common heritage to be shared, protected, managed and enjoyed by all. A commons framework requires a shift in water governance to prioritize the human right to water, public participation, and the inclusion of First Nation and other communities in decision-making processes. Public trust principles require governments to protect water sources for communities' reasonable use, and to make private use subservient to community rights. It is through this lens that new energy projects and the transition to a low-carbon society should be viewed[15]. If implemented, this would have serious implications for extreme energy, a group of new energy extraction methods that require more water, energy, and effort, and are more destructive to the environment and surrounding communities. Examples include tar sands development, hydraulic fracturing (fracking), mountaintop removal mining and deep water drilling. The extraction of extreme energy and associated transportation projects leave municipalities and Indigenous communities vulnerable to spills, associated health care costs, and the impacts of climate change on watersheds and water infrastructure.

Energy project decision-making must also respect the **free, prior and informed consent of Indigenous Peoples (FPIC)**, including the right to say "no." This is implied in Sustainable Canada Dialogues' key policy orientation #10, but needs to be clearly stated, despite the failure on the part of the federal government to acknowledge this internationally recognized right. Canada has the dubious distinction of being the only country to vote against the United Nations Declaration twice. This tension between energy projects and respecting FPIC exists in several Canadian examples, including the proposed Site C dam in B.C.[16].

The Council of Canadians appreciates this opportunity to provide feedback on the collection of texts, grounded in our experiences campaigning in these areas. We hope the measures suggested here will

13 Barlow, M, and Clarke, T. (2007). Blue Covenant: The Global Water Crisis and the Coming Battle for the Right to Water. Toronto: McClelland & Stewart.

14 Lui, E. (2015). Water Chapter. Alternative Federal Budget 2015. Report, Canadian Centre for Policy Alternatives, Ottawa, pp. 83, accessed on June 1st, 2015.

15 Ibid.

16 http://canadians.org/action/stop-site-c-dam, accessed on June 5th, 2015.

be further considered. We will continue to demand better from our governments and work with our supporters, volunteer chapters, and allied organizations, groups and Indigenous communities towards realizing these measures in our work.

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The Canadian Centre for Policy Alternatives is an independent, non-partisan research institute concerned with issues of social, economic and environmental justice. Founded in 1980, the CCPA is one of Canada's leading progressive voices in public policy debates.

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MARC LEE SPEAKING AT THE CANADIAN CENTRE FOR POLICY ALTERNATIVES' RECENT CONVERSATION ON CLIMATE JUSTICE, A FOUR-DAY DELIBERATIVE EXERCISE WORKING WITH ORDINARY CITIZENS IN DIALOGUE

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MARC LEE

Envisioning a Good Green Life in British Columbia:

Lessons From the Climate Justice Project

Introduction

This paper highlights some key findings and directions from six years of research, spanning 30 publications, by the Climate Justice Project[1]. The Climate Justice Project (CJP) is a collaboration among researchers in academia, environmental NGOs, trade unions and a wide range of other community and advocacy organizations[2].

The CJP's research agenda has aimed to better understand the linkages between climate action and social justice, primarily using British Columbia as a case study, and with a view towards developing more inclusive and effective policies. We see extreme and growing inequality as the other inconvenient truth. If policies don't take into account inequalities and differing resources, they will likely make things worse for vulnerable people who have done the least to contribute to the problem.

In addition to commenting on social justice aspects of climate action, we suggest that measures outlined by Sustainable Canada Dialogues' 2015 *Acting on Climate Change: Solutions from Canadian Scholars* report are not sufficient to achieve the target of 80% reduction in emissions by 2050. In particular, the Sustainable Canada Dialogues report does not wrestle with the concept of a global carbon budget, and the key implication that a large majority of fossil fuel reserves need to be kept in the ground. Below we sketch out the linkages between climate, industrial and labour market policies as a program aimed at achieving a "green industrial revolution" [3].

Fair and Effective Carbon Pricing

A well-designed carbon tax can be the engine of a green industrial revolution – it can propel climate action from public and private sectors because it both raises the cost of emitting carbon dioxide and other greenhouse gases (GHGs), and provides the revenues needed

1 All publications available at: https://www.policyalternatives.ca/publications/reports/climate-justice-project

2 See full list of partners and collaborators at: https://www.policyalternatives.ca/projects/climate-justice-project/about/partners

3 Lee, M. and Card, A. (2012). A Green Industrial Revolution: Climate Justice, Green Jobs and Sustainable Production in Canada. Canadian Centre for Policy Alternatives, Ottawa https://www.policyalternatives.ca/publications/reports/green-industrial-revolution

to make public investments that reinforce climate action.

A key equity challenge is that taxes on consumption like the carbon tax are regressive in their distribution — lower-income households pay a larger share of their income to the tax, even though they have the smallest carbon footprints. Indeed, the carbon footprint of the richest 20% of Canadians is almost double that of the poorest 20%[4]. This is due to richer Canadians having bigger houses, more cars and travel, and greater overall consumption.

To address this problem, we argue that half of carbon tax revenues be used to fund a broad-based credit that would flow to low- to middle-income households (instead of personal or corporate income tax cuts). Specifically, we model a system (based on the Canada Child Tax Benefit model) that would provide a carbon credit to the bottom 80% of households, with the bottom half of households receiving more in credits, on average, than they would pay in carbon tax[5].

Sustainable Canada Dialogues noted the revenue-neutrality of BC's carbon tax as a possible option. We disagree with revenue-neutrality. In particular, the other half of carbon tax revenues should be used to support climate action initiatives. Top priorities include: support for public transit expansion and new infrastructure; retrofit programs for residential, institutional and commercial buildings; education and training programs for green job development; clean energy infrastructure; and forest conservation initiatives. Sustainable Canada Dialogues clearly recognizes the need for such green public infrastructure in its first report, yet does not identify a revenue source.

