Old Harry and the Gulf of Saint Lawrence –
A path to sustainable energy in Canada and the Atlantic Provinces

3/28/2011

Public Comments – Old Harry Project
Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water St., St. John's, NL A1C 6H6

Dear Members of the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB):

I appreciate the opportunity to provide comments related to the Old Harry Project. While I have reviewed the project, I will simply provide a few general comments.

Sincerely,
Matthew McCarville

Fossil fuel subsidies exacerbate global warming

First, it is my understanding that globally, fossil fuel subsidies totaled $557 billion (US) in 2008[i]. The G-20 has recognized this as a major structural problem which must be addressed in order to more effectively deal with climate change. In Canada these subsidies amount to more than $1.4 billion per year.[ii] Dr. Fatih Birol, Chief Economist for the International Energy Agency and John P. Weyant, Professor (researcher) at Stanford University have both modeled scenarios and concluded that with current fossil fuel subsidies we appear to be on a trajectory of up to six degrees Celsius of rapid global warming. Associated environmental impacts of this trajectory are not addressed by Corridor Resources Incorporated. For instance, their prospective development would occur within a marine environment yet if fossil fuels continue to be supplied as is currently being projected into the future, at least 4-5 degrees Celsius of warming is almost certain to occur, and this is thought to be a threshold beyond which we will essentially collapse marine ecosystems and they will largely cease to function.

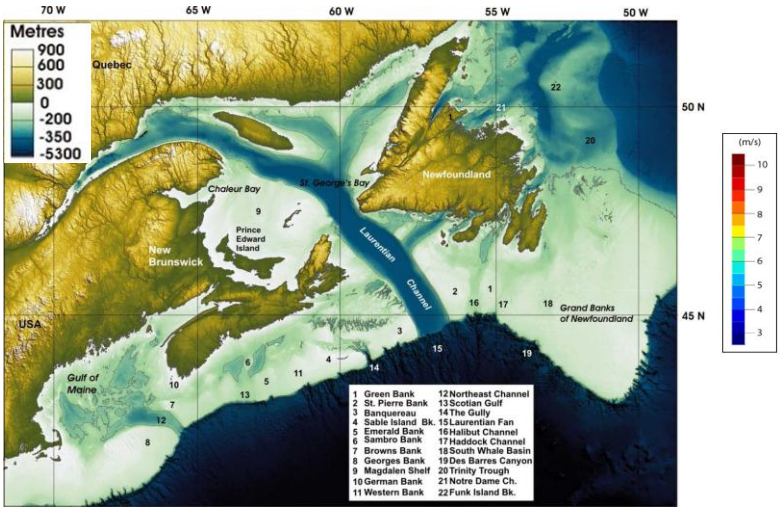
Offshore wind power in the Gulf of Saint Lawrence

The Old Harry project site area is 304 km^2. Offshore wind power could be developed on a site of equal size, such as off the coast of the Magdalen Islands where water depths are only 0-50 meters (m). Blade diameter for the 5 megawatt (MW) REpower 5M wind turbine is 126 m. To minimize inter-turbine wake losses, spacing of about 0.79 km^2 per 5M is needed. Thus, within the same area of the Gulf of Saint Lawrence, it is possible to install 385 5 MW wind turbines, or 1925 MW of wind capacity. Modern turbines in average wind speeds greater than 7 meters per second typically have average capacity factors greater than 30 percent. The Canada Wind Energy Atlas shows the Gulf of Saint Lawrence has average wind speeds greater than 10 meters per second. Assuming conservatively that the average capacity factor for offshore wind power in the Gulf is 40%, this amount of offshore wind development would generate 6.7 terawatt hours per year – enough electricity to supply about two million electric cars.

Let's assume the area of the southern Gulf of Saint Lawrence is about 120,000 km^2 (600 km x 200 km). To install 6000 MW of wind less than 950 km^2 of area would be needed for spacing. This amount of offshore wind would be beneficial to the Atlantic region – providing 25 percent more power to than the proposed Lower Churchill Falls Hydroelectric Generation Project (including Gull Island and Muskrat Falls).

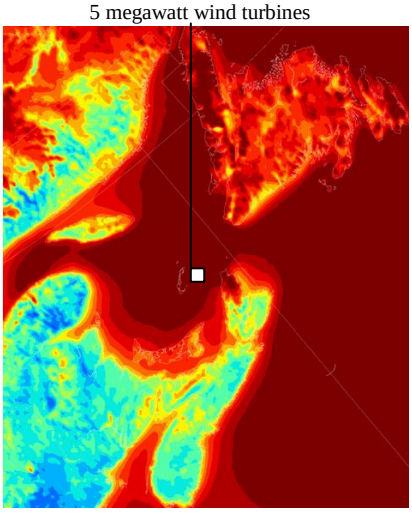
Atlantic Canada

Bathymetry Map



Wind Map

Total area needed for spacing 1200 5 megawatt wind turbines

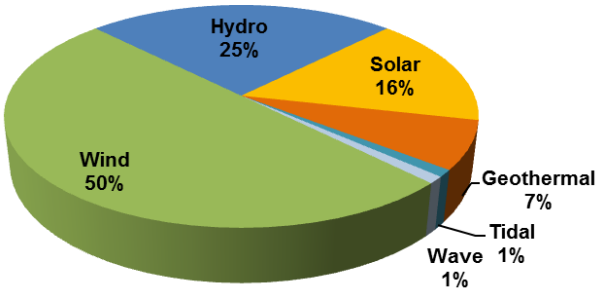


A path to sustainable energy in Canada

On March 2nd, I testified to the Parliament of Canada Senate Committee on Energy, the Environment and Natural Resources with a plan to power Canada with 100% renewables by 2050. I motivated this asking what's the problem? Why care? Why act quickly; not in 100 years?

