# Information Request Number: JRP.7

# Greenhouse Gas Emissions

**Requesting Organization – Joint Review Panel** **Information Request No.: JRP.7**

**Subject - Greenhouse Gas Emissions**

**References:**

EIS Guidelines, Section 4.3.2.1 (Alternatives to the Project) & Section 4.5.1 (Environmental Effects – General)

EIS, Volume IA, Section 2.4.3 (Project Rationale – Addressing Climate Change); Section 2.4.4 (Project Rationale – Market Opportunities) & Section 2.5.7 (Alternatives to the Project – No Project)

**Rationale:**

The EIS Guidelines require the EIS to contain "(…) an analysis of alternatives to the project, including… (e) status quo (no Project)" (p. 15) and "a comparative analysis of environmental effects (…) of alternatives." (p. 16). The EIS Guidelines also require that "Predicted environmental effects (positive and negative, direct and indirect, short and long-term) shall be defined quantitatively and qualitatively for each project alternative and for each VEC." (p. 32).

The EIS Guidelines further require the EIS to contain "a description of specific greenhouse gas emissions that the Project will or could offset, the necessary conditions for that offset occurring, and a quantitative net estimate of potential greenhouse gas reductions or increases." (p. 33).

The EIS is deficient with respect to project markets and alternatives and associated effects on GHG emissions.

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**Information Request:**

**a. In order for the Panel to assess GHG emissions potentially offset by the Project, in the absence of known markets, the Proponent is asked to provide a comparative analysis of GHG displacement scenarios for possible electricity markets served and generation sources displaced.**

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**Response:**

In compliance with the Guidelines, Section 2.4.3 of the EIS has described the GHG's that the project could offset. As the Project will operate in a competitive electricity market, the destination for the electricity and the markets served will ultimately be determined through market forces and negotiation with counterparties to long-term contracts. To date, neither Canada nor Newfoundland and Labrador has imposed GHG regulation, so the cost of generation alternatives in a GHG constrained market cannot readily be forecasted. As a result, the Proponent has evaluated market options and completed financial analysis with no cost for carbon, and considers increases in market price resulting from carbon constraints as an upside opportunity.

In an unconstrained carbon market, the GHG displacement potential of the Project is largely a factor of the marginal cost of other generation alternatives that are also available to a given market. Since GHG emitting generation sources all have a fuel cost, hydro generating units are inclined to operate as 'price takers' in competitive markets, and will beat out emitting generators that have a fuel cost, since no generator would bid below its variable operating costs.

The GHG displacement and avoidance of the Project will ultimately be determined by the following major factors:

- **Government Policy.** The extent to which various generation sources are removed from a market and the timing of the policy implementation, in the manner as Ontario's decision to retire its coal fired generation, or the Government of Canada's proposal to ban the construction of conventional coal fired generation by 2012.
- **Marginal Operating Costs.** The marginal cost of generation in a market, including any indirect or direct carbon costs, will strongly influence the merit order of generation dispatch.
- **Substitution Effects.** Any increase in demand for electricity resulting from limits on other uses of fossil fuel, such as transportation.

Once the Project is completed, the Project will displace higher cost generation. In the limit, the minimal marginal operating cost of the Project would see the Proponent accepting any price rather than spilling water for no revenue. Consequently, the Proponent has a high degree of confidence that displacement of other generating alternatives will take place if the Project is constructed. It should also be noted that other renewable energy sources also have low marginal operating costs, so the Proponent does not expect to displace other in-service renewable production.

As noted in IR #JRP.5, attributes of the supply from the Project offer competitive advantages in the identified Northeast markets. The Project's lack of GHG emissions is a significant advantage. With the introduction of GHG regulation and a price on carbon, this will translate to a cost advantage. The magnitude of this cost differential will depend on the cost of carbon, the intensity of the GHG emissions of each fossil fuel generation source, and the fossil fuel costs. Higher cost supply will be displaced first.

Table 1 compares the cost of electricity generated from coal and natural gas for a range of carbon costs. In the absence of a charge for carbon emissions coal provides the least cost supply alternative. With a higher carbon cost, it becomes the more expensive option.

**Table 1 2020 Forecasted Price of Wholesale Electricity by Fuel Type with Carbon Price ($2007US/MWh)**

| Fuel Source | Price of Carbon (per tonne) | | | |
|---|---|---|---|---|
| | $20 | $50 | $100 | $200 |
| Coal | $38 | $66 | $111 | $201 |
| Natural gas | $62 | $74 | $95 | $137 |

Source: Lower Churchill Project
Fuel Price Forecasts US Department of Energy, Annual Energy Outlook 2009 (Revised April 2009)

Potential fuel displacement scenarios have been considered based on an assessment of current and forecast generation supply mixes in the respective markets, the supply attributes that the Project can offer in these markets and government environmental policy goals. Both provincial and federal governments recognize the need to address GHG emission reductions in the electricity sector. For example, Nova's Scotia's *2009 Energy Strategy* identifies the need for an orderly transition from dirty coal to cleaner and more sustainable energy sources.