A challenge in moving away from fossil fuels is that companies are putting billions of dollars on the table for their investments. We argue that the carbon tax is an ideal source of revenues to support alternative investments in needed services and infrastructure.

Shifting to 100% Clean Energy

We generally support Sustainable Canada Dialogues' emphasis on new clean electricity generation to displace coal and gas-fired plants, and development of an east-west power grid. However, we are concerned about potential for privatization in the transition, and prefer new generation to be in the public sector[6].

Like carbon taxes, electricity pricing must take into account the impact on low- to middle-income earners, who pay a greater share of their income in energy/electricity costs[7]. Low-income households are also far more likely to rent their housing and to live in poorer quality housing. As tenants, they typically are not in a position to make major decisions with respect to energy efficiency improvements in their homes. To the extent they exist at all these days, most home energy retrofit programs tend to be geared toward homeowners, and so benefit the most affluent.

4 Lee, M. (2011). Who Occupies the Sky? Canadian Centre for Policy Alternatives, Vancouver.

5 Lee, M. (2011). Fair and Effective Carbon Pricing: Lessons from BC. Canadian Centre for Policy Alternatives, Vancouver, https://www.policyalternatives.ca/publications/reports/fair-and-effective-carbon-pricing. While BC has a low-income credit as part of its revenue-recycling regime, it accounts for only a small portion of revenues and is not sufficient to compensate for the regressive impacts of the tax on low-income households.

6 Calvert, J. and Lee, M. (2012). Clean Electricity, Conservation and Climate Justice in BC: Meeting our energy needs in a zero-carbon future. Canadian Centre for Policy Alternatives, Vancouver, https://www.policyalternatives.ca/electricity-justice.

7 Lee, M., Kung, E. and Owen, J. (2011). Fighting Energy Poverty in the Transition to Zero-Emission Housing: A Framework for BC. Canadian Centre for Policy Alternatives, Vancouver, http://www.policyalternatives.ca/energy-poverty

District energy (centralized production of thermal energy for heating and hot water) has a long history in urban areas, and should have a greater profile in the transition. Modern, hydronic systems offer a green infrastructure platform to reduce carbon emissions from buildings. The City of Vancouver's Neighbourhood Energy Utility is a leading example, providing heating and hot water to new buildings in Southeast False Creek, with 70% of energy demand met through recapture of waste heat from the sewer system[8].

Transportation and Complete Communities

We generally support Sustainable Canada Dialogues' directions towards a low-carbon transportation system, including electrification, active transportation and public transit. We note that several other external costs are present in transportation: air and noise pollution, time lost due to congestion, accidents leading to injury and death, other environmental costs of extracting and processing fuel, and opportunity costs of parking spaces[9]. This suggests that well-designed transportation investments have potential to improve quality of life in a variety of ways, which may have more direct relevance to Canadians, while also reducing GHG emissions.

With decent, dedicated funding for transit expansion, more efficient and higher-capacity transit networks could be built throughout Canada within a decade. Existing public transit infrastructure could be more efficiently utilized if funding is made available and accompanied by measures to discourage private vehicles by reducing available road and parking space. There is much room for performance improvement and economic benefits by investing in new infrastructure to speed up transit connections, if there are both sufficient demand and supportive land use policies[10].

Our long-term vision is of "complete communities" that emphasize walking, biking and transit, supplemented by car-sharing, with much greater proximity of homes to work, shops, entertainment, parks and public services[11]. Such a shift is already evident in parts of Canadian cities, with the City of Vancouver recently reporting that half of all trips are now by bike, walking or transit[12]. Complete communities level the playing field for seniors, youth, people with disabilities, and low-income families so they can live and move easily – even if they are not able to drive or cannot afford a car.

Affordable housing must be integrated into complete communities, including minimum affordable housing percentages in new developments and purpose-built rental[13]. The need for new housing for a growing and aging population provides an opportunity for redevelopment plans that reinforce complete communities. For our growing ranks of seniors, a range of smaller residential homes and supported care units, close to commu-

8 Lee, M. (2015). Innovative Approaches to Low-Carbon Urban Systems: A Case Study of Vancouver's Neighbourhood Energy Utility. Future Economy Project, EcoTrust and E3 Network.

9 These external costs are estimated to be three times vehicle operating costs by Litman, T. (2010). Evaluating Transportation Economic Development Impacts: Understanding How Transport Policy and Planning Decisions Affect Employment, Incomes, Productivity, Competitiveness, Property Values and Tax Revenues. Victoria Transport Policy Institute.

10 Ibid.

11 Condon, P., Doherty, E., Dow, K., Lee, M. and Price, G. (2010). Transportation Transformation: Building complete communities and a zero-emission transportation system in BC. Canadian Centre for Policy Alternatives, Vancouver, https://www.policyalternatives.ca/transportationtransformation

12 http://www.vancouversun.com/news/Transit+cycling+walking+together+rival+Vancouver+travel/11050346/story.html#ixzz3a3T58rYa

13 Lee, M., Villagomez, E., Gurstein, P., Eby, D. and Wyly, E. (2009). Affordable EcoDensity: Making Affordable Housing a Core Principle of Vancouver's EcoDensity Charter. Submission by Canadian Centre for Policy Alternatives to the City of Vancouver, https://www.policyalternatives.ca/publications/reports/affordable-ecodensity

nity health centres, would reduce mobility challenges. Public sector investments can help anchor redevelopment, with libraries, childcare, and community health centres.

Closing the Loop

"Closing the loop" refers to the shift from a linear economic model – where materials are extracted, produced into consumer goods, then trashed – towards a resource recovery model where materials cycle through the economy[14]. Upstream, proactive solutions include aggressive materials reduction, re-design, and re-use before recycling and composting. The object is dramatic reductions in the volume of materials that flow through the economy, and therefore the amount of energy used and carbon emissions from resource extraction, processing and transportation.