Aside from 2.5-3 million air pollution deaths a year, hidden medical and insurance costs, etc., temperatures are rising. In Atlantic Canada from September to December in 2010, 89 new temperature records were set; 3 new lows and 86 new highs. In the 2000's arctic sea ice decreased 15% and we had 9 of the 10 hottest years in recorded history. As sea ice disappears it's more difficult for it to recover. Once gone, the climate can warm even more rapidly. So this is important as we can't rely on solutions that might become available. We have huge populations to support, we have infrastructure and want to be sustainable for a while, so we must rely on the best technologies existing today to solve this.

Canada Energy Supply, 2050



I estimate that approximately 55,000 5 megawatt (MW) wind turbines, 500 300 MW concentrated solar plants, 500 300 MW solar PV power plants, 3 million 3 kilowatt (kW) rooftop PV or small wind systems, 150 100 MW geothermal power plants, 5000 0.75 MW wave devices, 5000 1 MW tidal turbines, 10 new 1300 MW hydroelectric power plants and 70,000 MW of existing hydroelectric power plant capacity, can power Canada with electricity and electrolytic hydrogen for all purposes within 40 years at costs similar to today.

Vehicles, ships and trains would be powered by electricity and hydrogen fuel cells. Aircraft would run on liquid hydrogen. If Canada converts all personal vehicles to battery electric vehicles powered by wind, towers on the ground require less than 0.2 km^2 – twice the area of Parliament Hill. Land for turbine spacing can still be used for agriculture.

Wind power is the greenest energy supply option and it's about twice as powerful in the coldest month compared to the warmest. Space heating is 63% of end-use energy in Canada's residential sector. So homes would be warmed with excess winter winds using electric thermal storage heaters – no need for coal, oil, natural gas, nuclear or biofuels – and water would be preheated by the sun.

Aside from cryogenic hydrogen for aircraft, which you have to combust, along with some high temperature processes that would replace steel production, there would be no need for any combustion except in very remote circumstances. In sum, this path to sustainable energy in Canada achieves about 90% reductions in GHGs from energy use by 2050. Barriers to the plan are primarily social and political, not technological or economic.

Note – Please view my original testimony for details, sources, calculations and methodology.

A path to sustainable energy in Atlantic Canada

To convert Atlantic Canada to 100% renewables with wind, solar, tidal, wave and hydroelectric power for all purposes by 2050, I estimate the following electricity generating portfolio may be sufficient:

- 30 250-MW onshore wind farms in the Maritimes;
- 30 250-MW onshore wind farms in Newfoundland and Labrador;
- 12 500-MW offshore wind farms in 0-50 meters water depth;
- 3000 1-MW tidal turbines in the Bay of Fundy;
- 2000 0.75 MW wave devices;
- 3,074-MW of new hydroelectric plant capacity at Gull Island and Muskrat Falls; plus
- New Brunswick's total hydroelectric capacity of 890 MW.

Atlantic Canadians consumed 484,724 terajoules (TJ) of energy in 2008.[iii] One TJ of energy is equivalent to 0.27778 gigawatt hours (GWh) of electricity. Thus, Atlantic Canadians consumed the equivalent of 134.65 TWh/yr in 2008. Using this system of electricity and electrolytic hydrogen for all purposes, Atlantic Canadians could reduce total energy demand by about 30 percent due to conservation measures. The total energy demand would be about 94.26 TWh/yr.

7500 MW onshore wind $_{\text{Maritimes}}$ x 0.36 x 8760 hr/yr = 23.65 TWh/yr
7500 MW onshore wind $_{\text{NFLD}}$ x 0.36 x 8760 hr/yr = 23.65 TWh/yr
6000 MW offshore wind $_{\text{Atlantic Canada}}$ x 0.40 x 8760 hr/yr = 21.02 TWh/yr
3000 MW tidal $_{\text{Bay of Fundy}}$ x 0.40 x 8760 hr/yr = 10.51 TWh/yr
1500 MW wave $_{\text{Atlantic Canada}}$ x 0.25 x 8760 hr/yr = 3.29 TWh/yr
3074 MW new hydro $_{\text{NFLD}}$ x 0.62 = 16.70 TWh/yr
890 MW existing hydro $_{\text{NB}}$ x 0.45 = 3.51 TWh/yr
Total annual electricity production = 102.33 TWh/yr
Again, water would also be preheated by the sun, etc.

Useful Resources

These paths to sustainable energy in Canada and Atlantic Canada were developed using the following resources:
http://www.stanford.edu/group/efmh/jacobson/Articles/I/susenergy2030.html

1. Review of solutions to global warming, air pollution, and energy security
2. A path to sustainable energy by 2030 "Providing all global energy with wind, water and solar power" (pdf-Part I, pdf-Part II)
3. Report on matching hourly and peak demand by combining renewables (link, pdf)

Conclusion

There is no need to develop new fossil fuel resources such as Old Harry, as the evidence shows it is possible to switch to alternatives in sufficient quantities at reasonable costs using existing technologies. Furthermore, it is necessary to choose only the best alternatives in order to have a reasonable chance of limiting global warming to within 2 degrees Celsius.

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[i] http://www.iea.org/files/energy_subsidies.pdf
[ii] http://action.davidsuzuki.org/subsidy
[iii] Includes primary and secondary/final demand: http://www.statcan.gc.ca/pub/57-003-x/57-003-x2008000-eng.pdf