The Not Impossible Plan for Canada

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1 Introduction

Tackling climate change requires massive reduction in fossil fuel use, in the range of 80 to 90% by mid-century. Thus far, policies to achieve a level of reduction that is both effective and politically acceptable have proved elusive.

For example, on March 3, 2016, CBC news reported "Prime Minister Justin Trudeau and the provincial premiers emerged from their meeting in Vancouver to say they are working toward a national climate change plan that includes an agreement in principle for a carbon-pricing mechanism — although they did not offer specifics as to how it would work."

The Not Impossible Plan is a policy alternative that uses a modest $20/tonne national fossil CO_2 tax to provide long-term, zero interest, loans to renewable energy projects. These loans allow for the lowest possible production costs for new renewable energy projects by loaning out all the money available every year, year after year, hence driving so much investment into renewables that we would have enough renewable energy available by 2060 to leave no room in the energy mix for fossil fuels. Complete details of the plan are available here.

The Not Impossible Plan is suitable for any country to adopt, but the original paper focused on the United States. This paper looks at how the Not Impossible Plan could be applied in Canada and assumes some familiarity with the original document and the National Renewable Energy Fund (NREF) concept described herein.

Canada is particularly well suited to implement the NREF because the concept is modeled after Canada's own Canada Pension Plan Investment Board (CPPIB) which is an investment body that is separate from the government but responsible to the government. The CPPIB has been instrumental in ensuring the Canada Pension Plan is fully funded and generating the returns needed to provide for Canadians in their retirement. Similarly, the NREF would be key to providing funding to renewable projects throughout the country and in doing so ensuring Canada weans itself off fossil fuels with a minimum of pain and disruption.

2 Canada's Energy and CO_2 Emissions Picture

Canada has huge reserves of coal, oil and natural gas and uranium, along with vast potential for renewable energy from solar, wind, hydro and geothermal.

Being a modern society in a cold climate, having long distances between population centres and being an exporter of oil and natural gas along with a small population results in Canada having a high annual per person CO_2 emission level of 21.7 tonnes/person. However, the per-capita emissions are not equal across the country. Alberta and Saskatchewan have the highest per capita emissions due to fossil energy exports while Quebec has the lowest due to no fossil fuel reserves and high levels of hydro power production. See Table 1.

Province or territory (in order of emissions per capita)	**2013 GHG emissions (megatonnes of CO2e)**	**2011 Population**	**GHG/capita**
Alberta	267.2	3,645,257	73.3
Saskatchewan	74.8	1,033,381	72.4
Northwest Territories and Nunavut	1.7	65,803	25.8
New Brunswick	15.7	751,171	20.9
Nova Scotia	18.3	921,727	19.9
Manitoba	21.4	1,208,268	17.7
Newfoundland and Labrador	8.6	514,536	16.7
British Columbia	62.8	4,400,057	14.3
Ontario	170.8	12,851,821	13.3
Prince Edward Island	1.8	140,204	12.8
Yukon	0.4	33,897	11.8
Quebec	82.6	7,903,001	10.5
Canada Total	**726.1**	**33,469,123**	**21.7**

Table 1 Source:

Oil and gas production accounts for 163 Mt, or 25% of total emissions, the majority coming from fossil fuel production for export.

To do their part in reducing fossil CO_2 emissions by 2060, Canadians would need to drop their fossil CO_2 emissions by at least 80%, and preferably 90%. This equates to total emissions for the country of between 72 to 144 Mt. Looking forward, Canada's population is projected to be about 50M in 2060, so that implies a per capita GHG emission level of 1.4 to 2.8 tonnes/capita.

This is a huge challenge. Note that the country's total emissions must be less than the emissions currently coming from just oil and gas production. Even without the oil and gas production, reducing to 1 to 2 tonnes per person while still heating our homes, having transportation, having industry is hard to imagine. One tonne of fossil CO_2 is equivalent to about $300 of gasoline at today's prices, or $25/month. And that doesn't leave anything to heat a home or, heaven forbid, fly somewhere warm for a week in the winter.

The central goal of the Not Impossible Plan is to see to it that we build enough renewable energy so we can live a relatively fossil carbon free life without giving up much of anything or changing our lifestyles. The good news is that there is more than enough renewable energy available in Canada to replace 80 to 90% our fossil fuel use.

3 Modeling the NREF in Canada

Using the same model presented in The Not Impossible Plan document, Canada's emissions were modeled to see what would happen if the NREF was put in place in Canada starting in 2017.

Baseline emissions were taken to be 529 Mt of fossil CO_2, as that is a good estimate of emissions without fossil fuel production (source) The reason behind not including fossil fuel production emissions is we expect to be pretty much off fossil fuels by 2060, thus the emissions from producing fossil fuels will be mostly gone at that point as well. Also, having production emissions will add to the tax revenue, so they will only speed up the transition, not slow things down.