Incineration is promoted (as waste-to-energy) as a way of generating heat and electricity, and gives the perception of making waste disappear. However, incineration only transforms materials into different forms, releasing GHGs and other toxic compounds like dioxins and furans into the air, while still contributing solid waste (toxic ash) that must still be landfilled. Incineration also wastes the embodied energy in products that result from resource extraction and processing, product manufacture and transportation.

A wide range of innovative economic activity is possible with well-designed policies, including dematerialization, support of sharing economies, and new leasing models for various services. Re-use policies could apply "beer bottle" deposit-and-return systems to all beverage containers, containers from the grocery store, packaging from consumer electronics, etc. This would help eliminate the single-use plastics that comprise half of all the plastic produced.

Well-designed re-use policies can support local economic development and the creation of new green jobs by increasing local capacity to manage and add value to materials that are recovered. Federal and provincial governments could help build this capacity through their procurement policies and by setting minimum recycled content standards for the marketplace.

Shifting to Green Jobs

As can be seen above, there is lots of work that needs to be done, and this should be embraced as part of a national project. We advocate divestment from fossil fuels and re-investment in green infrastructure and services. Importantly, green investments tend to be more labour-intensive, and so yield anywhere from three to 30 times more direct jobs than equivalent investments in fossil fuel infrastructure. Thus, a well-designed transition plan should have a net positive impact on employment.

In addition to the areas mentioned above, a green jobs agenda should support investments in:

- Local and sustainable food systems, which will be needed in the face of climate impacts on other parts of the world, such as California's drought[15].

14 Lee, M., Legg, R., Maxwell, S. and Rees, W. (2013). Closing the Loop: Reducing Greenhouse Gas Emissions Through Zero Waste in BC. Canadian Centre for Policy Alternatives, Vancouver, http://www.policyalternatives.ca/publications/reports/closing-loop. Note that carbon dioxide is BC's single largest waste by weight—more than 49 million tonnes in 2010, compared to five million tonnes of solid waste generated –– even though carbon pollution goes into the atmosphere not a landfill.

15 Lee, M., Barbolet, H., Adams, T. and Thomson, M. (2010). Every Bite Counts: Climate Justice and BC's Food System. Canadian Centre for Policy Alternatives, https://www.policyalternatives.ca/everybitecounts

- Other low-carbon services, such as early learning and childcare, and seniors' care, including home and residential care.

- Enhanced apprenticeship and training opportunities for traditionally disadvantaged populations.

We will also need to ensure a "just transition" strategy for resource industry workers. The costs of adjustment should not be shouldered by those most impacted by them. In past resource busts, families have faced extreme instability due to lost incomes, including drug and alcohol addiction, increased domestic violence, and divorce[16]. Active public management should seek to stabilize production levels in the transition period, averting the boom and bust dynamics that plague resource communities in Canada. Over the course of three decades a smooth transition off of fossil fuels that is also fair to workers is not unreasonable.

16 Cooling, K., Lee, M., Daub, S. and Singer, J. (2015). Just Transition: Creating a green social contract for BC's resource workers. Canadian Centre for Policy Alternatives, https://www.policyalternatives.ca/publications/reports/just-transition

Youth

GENERATION | squeeze

ABOUT THE ORGANIZATION

GENERATION SQUEEZE

PAUL KERSHAW

Generation Squeeze is a uniquely positioned, national, non-partisan organization that speaks up for Canadians in their 20s, 30s, 40s and younger who are squeezed by lower incomes, higher costs, less time, and a deteriorating environment. Because governments are less willing to adapt for younger Canadians than others, we're squeezing back so Canada works for all generations.

A CARP for Younger Canada: our enterprise takes inspiration from the model of generational organizing implemented by the Canadian Association of Retired Persons (CARP), which lobbies on behalf of Canadians age 50+.

Our theory of change is simple: if younger Canadians had an organization with political and market clout that matched that of CARP, governments would be more likely to adapt policies to address the squeeze on their generation with the same conviction they do for the aging population. Presently, Canadian governments combine to spend $33 000 to $40 000 annually per person age 65 and older, compared to less than $12 000 per person under age 45; and governments leave younger generations larger fiscal and environmental debts than were inherited by today's aging population when they were young adults.

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GENERATIONS IN THEIR 20S, 30S, 40S & THEIR CHILDREN ARE SQUEEZED FOR...

TIME

AT HOME WITH CHILDREN

SERVICES

AFFORDABLE CHILD CARE

MONEY

HIGHER STUDENT DEBTS, HIGHER HOUSING COSTS, & STAGNANT INCOMES

WHILE LEFT WITH LARGER

GOVERNMENT AND ENVIRONMENTAL DEBTS

RESEARCH SHOWS THAT CANADIANS IN THEIR 20S, 30S, 40S AND THE CHILDREN THEY RAISE ARE SQUEEZED BY LOWER INCOMES, HIGHER COSTS, LESS TIME AND A DETERIORATING ENVIRONMENT COMPARED TO A GENERATION AGO.

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GENERATION SQUEEZE

Building Political Will

for a Low-carbon, High Prosperity Canada

Endorsing the Report.
Adopting its Recommendations.

Generation Squeeze[1] applauds the time, expertise and process used to produce the Sustainable Canada Dialogues 2015 report *Acting on Climate Change: Solutions from Canadian Scholars*. We are inspired by the vision for Canada presented in the report, and enthusiastically embrace its recommendations to move toward a sustainable, low-carbon, high prosperity Canada that works for all generations. The recommendations are powerful in part because they reflect a consensus among more than 60 scholars representing every region in the country, and also because they articulate science-based, viable solutions for greenhouse gas (GHG) reductions that will ensure Canadians successfully meet our international obligations, along with our domestic commitments to intergenerational fairness.

