THE NORTHERN GATEWAY PIPELINE: A POSSIBLE CORRIDOR TO SEED RENEWABLE ENERGY IN BRITISH COLUMBIA, CANADA

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ABSTRACT

As fossil fuels become depleted over the next century, it is imperative that Canada and other countries examine ways to transition to other sources of energy, particularly renewable resources.

A critical obstacle to developing Canada's renewable energy resources is the scarcity of infrastructure to wheel the generated electricity to a viable market. For each megawatt of renewable electrical power, a maximum of 1 km of connecting power line is typically feasible. This means that hydropower, geothermal, and wind power projects with capacities up to 100 MW must be located within a maximum of 100 km of a main power line in order to be economically viable.

With a total length of about 1200 km, the proposed Northern Gateway oil pipeline project creates an excellent opportunity to become a corridor that can seed renewable energy projects in Northern British Columbia and Alberta. Utility companies must build new infrastructure to provide the electricity for constructing and operating the proposed pipeline. The pipeline and linked power line infrastructure therefore, should be designed and built with consideration to create an energy highway to the significant renewable energy resources, such as hydro, wind, and geothermal, in the vicinity of the proposed pipeline.

Some of the important renewable energy resources in northern British Columbia can be developed in connection with the proposed pipeline. It is estimated that close to 2,500 MW of commercially viable wind, geothermal and run-of-river power resources are present in the proximity of the proposed pipeline corridor. While oil flows westward from the Alberta bitumen fields, the generated green power can flow eastward to help the Canadian oil sand industry to offset as much as 10 Megatons of carbon emissions per year. The generated carbon credits are equivalent to 75% of the emissions associated with extraction of the 525,000 barrels per day of oil from oil sands, intended to be carried by the pipeline.

KEYWORDS

Northern Gateway Pipeline, Oil sands, Renewable energy, Geothermal energy, Power corridor, Greenhouse gas (GHG) emission

INTRODUCTION

As early civilizations were built along hydrological corridors, modern communities are being developed along energy hallways. Human livelihood in all geographic regions depends on energy. Energy is needed when we rest and when we move. Energy is needed for what we eat and for what we drink. Energy is needed for our basic necessities and for our superfluous luxuries. Energy is needed as much for making tomatoes in Canada as it is needed for desalinating water in Saudi Arabia. Energy is needed for our cars, airplanes, and trains. Energy is needed for our computers and mobile phones. Energy is needed for travelling to the wonderful sky above our head and for drilling deep into the wealth of the ground beneath our feet.

Energy has permeated into all aspects of our civilization and is needed equally by all nations on earth. Yet energy resources are not evenly distributed around the globe. Some types of energy like solar are found the world over, yet other more readily usable sources like oil and natural gas are concentrated in specific fortunate regions.

Presently, fossil energy is needed to take us to higher technological levels at which renewable energy would be no more a luxury boutique for the privileged but an affordable superstore for all. Until we reach this objective, countries with fossil fuel resources should adopt a double-rack strategy of trading their conventional energy, while investing in renewable energy technologies.

Canada is blessed with abundant resources of fossil fuels (Figure 1) and is willing to trade its surplus energy with other nations around the world. This trade however, should create opportunities to bring Canada closer to its objectives in development of renewable energy resources.

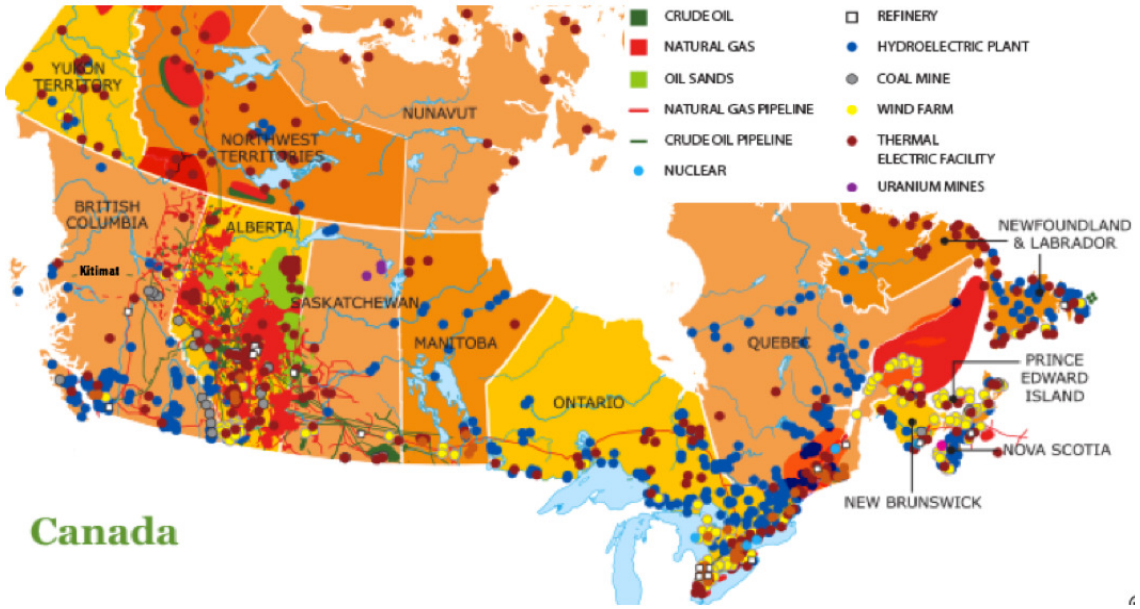

Figure 1 – Energy resource map of Canada, After Canadian "Centre for Energy", 2013.
Shown on the Map is Kitimat (British Columbia), the location of the Pacific terminal on the proposed Northern Gateway pipeline (Figure 2)