Assuming a $20/tonne fossil CO_2 economy wide tax, as called for in the Not Impossible Plan, with that money being used to build renewable energy projects, the annual loans available would look like Figure 1. This level of tax would increase the price of gasoline by about 5 cents per litre, the price of coal generated electricity by about 2 cents/kWh and the price for natural gas generated electricity by about 1 cent/kWh.

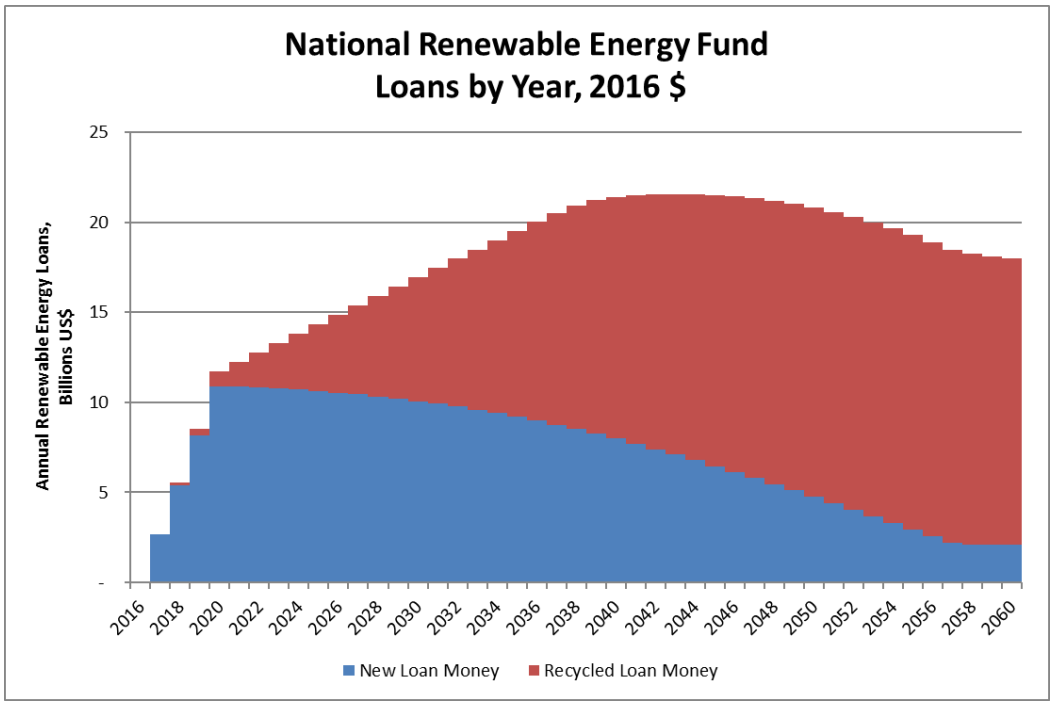

Figure 1

After the tax ramp-up period (it starts at $5/tonne and goes up $5/year until it reaches $20/tonne fossil $CO_{2)}$ annual zero interest loans are $13B/year (all dollar amounts are constant 2016 $), climbing to over $20B/yr. by 2036. In the first 10 years of operation at $20/tonne tax rate, $141B will have been invested. By 2058, $746B will have been invested in renewable energy. Emissions begin to fall because the renewable energy produced will be displacing fossil energy. By 2058, an 80% reduction from 2016 levels is achieved, even while increasing total energy consumption by 52% to account for population growth, See Figure 2.

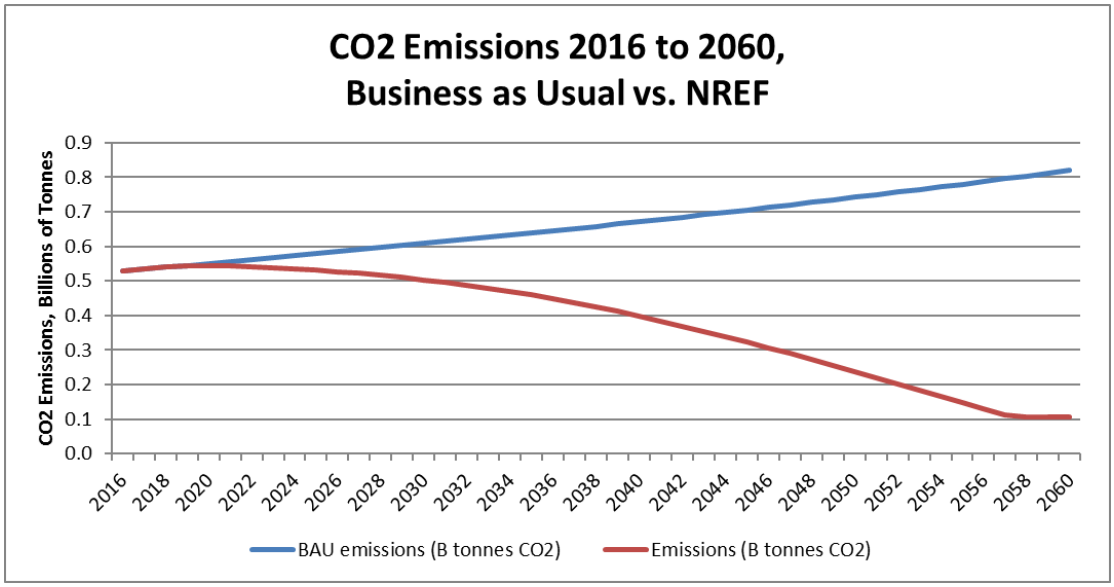

Figure 2

If we can increase efficiency in the meantime so that the overall energy consumption does not rise as rapidly, the date of 80% reduction could be achieved sooner moving to 2050, but using a conservative approach means including the increase in energy consumption.