Generation Squeeze has integrated the *Acting on Climate Change: Solutions from Canadian Scholars* recommendations to inform our vision for a *Better Generational Deal*[2]: one that gives all Canadians a chance to live up to our potential, enough time and money to enjoy life, and the opportunity to work together to leave our country and planet better off than we found them. To this end, we pursue policy adaptations that enhance the ability of younger Canadians to:

- Pay off student debt
- Find a good job
- Reduce the time it takes to save and pay for a home
- Afford a family
- Save for retirement
- **All while leaving at least as much as we inherited**
- **Using and collecting tax dollars better**

In pursuit of the final two components of a Better Generational Deal, we formally endorse recommendations from *Acting on Climate Change: Solutions from Canadian Scholars.*

1 http://www.gensqueeze.ca

2 http://www.gensqueeze.ca/policies

Specifically, in order to leave at least as much as we inherit, Generation Squeeze endorses the recommendations to:

- Build East-West intelligent grid connections that allow provinces producing hydroelectricity to sell electricity to their neighbours while taking full advantage of Canada's low-carbon energy potential. Hydroelectricity could then be combined with intermittent renewables such as wind and solar energy across the country so Canada relies 100% on low-carbon electricity production by 2035.

- Well-managed energy efficiency programs that produce significant positive economic returns across the board, through cost savings as well as job creation. Energy efficiency programs could target the building sector, businesses and industries, and especially transportation.

- Support evolution of the building sector toward a carbon neutral or carbon-positive sector, including investment in renewable and ambient energy for new and existing buildings. Integrate sustainability and climate change into landscape planning at the regional and city levels to ensure that, amongst other goals, new and maintenance infrastructure investments are consistent with the long-term goal of decarbonizing.

- Support sustainable fisheries, forestry and agriculture practices, offering opportunities not only to limit GHG emissions but also, where possible, to enhance carbon sequestration, protect biological diversity and water quality.

To ensure we collect and use tax dollars better, Generation Squeeze recommends that Canada:

- Eliminate subsidies for fossil fuel industries, and fully integrate the oil and gas production sector in climate policies.

- Price pollution. This requires the introduction of either a national carbon tax or a national economy-wide cap-and-trade program. Revenue from pricing pollution can be used to reduce other taxes and/or invest in other components of a Better Generational Deal.

Building Political Will for a Low-carbon, High Prosperity Canada

While numerous research networks across the country deliver scientific expertise on climate change and sustainability, the *Acting on Climate Change: Solutions from Canadian Scholars* report acknowledges that "information alone is not enough to trigger leadership on climate change and more effective climate change governance. It is clear that decisions are made more on the basis of intuition and values than on rational, careful consideration of costs and benefits of action" (p. 47).

As experts about the large gap between scientific evidence and public policy decisions, Generation Squeeze affirms this conclusion. We believe that this component of the report could be strengthened by adding that **government decisions respond to those who organize and show up**.

Although all Canadians over age 18 have political entitlements, generational cohorts vary significantly in the way they exercise these liberties. Data show that citizens over the age of 45 are much more likely to cast a

ballot than are citizens under age 45[3]; and the latter group consists frequently of parents of minors who have no voting rights. Similarly, with over 300 000 members, the Canadian Association of Retired Persons (CARP) has built political clout for its constituency that is age 50+. By contrast, until Generation Squeeze began first as an awareness-raising campaign in 2011, and developed into a campaign to build political power for Canadians in their 20s, 30s, 40s and their children, there had been no pan-Canadian, big-tent generational organization to speak up for younger Canada. We still have considerable distance to travel to catch up to CARP's membership and associated political clout.

This age pattern in voting and political organizing poses a major barrier to the translation of research about climate change into government budgets and policy adaptations, because the risks of inaction to reduce GHGs are borne primarily by younger stakeholders, and the families they will be raising in the middle of this century. So long as Canadians under 45 are less likely to vote and organize in between elections, all political parties are less likely to design platforms that adapt for younger generations. This pattern is evident not only in regards to Canada's tepid commitment to climate change policy in comparison to international leaders, but also in regards to other policy areas related to population health. For instance, groups like Global AgeWatch[4] rank Canada among the top countries worldwide for aging because of spending on medical care, Old Age Security and the Canada Public Pension Plan. By contrast, groups like UNICEF[5] rank Canada among the least generous Organisation for Economic Co-operation and Development (OECD) countries for investments in the generation raising young children, judging that our parental leave and childcare services fall below international standards.

In order for Canada to implement *Acting on Climate Change: Solutions from Canadian Scholars*' recommendations, Generation Squeeze recommends that the authors urge **greater attention be paid to the implementation of interventions designed to increase the power of younger generations in the world of politics**. Certainly, they have the most to lose.

Our organization is at the forefront of one such intervention, and is enthusiastic about the opportunities to partner with authors from Sustainable Canada Dialogues to scale it up.

Consistent with the report's emphasis on the "need to establish organizations focused on the transition to low-carbon pathways" (p. 47), we are building a non-profit lobby designed to grow one million Generation Squeeze supporters by the medium-term. As our network grows, we will bring to the world of politics the one commodity that can out-compete money in a democracy — genuine person power.

To do this, we are organizing allies in part according to their residence in electoral districts. Once our membership is sufficiently large, we intend to approach all candidates running for office, particularly in districts that historically have close election results. In a strictly non-partisan way, we will share with all parties that: 1) the last election was won or lost by less than, for example, 1500 votes;

3 Uppal, S. and LaRochelle-Côté, S. (2012). Factors associated with voting. Perspectives on Labour and Income, 1-15.

4 Global AgeWatch (2013). Global AgeWatch Index 2013, http://www.helpage.org/global-agewatch/, accessed on March 25th, 2014.

5 UNICEF (2008). The child care transition: A league table of early childhood education and care in economically advanced countries. In Innocenti Report Card 8, UNICEF Innocenti Research Centre, Florence, http://www.unicef-irc.org/publications/pdf/rc8_eng.pdf, accessed on July 31st, 2009.

that 2) Generation Squeeze has thousands of allies in their district; and that 3) we only need to move a fraction of those allies to make the difference between winning and losing their local election. As we operationalize this strategy in upwards of 20 ridings, we will build an organization that can make the difference between winning and losing a majority government provincially and/or federally. We will use the resulting influence to transform existing priorities articulated by political parties across the political spectrum in ways that ensure their platforms embrace components of a Better Generational Deal so that Canada works for all generations.