Table 2 provides two displacement scenarios – one primarily based on a Maritime transmission route and one primarily using the Hydro-Québec TransÉnergie OATT:

**Table 2 Possible GHG Displacement Scenarios (Mt/yr)**

| Region | Generation Source Displaced | Maritime Route | | Quebec Route | |
|---|---|---|---|---|---|
| | | Energy Sales in Market (TWh) | GHG Mt/yr | Energy Sales in Market (TWh) | GHG Mt/yr |
| Newfoundland and Labrador | Heavy Fuel Oil | 2.3 | 1.7 | 2.3 | 1.7 |
| Maritimes | Heavy Fuel Oil/ Coal | 9.7 | 8.4 | 4.7 | 4.0 |
| Ontario | Natural Gas | n/a | n/a | 5.0 | 2.1 |
| Other | Natural Gas | 3.2 | 1.3 | 3.3 | 1.4 |
| **Totals** | | **15.2** | **11.5** | **15.3** | **9.2** |

**References:**

Section 2.4, Environmental Impact Statement *Potential Greenhouse Gas Displacement Forecast*, Lower Churchill Project

*Towards a Greener Future: Nova Scotia's 2009 Energy Strategy*, Government of Nova Scotia http://www.gov.ns.ca/energy/resources/spps/energy-strategy/Energy-Strategy-2009.pdf

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**Information Request:**

**b. What are the GHG implications of the status quo (no Project) alternative, including both high and low GHG scenarios for the Island of Newfoundland?**

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**Response:**

In the absence of the Project proceeding, power to the Island of Newfoundland would continue to be generated at the Holyrood Generating Station. In 2007, emissions from the Holyrood Station accounted for almost 19 percent of the total industrial emissions for the Province. Forecasts indicate that by 2030 between 1.1 Mt and 3.0Mt of greenhouse gases would be emitted annually by the Holyrood Generating Station, an increase of at least 123 percent from 2008 levels. The variation reflects low and high industrial load growth forecasts.

As outlined in Volume 1A, Section 2.4.4 of the Environmental Impact Statement, in the absence of power from the Lower Churchill development, there are limited options available to address future load on the Isolated Island system other than to continue generation at the Holyrood Station and to supplement supplies from other fossil fuel based technologies.

Power supplied to the Island from the Lower Churchill to the Island will displace the total generation from the Holyrood Station therefore displacing the associated greenhouse gas emissions.

These scenarios do not consider substitution of other fossil fuel uses with electricity, an alternative that is made much more difficult without the availability of energy from the Project.

**References:**

*Greenhouse Gas Forecasts, June 16, 2009*, Systems Planning Department, Newfoundland and Labrador Hydro.

Online Industrial Greenhouse Gas Search Tool, Environment Canada http://www.ec.gc.ca/pdb/ghg/onlinedata/dataSearch_e.cfm

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**Information Request:**

**c. According to the Proponent, what is the relevance of provincial, regional, national and international targets in determining the significance of GHG emissions?**

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**Response:**

The Intergovernmental Panel on Climate Change (IPCC) has conducted significant research into the increase since 1850 in global GHG emissions, the effect of such increases on climate and the resulting biological, social and industrial impacts. The IPCC's *Fourth Assessment Report* establishes that global GHG emissions have increased by 70% from 1970 to 2004 resulting in significant climate change and that the largest growth in GHG emissions over this period was in the energy sector with an increase of 145 percent.

The effects of climate change are profound and will be felt worldwide through:

- increased atmospheric temperature;
- increased sea levels;
- reduced glaciers and ice caps;
- increased precipitation in some areas and decreased precipitation in others; and,
- increased frequency in extreme weather events.

In the absence of global action to address rising GHG emission levels, the IPCC's modeling has projected regional impacts through their modeling including, among others:

- Africa: decreases in agricultural yields
- Asia: decreases in freshwater availability
- Australia: loss of biodiversity in the Great Barrier Reef
- Europe: increases in risk of inland flash floods and coastal flooding
- Latin America: decreases in productivity of some crops; and,
- North America: increases in the number, intensity and duration of heat waves

In its *Fourth Assessment Report*, the IPCC has identified the need to reduce GHG emissions by 50-85% from 2000 emission levels by 2050 to stabilize the impacts of climate change and anticipates that 60-80% of these reductions will come from the energy sector.

The IPCC has identified a number of measures that can help achieve the necessary reductions from the energy sector including:

- increased investment in low GHG technologies and processes
- introduction of a carbon tax or charge
- increased development of hydropower and other renewable resources

Canada's total GHG emissions in 2006 were 721 Mt, almost 22 percent higher than in 1990. The energy sector was the single biggest contributor of emissions in the country accounting for over 80 percent of Canada's total in

2006. The electricity industry was responsible for 115 Mt of GHG emissions in 2006, almost 16 percent of the national total.