So it would appear that developing enough renewable energy in Canada using the national NREF model and a $20/tonne non-escalating (except for inflation) carbon tax is feasible.

3.1 Potential Issues for Canada

Despite this encouraging result, there are two elephants in the room in the Canadian context.

First, given the realities of Canada's politics and geography, provinces may have a tough time accepting a national body managing the loan money. Provinces will want the tax money paid by its industries and citizens to stay within their borders for their benefit. I see two potential solutions -

1. Each province could setup its own Provincial Renewable Energy Fund (PREF) to provide loans exclusively within the province. All provinces have access to renewable energy sources, so this is likely doable though not as efficient as a national body. It would likely be wise for smaller provinces like the Maritimes to band together and cooperate with a single fund. It would be important for all provinces to have the same carbon tax level and for it be economy-wide to maintain a level playing field.
2. The national fund could be mandated as part of its charter to give out loans using a formula based on a province's payments into the fund. Thus the skills and expertise required to be successful won't have to be duplicated 12 times. This would also allow for better planning across provincial boundaries.

Second, Alberta and Saskatchewan have a high reliance on fossil oil and gas for a large percentage of their economies (23%). Giving up fossil fuels will be especially difficult for these two provinces. Their high fossil CO_2 emissions would lead to a lot of money being available for renewable energy projects, but is there something that can be done about the impact on their major source of employment?

A key part of the Not Impossible Plan's expected success comes from building renewable energy projects that feed our current energy systems. That is, I don't see replacing oil for transportation with battery electric vehicles or hydrogen vehicles or mass transit solving our transportation needs. The transportation future will be most likely, in my opinion, based in large part on low fossil carbon liquid fuels. In other words, fuels that are still carbon-based like gasoline, diesel and jet fuel, but instead of being mined, they will be synthesized using a combination of renewable energy, biomass, and captured CO_2. When

these fuels are combusted they release no net carbon to the atmosphere because their carbon content originated from the atmosphere. See my paper *Future Energy and Its Delivery* for details.

As we transition from full fossil carbon fuels today to low fossil carbon fuels in 2060, there will be a long period of blending, where low/zero fossil carbon fuels are blended in increasing amounts with fossil fuels to form the gasoline, diesel and jet fuel supply. This blending will likely begin slowly in 2020, and in earnest around 2030 and increase every year after that so all fuels are low/zero fossil carbon by 2060.

Alberta and Saskatchewan are perfectly positioned to take the lead on this technology. They have vast renewable energy available through wind and solar, they have access to biomass though farm waste, they have the liquid hydrocarbon infrastructure and knowhow, they have Universities that are already in the forefront in researching this area. With leadership, Canada's major fossil carbon emitter provinces could transform themselves into world leaders in low fossil carbon fuels using loans from the NREF (or PREF) to build renewable energy collection systems and systems to convert that energy into low fossil carbon fuels.

The ironic part is if this plan is followed and Alberta and Saskatchewan become Canada source for low/zero fossil carbon fuels, there would be good reason to build the Energy East pipeline so all of Canada could be supplied with this important fuel.

This solution also points out the advantage of the National body to provide loans. It may be much more efficient and practical for the low carbon fuel production to be concentrated in one area, rather than each province having its own industry.

4 Conclusion

We can see from the model results presented above, it would be possible for Canada to reduce its fossil CO_2 emissions well over 80% by 2060 without having to give up the lifestyle we have come to enjoy. With a modest, non-escalating fossil carbon tax providing investment money for renewable energy, increases to consumers' energy bills would be very modest as well and within the average Canadians' willingness to accept. In addition, with leadership and planning the current fossil energy supply centres in Canada can transition to a renewable future while keeping their economy strong.

To learn more about the Not Impossible Plan, visit http://www.notimpossibleplan.org

5 About the Author

Don Gayton holds a Masters of Engineering in Clean Energy Engineering and a BASc in Electrical Engineering from the University of British Columbia. He has an unusually

broad knowledge of renewable energy systems, business, electronic/mechanical design, and software design along with a deep understanding of thermodynamics, chemistry and statistics. In 2009 he left a successful 25-year career as a high technology executive to focus his efforts on helping prevent further climate change. Since that time he has worked in the clean tech sector while he was developing the ideas presented here.

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