By adopting the recommendations from *Acting on Climate Change: Solutions from Canadian Scholars* as part of our vision for a Better Generational Deal, Generation Squeeze is an intervention designed to grow political will in support of the scholarly consensus articulated in that report. This is a variation on the report's emphasis regarding "social mobilisation" (p. 48) – one that not only focuses on behaviour change to promote sustainability at the individual level, but also to increase our collective capacity to promote sustainability at the population level.

In keeping with the authors' focus on "the importance of triggering a values shift in response to climate change" (p. 47), Generation Squeeze recommends that Sustainable Canada Dialogues contribute to telling a **broader narrative about generational prosperity and intergenerational fairness.**

Generation Squeeze organizes its political mobilization activity around a communications narrative that has been expertly shaped in the light of Canadian values about intergenerational fairness, and emerging concerns that younger Canadians are inheriting a socioeconomic and environmental standard of living that is deteriorating compared to the one their parents inherited a generation ago in Canada. Accordingly, we purposefully link interests and values related to sustainability with concerns that people feel immediately in their wallets as a result of stagnant wages, high housing costs, less time and larger government debts. This innovative communication frame marries the environmental and economic, often in deeply personal ways for people, and can complement existing communication strategies within green environmental movements. Specifically, our plan to build political will in support of a low-carbon, high prosperity Canada makes available a unique opportunity to attract the interest, time, and eventually clout, of a broader constituency of Canadians who have not yet connected the dots between the risks of climate change with other components of the time, money and service squeeze they are feeling more immediately in their lives.

In sum, Sustainable Canada Dialogues has identified the policy adaptations that will put Canada on a secure path to a low-carbon, high prosperity future. It is time to embed these recommendations in interventions designed to grow the political will required to achieve their implementation. Building a national lobby for those in their 20s, 30s and 40s, along with the children they parent – one that is organized around a broad narrative of generational prosperity and fairness – can be a major contributor to building this political will. Generation Squeeze therefore welcomes the opportunity to work in collaboration with Sustainable Canada Dialogues partners in support of their inspiring vision for Canada.

ABOUT THE ORGANIZATION

CENTRALE DES SYNDICATS DU QUÉBEC

JEAN ROBITAILLE

The Centrale des syndicats du Québec (CSQ) represents more than 200 000 members, nearly 130 000 of which are educational personnel. It is the largest trade union organization in education and early childhood in Quebec. The CSQ is also active in health and social services, childcare, municipal, leisure, cultural, community and communications sectors. The CSQ initiated the Établissement vert Brundtland (EVB)[1], a network of 1400 institutions that aspires to a more environmentally friendly, peaceful, united and democratic world. Created in the wake of the Brundtland Report[2], the EVB-CSQ movement is the main network of schools promoting this type of education in Quebec. Today, more than one-third of Quebec schools have an education plan based on promotion of these four flagship values.

What is the relationship between EVB and the CSQ? The CSQ works with teachers to train them in pedagogical approaches to issues related to sustainable development. This is to equip teachers to take action with youth and support them in projects that target youth involvement in concrete actions.

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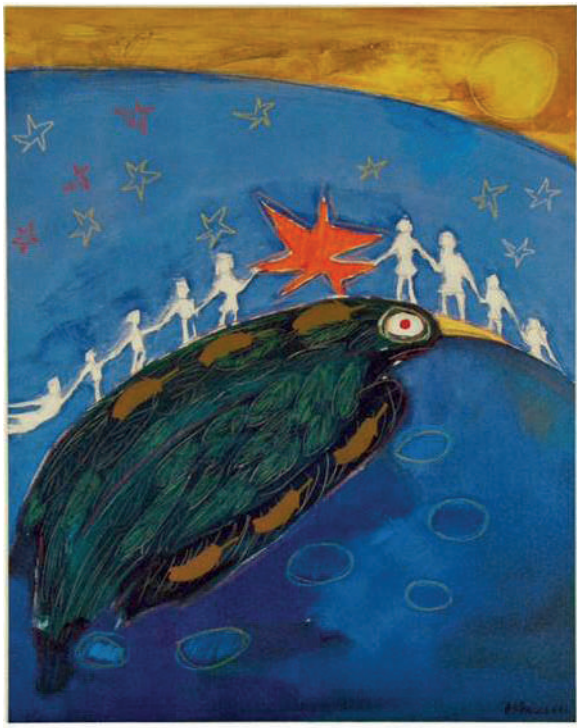

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CENTRALE DES SYNDICATS DU QUÉBEC

The Role of Education in the Transition to a Low-carbon Economy

An Interview With Jean Robitaille, CSQ

Conducted by Ms. Divya Sharma, *Sustainable Canada Dialogues*

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

This contribution is an interview with Jean Robitaille, educational consultant for a sustainable future at Centrale des syndicats du Québec.

Question from Sustainable Canada Dialogues:
What is the role of education in the transition toward a low-carbon economy?

Jean Robitaille: Since the EVB-CSQ movement began in 1993, CSQ's concern has always been to inform the public and, in particular, young people about issues concerning environment, peace, solidarity and democracy – issues that must be addressed simultaneously if we want to move toward real sustainable development. The first observation we can make is that the dominant discourse still pits economy and environment in opposition, often to the detriment of the social aspect. There needs to be a new narrative and educative effort to show that we cannot have one without the other. *Environment* is the basis on which societies are built, while the *economy* is a means to meet the needs of those societies. However, just looking out the window or listening to the newscast, one realizes the consequences of climate change are becoming apparent. I have the impression the population is beginning to make connections and to understand more about what's happening.