The application of international, national, or regional regulatory targets will have a very real impact on the levels of greenhouse gas emissions in the atmosphere. The table below demonstrates the reductions potentially required in GHG emissions from the electricity sector in Atlantic Canada if the various targets identified were implemented.

**Table 3 Atlantic Canada Electricity Sector: Reductions Required to Meet Greenhouse Gas Targets**

| Framework | Target (Mt/yr) | Required Reductions (Mt/yr)[1] |
|---|---|---|
| Kyoto Target 2012 (6% below 1990) | 13.4 | 5.9 |
| New England Governors/ Eastern Canadian Premiers Target 2020 (10% below 1990) | 12.8 | 6.4 |
| Government of Canada 2020 (20% below 2006) | 13.4 | 5.8 |
| Government of Canada (60% below 2006) | 6.7 | 12.6 |
| Regional Greenhouse Gas Initiative 2018 (10% below current levels) | 16.3 | 1.8 |

[1]Required reductions based on the 2004-2006 average electricity sector emissions in Atlantic Canada.
Source: Lower Churchill Project

For Atlantic Canada the available sources of non emitting supplies that can help achieve these targets are limited. Wind energy conversion technology, while helpful, offers limited application as a result of constraints on penetration levels. Electrical energy supplied from the Lower Churchill Project has the potential to help the region achieve all the emissions reductions required of the electricity sector in the region, and then some.

A recent report by the National Round Table on the Environment and the Economy advocates a unified Canadian carbon pricing policy to meet the federal government's Greenhouse gas (GHG) emission reduction targets in 2020 and 2050.1 Part of the plan involves a phasing in a cap-and-trade auction process for emission permits by 2020, with a price ceiling on emission permits to avoid price shocks which could cause damage to the economy. Based on this proposed carbon policy and approach future carbon prices have been derived. The report suggests that the ceiling cost per tonne of carbon ($2006) will need to be $50 in 2015, rising to $100 by 2020 and $200 after 2025.[2]

The report also refers to a trend denoted as "*The electrification of the economy*". It states, "*The economy will not only reduce its dependence on fossil-generated electricity, it will significantly grow the quantity of non-fossil-generated electricity produced…the electricity sectors will grow under the carbon pricing policy by 25% above forecast levels by 2020 and 50% by 2050. All of this will need to come from a comprehensive portfolio of low- or zero-emitting technologies, notably CCS,* ***hydroelectric power****, nuclear Energy and renewables…To ensure that electrification is sustainable, however, it will be necessary to reflect the full economic, environmental, and social costs of generation and transmission*."[3] Overall, the electricity sector will see increased investment as demand for renewable energy products increase and "*rising electricity costs relative to the fossil fuel alternatives*". [4]

The Canadian Council of Chief Executives is an association dedicated to public policy development and solutions and is comprised of 150 sector CEOs and entrepreneurs from across the country and across various sectors

1 National Round Table on the Environment and the Economy, "Achieving 2050: A Carbon Pricing Policy for Canada", 2009, Retrieved from: www.nrtee-trnee.ca
2 Ibid. p. 55.
3 Ibid, p. 80.
4 Ibid. p. 82.

including electricity. In April, 2009 the Council issued a press release publicly announcing its support for the approach outlined in the National Round Table report.[5]

If one were to accept the forecasts of the IPCC, then the development of international, national, regional, and provincial targets must provide the framework to achieve that target. Put simply, the existence (or not) of these targets will not change the need to achieve substantial GHG emission reductions; they will help guide our society to the best way to get there. If reductions on the scale proposed by the IPCC by 2050 were applied to Canada, reductions in the order of 360 to 612 Mt, based on 2006 emissions, would need to be achieved.

There are a limited number of ways to achieve these reductions:

- reduce energy consumption
- displace use of fossil fuel with non-emitting alternatives
- capture GHG's after they have been created and sequester them permanently

No matter how targets are established to reduce emissions, non-emitting generation projects such as the Lower Churchill will need to play a key role, particularly to achieve targets within the next decade.

**References:**

*National Greenhouse Gas Inventory Report 2006*, Environment Canada, http://www.ec.gc.ca/pdb/ghg/inventory_report/2006/som-sum_eng.cfm#s4

Online Industrial Greenhouse Gas Search Tool, Environment Canada, http://www.ec.gc.ca/pdb/ghg/onlineData/dataSearch_e.cfm

*Climate Change 2007: Synthesis Report*, Intergovernmental Panel on Climate Change

*Mitigation of Climate Change*, Working Group III, Intergovernmental Panel on Climate Change

*Achieving 2050: A Carbon Pricing Policy for Canada,* National Round Table on the Environment and the Economy, 2009, www.nrtee-trnee.ca

Canadian Council of Chief Executives Press Release, April 16, 2009, http://www.ceocouncil.ca/en/view/?document_id=1345&type_id=1

5 Canadian Council of Chief Executives Press Release, April 16, 2009, http://www.ceocouncil.ca/en/view/?document_id=1345&type_id=1