Education can contribute significantly to changing the discourse around issues such as climate change. The problem, often, is that people are made to believe the solution is merely technological. Canada's commitment at the G7 meeting in Germany in June 2015 illustrates this vision[3,4]: by focusing on technology, it will be possible

1 http://www.evb.lacsq.org/accueil/

2 http://www.un-documents.net/our-common-future.pdf

3 http://www.ledevoir.com/international/actualites-internationales/442197/sommet-du-g7-harper-discute-de-changements-climatiques-au-2e-jour

4 http://quebec.huffingtonpost.ca/2015/06/08/changements-climatiques-le-canada-et-le-japon-ont-dilue-la-declaration-du-g7_n_7536364.html

to have solutions that enable continued use of oil. That's an important problem because the main changes needed are changes in mentality.

During her visit to Montreal in June 2015, Ségolène Royal, French Minister of Ecology, Sustainable Development and Energy, spoke about a third industrial revolution. I enjoyed that; it's something the average person can relate to. We can see to some extent how the first industrial revolution led, in the second instance, to changes in communications, opening of markets and even globalization. The idea of a third revolution is therefore positive. It would lead to dematerialization and a low-carbon economy. A*cting on Climate Change: Solutions from Canadian Scholars* is clear on this point. It develops well the idea that a low-carbon economy and society will be a transition similar to the way the industrial revolution was a transition. We need to insist a little on these ideas from the point of view of education.

Workers may see the transition to a low-carbon economy in a threatening light. It will be all the more threatening if we do not now set in place the actions needed to transform our economy into a low-carbon economy. This brings us to the link between environment, economy and employment, for example during discussions against the transport of oil through Quebec and into New Brunswick. The reflex of industry is to say "in any case, we have oil, so it should be used. It's a way to ensure economic development". The industry should instead speak of the transition to low-carbon, and the effort companies should make to break free from carbon. There's currently no transition action plan in Canada that offers an alternative to oil. To me, this is a major problem.

I work mainly in schools with teachers, support staff, professionals and indirectly with young people. In the EVB-CSQ, we talk increasingly about how to rethink to some extent the way we present messages to young people. A few years ago we organized a symposium, entitled *How to talk to young people about the future*. Newspapers, television, radio bulletins – they all project an image of the future that is too dark, too bleak. We need to change to what we call "a pedagogy of hope".

We must present solutions and ensure that young people can participate in these solutions. We're working more and more toward youth engagement so that young people become aware of their chance to act on reality and be part of the solution, rather than be spectators of decisions that are taken above their heads and over which they have no control. So education has a very important role to play in that respect. We need to know about the initiatives undertaken by academics, civil society and businesses that are already following the green transition.

Promising solutions such as a circular economy, reductions at the source, and so on, are not put forward and are not presented to young people. Similarly there are no real choices offered to workers. They are given a false choice: either keep your job or end oil (or forest) exploitation. This is well illustrated by the tension between the papermaker Resolute Forestry Products and Greenpeace in Saguenay[5]. In this case, some tried to shift the blame to civil society when international action, that it's beneficial to respect, was taken over the forest. There is a lack of political will to change things. In conditions like this, since jobs are at stake, a major problem of perception is created because the alternatives are not presented. Thus in schools we have an important role to play: that of demonstrating the existence of solutions,

5 http://montrealgazette.com/news/quebec/saguenay-mayor-sparks-new-controversy

which can often be applied right away but are held back due the lack of political will and political decision-making.

Another big problem is household debt, which is related to the increasingly individualistic society in which we live. Someone who is financially stretched would be more receptive to solutions that will help solve their problems than those that will allow redistribution of wealth. So we must make links between our consumption and the impact of our consumption on the use of oil and, therefore, on issues of climate change.

Question from Sustainable Canada Dialogues:

I would like to look to the past: Quebec has already experienced major transitions like the Quiet Revolution and, more recently, a revolution in communications with the advent of the Internet. Here, certain employment sectors have certainly contracted while others have emerged. Are there lessons learned that could inform the transition toward a low-carbon economy?

Jean Robitaille: Having very, very vast oil production has led to a rise in the Canadian dollar and done much harm to the manufacturing markets in Quebec and Ontario. It would have been a nice opportunity to redistribute oil profits, to get companies to change their practices. I feel the damage is done, and the work environment is behind the times in this transition. It's certain that it will have an impact on the job market and it's important to train existing workers and new cohorts of students in a way that enables them to adapt to a labour market based on a low-carbon economy.

Therefore we work a lot with young people in high school on the idea of youth leadership. We seek to organize youth leadership days, open to secondary schools around Quebec, with around a hundred youth delegates to whom we present reasons to engage, as well as the means to engage. For example, we show them how to form a committee and how to publicize projects they're launching. These leadership days end with implementation of an action plan for their school together with school personnel, to educate the entire school community about current problems and solutions.

We appreciate the work done by Sustainable Canada Dialogues to build relationships and present solutions. We would be very interested in strengthening such exchanges, which could be realized in the framework of our activities, either through our national and regional sessions or directly with young people at major youth leadership meetings that we will organize as of next year.

ABOUT THE AUTHOR

DR. SHAZEEN SULEMAN

Dr. Shazeen Suleman is a paediatric resident physician at the Hospital for Sick Children in Toronto. She completed her medical degree at the University of British Columbia, where she was a Wesbrook Scholar, and a graduate degree in physiology at the University of Toronto. She has been a member of the Canadian Commission for UNESCO (CCUNESCO)'s Youth Advisory Group (YAG) since 2010. Members of the YAG act as a liaison between their organizations and networks and CCUNESCO, and help identify issues and concerns of youth in their communities, provide recommendations, and support the development of new local initiatives and activities. Dr. Suleman is the co-founder and President of the MusicBox Children's Charity, a national Canadian charity that provides music education opportunities to vulnerable children in Canada.

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DR. SHAZEEN SULEMAN

Perspective From Youth & Health

Our children and youth motivate and drive many of our actions. We want their lives to be better than our own. We want them to do the things we could not ourselves do. We want them to be healthier; we want them to have better education; we want them to be happier, cleaner, more connected, more fulfilled. The desire to make our successors' lives better and easier than ours is deeply ingrained in our culture.

However, the desire to promote and cherish our environment has not held the same clout. For many, there are more tangible assets that are sought, such as financial and physical safety, at the expense of preserving the environment. The *Acting on Climate Change: Solutions from Canadian Scholars* report outlines 10 key policy orientations that broadly encompass short- and long-term recommendations that can be employed to promote climate change mitigation. Much like many chronic healthcare conditions, climate change and the strategies outlined in the report may feel intangible and not applicable to us. Just as a sedentary lifestyle now seems distant and unrelated to a cardiac arrest decades later, many of the policies outlined have effects that may not be felt by individual citizens or communities, leading to a lack of uptake and support for the proposed actions. One way to address this challenge is by addressing direct impacts of climate change and the proposed policies on individual and community health. To further this understanding, a strong partnership with healthcare agencies and professionals and youth, respectively, may strengthen the application and uptake of the proposed policy orientations.

Address the Impact of Policies on Individual and Community Health

There is growing recognition and concern about the impact of our environment on our health, and particularly on that of our children. From the air we breathe to the water we drink, our concern for our planet is heightened when tied to our personal wellbeing. The proposed policy orientations in the *Acting on Climate Change: Solutions from Canadian Scholars* report focus on community-specific needs, which should be commended. To strengthen their position, it may be worthwhile to include the impact of these policies on the wellbeing of all individuals and communities. For example, the report highlights housing as a major determinant of Canada's carbon emissions, and discusses the importance

of improving infrastructure to improve energy efficiency among other targets. The World Health Organization has outlined the deleterious relationship between poor housing, physical health and climate change, estimating "that nearly two million people in developing countries die from indoor air pollution caused by the burning of biomass and coal in leaky and inefficient household stoves"[1]. It is also important to recognize that some proposed policies may not benefit all communities equally. For example, while transforming urban areas into walkable, mixed use and high-density cities may promote cardiovascular health, revitalization may lead to displacement of more vulnerable families, leading to further isolation[2]. In another example, active transportation necessitates safe cities and communities, which, without other policy and community rebuilding, is not possible for many vulnerable communities where safety is a concern. Therefore, in discussing potential strategies to reduce climate change, it is imperative that policy-makers relate solutions to improved health and wellbeing to engage communities in climate mitigation.

Engage Health Care Agencies and Professionals in Policy

In the discussion on sustainability, many sectors such as finance and agriculture were mentioned in the *Acting on Climate Change: Solutions from Canadian Scholars* report as foundational to sustained change. I would like to suggest that an often-neglected but interested stakeholder is the healthcare industry. As outlined above, in seeking to implicate health improvement through the proposed policies, engaging healthcare professionals as advocates and stakeholders would be instrumental in promoting public buy-in. Additionally, healthcare facilities are not insignificant producers of carbon emissions[3]. Hospitals are some of the most energy consuming buildings in Canada, and there have been successful interventions to reduce their carbon emissions[4]. By including motivated healthcare professionals in the dialogue on climate change mitigation, I believe it will also promote an attitude shift within the field. The Canadian Association of Physicians for the Environment (CAPE)[5] may be an interested stakeholder in taking action against climate change by helping change a culture within healthcare and by advocating for more effective, environmentally-sustainable treatments and processes within health care: a healthy patient requires a healthy environment.

Engage Youth in Policy Creation and Deliverables

Finally, the *Acting on Climate Change: Solutions from Canadian Scholars* report begins with youth as the motivation and driving force of acting on climate change. However, within the outlined policies, where are the youth as engines, motivators and collaborators in climate mitigation? In order to change the future, we must harness the energy and values that young people espouse, and identify clear ways in which policies are both youth-informed and youth-targeted. Policy-makers should strive to include the perspectives of youth in the community and those engaged in advocacy through specific, inclusive consultations with the goal to listen and implement their recommendations. Additionally, involving young people in action plans and policy is

1 http://www.who.int/hia/house_report.pdf?ua=1

2 http://www.thestar.com/opinion/commentary/2014/05/05/how_revitalization_is_leading_to_displacement_in_regent_park.html

3 http://www.eia.gov/consumption/commercial/reports/2007/large-hospital.cfm

4 http://www.ec.gc.ca/ecoaction/default.asp?lang=En&n=F-4BE13C2-1

5 http://cape.ca

essential: they are malleable, creative and tomorrow's future leaders. To engage them in protecting our future, we must not just work for them, but with them through providing opportunities for youth to be part of the research, policy and implementation process. The Youth Advisory Group (YAG) for the Canadian Commission for UNESCO, Students on Ice and Man and Biosphere Reserves are just some examples of effective and diverse ways to include youth in meaningful roles. Through their inclusion in strategic planning, excursions and advocacy, youth gain valuable skillsets, perspectives and attitudes that will further permit them to continue to partake in climate change mitigation.

United Nations Educational, Scientific and Cultural Organization

Manicouagan-Uapishka Biosphere Reserve

ABOUT THE ORGANIZATION

NORDMAB'S STUDENTS ON ICE

CORINE CADORET AND NOAH PICARD-SIMON

Resulting from a call for applications issued by the Manicouagan-Uapishka World Biosphere Reserve (RMBMU), two students from that region were selected to participate in an Arctic expedition July 28th - August 9th, 2015: Corine Cadoret and Noah Simon Picard.

This initiative was the result of a partnership between the renowned international organization Students On Ice and UNESCO's Man and the Biosphere Northern network (NordMAB), mainly supported by the Nordic Council of Ministers. As co-leader of this network, the RMBMU received funding for participation of the two Manicouagan youth from the Department of International Relations and La Francophonie and the Canadian Commission for UNESCO.

In addition to the pre-departure activities coordinated by Students On Ice, Corine and Noah held preparatory meetings with the Société du Plan Nord and the Canadian Commission for UNESCO. In addition, a meeting with Dr. Catherine Potvin of Sustainable Canada Dialogues was held to prepare the drafting and dissemination of a call to action that would be an outcome of the youth's observations and reflections during and after their expedition. The experience has inspired them to share with the world what is happening in real time in the Arctic and how youth can play a role in the fight against climate change. After writing their call to action, the youth received endorsement from 66 other student participants of the 2015 expedition.

FOR MORE INFORMATION, PLEASE CONTACT

info@rmbmu.com

OFFICIAL WEBSITE

studentsonice.com

NOAH PICARD-SIMON & CORINE CADORET

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"I was impressed to feel at home in the Inuit communities despite the distance, isolation and difference of language. At the same time, there was something similar to what I know; we have common challenges, and community and family life that resemble one another. After the expedition, I enrolled in a technical program in wildlife and land management, whereas before the expedition, I had no idea what I really wanted to study."

Noah Picard-Simon, 17 years old, student from Pessamit

"I walked on a huge glacier and the experience was very inspiring. However, one of the specialists present told us that if we were to return to the same place next year we would be walking on stones, because this part of the glacier will have melted. It made me realize the impact on northern territories of industrialized countries' decisions. This motivated me to want to share with my region my experience in the Arctic."

Corine Cadoret, 17 years old, student from Baie-Comeau

Contributed by

NORDMAB'S STUDENTS ON ICE

Call to Action

Original text in French available at *www.sustainablecanadadialogues.ca/fr/vert/versundialogue*

On July 29th, 2015 we began our Arctic expedition along with more than 100 other students from all around the world, plus 80 experts from the scientific, artistic and cultural worlds. The main objective was to better understand and observe changes in Greenland and Nunavut due to climate change. After two weeks of expedition, we had gained new cultural and scientific knowledge, inspiring us to raise the world's awareness about what is happening in real time in the North and why we, the youth, must act today.

First of all, most people seem to be ignorant of the diversity of life that occupies polar territories. Indeed, we need to realize that inhabitants of the Earth's summit are the first victims of our actions and that we are progressively destroying what they have built over thousands of years. As an example, pollution residues from China were discovered beyond the Arctic Circle. For us, this is non-negligible evidence that regions visited during the expedition are affected by the choices of rich countries. The heads of state around the world must understand that their decisions affect the Arctic and, like the canary in the coal mine, what is happening in the North is only a foretaste of what awaits us all. As young citizens of the world, we realized that the present of northern communities is a reflection of our future.

As we speak, Arctic communities are facing melting ice. This fact challenges the knowledge of nature that Arctic elders have developed and used for thousands of years, and drastically affects their lifestyle. Besides being essential to their way of life and the practice of their traditional activities, the ice is the habitat of numerous species that play an important role in ecosystems. So, if it disappears, CO_2 emitters will be the cause of the extinction of a flame that has illuminated a region of the world since time immemorial.

Listening to the testimonies of communities who live every day what we experienced during those two weeks, we realized that too little is done by industrialized countries to prevent climate change. Being young people who have had the opportunity to explore the Arctic, we are particularly moved by current decisions taken by industrialized countries that will affect us all sooner rather than later.

In 2015, it is our duty to mobilize not only for the Arctic, but especially to limit the consequences of climate change around the globe. The voice of youth supports the scientists

in their efforts to shake our leaders. We appeal to all young people to get informed and to remain alert to any opportunities that arise around them to make their voices heard, whether participating in a local, national or international event, targeting climate change as a subject in school work or being involved in a local committee. We recognize the importance of seizing these opportunities, but also of having the courage to create them ourselves. The impacts are visible, the damage is extensive and it is time for action!

Endorsed by

1. **Ahmad Amirul Farhan bin Zulkifli**, 16 years old, Terengganu, Malaysia
2. **Alice Xu**, 16 years old, Richmond, British Columbia, Canada
3. **Alicia Wang**, 15 years old, Shanghai, China
4. **Amber Rose Dwyer**, 18 years old, Salt Lake City, Utah, USA
5. **Andrew Fitzsimmons**, 23 years old, Regina, Saskatchewan, Canada
6. **Andrew Xu**, 16 years old, Guelph, Ontario, Canada
7. **Ashley Cummings**, 17 years old, Iqaluit, Nunavut, Canada
8. **Béatrice Chemtov**, 16 years old, Montreal, Quebec, Canada
9. **Brian Robert Ituluk**, 17 years old, Iqaluit, Nunavut, Canada
10. **Caitlyn Baikie**, 23 years old, Nain, Nunatsiavut, Newfoundland and Labrador, Canada
11. **Cameron Flooren**, 17 years old, Fort Vermilion, Alberta, Canada
12. **Camille Morin**, 30 years old, Gatineau, Quebec, Canada
13. **Charmaine Putulik**, 17 years old, Naujaat, Nunavut, Canada
14. **Christella Igihozo**, 18 years old, Rwanda
15. **Christina Cheung**, 17 years old, Vancouver, British Columbia, Canada
16. **Cody Pisteolak**, 18 years old, Pond Inlet, Nunavut, Canada
17. **Dakshita Jagota**, 17 years old, St. John's, Newfoundland and Labrador, Canada
18. **Darshana Powell**, 14 years old, Barrie, Ontario, Canada
19. **Didiane Shengedidi**, 17 years old, Rwanda
20. **Emi Kingan**, 15 years old, Hong Kong, China
21. **Erinn Drage**, 20 years old, Halifax, Nova Scotia, Canada
22. **Evie Rowe**, 13 years old, Washington, USA
23. **Frédérika Giorcelli**, 17 years old, Monaco
24. **Gabrielle Foss**, 18 years old, Toronto, Ontario, Canada

25. **Gage Nochasak**, 17 years old, Nunatsiavut, Labarador, Canada
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