With a total of 3.4 million barrels per day (mbd) of production and 2.2 mbd of consumption, Canada has a surplus of 1.2 mbd for export. Canada has also a surplus of 9 billion cubic feet per day of natural gas for export. If Canada desires to become a global energy leader, it needs to broaden its energy trade beyond North America. The proposed Northern Gateway (NGW) pipeline can be a major step towards expanding the Canadian energy market to Asia and South America, while providing a corridor for seeding renewable energy projects.

The proposed pipeline, linking northern Alberta oilfields to LNG/oil terminals on the Pacific Coast, can create a great opportunity for a double-track energy strategy for Canada, in which trading oil and gas can be integrated with development of renewable energy resources such as geothermal, wind and run-of-river.

NORTHERN GATEWAY PROJECT

The proposed NGW pipeline consists of a 1,176 km twin pipeline system and marine terminal in Kitimat (Figures 1 and 2). The pipeline, currently under regulatory review, would transport 525,000 bpd of oil for export and import 193,000 bpd of condensate. Condensate is a diluent in oil refining, which is needed to decrease the viscosity of heavy oil from oil sands, and to make it transportable via a pipeline. The proposed pipeline can create opportunities for economic growth across both northern BC and northern Alberta. The proposal should, however, be fully reviewed and approved at Federal and Provincial levels.

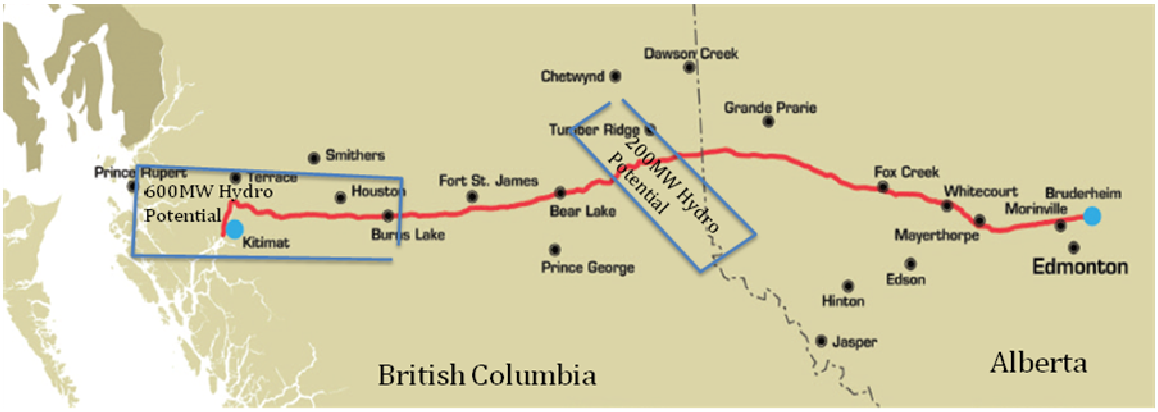

Figure 2 – Proposed NGW pipeline connecting northern Alberta oilfields to northern BC. Pump stations in BC will be at Tumbler Ridge, Bear Lake, Fort St. James, Burns Lake, Huston, Clear Water, and Kitimat

The construction of the proposed pipeline is expected to create 3,000 full-time jobs (during the 3 year construction phase) and about 600 jobs for the 30 year life cycle of the project (Northern Gateway Alliance, 2013).

The created long-term occupations will be mostly in northern BC, where economic sustainability of many communities (especially First Nations) depends on local jobs. Enbridge (the energy utility that has proposed the project) has promised to establish a long-term partnership with affected First Nation communities to make the most economic and social benefits from the project. The Province of British Columbia will benefit from $1.2 billion direct tax revenue and scores of jobs and economic growth opportunities linked directly or indirectly to the project. One great opportunity will be to seed green energy projects in the proximity of the proposed pipeline corridor.

Should the proposed NGW pipeline be constructed, significant electrical power would be needed to run the pump stations along the pipeline. While individual fossil-fuelled generating facilities can provide the necessary power, there is an opportunity to supply the needed energy directly from the provincial grid. The grid extension through the entire length of the corridor would open a wide hallway to harvest alternative energy resources which are available within 100 km of the pipeline. Note that if a renewable power resource (e.g., geothermal or hydro) is greater than 100 MW, it can justify the cost of up to 100 km of power line to connect the resource to the grid.

It is estimated that 107 MW of power (equivalent to 940 GWh/y of energy) will be required for the proposed pipeline portion in BC. This power demand is for the 7 oil/condensate pump stations on the BC section (Fig. 2). In BC, the NGW project will be responsible for supplying connection facilities to BC Hydro, and in Alberta, the utility providers will supply the connection facilities. So far, there is no clear evidence of BC Hydro's ability to meet the electrical needs of the project. The needed power could derive from BC hydro’s grid production, with the additional power supply coming from new renewable energy projects.

GREEN POWER OPPORTUNITIES

Since the beginning of the second decade of the 21st century, there has been a rising interest in building new generating facilities in BC, firstly due to increasing local demand and secondly because of emerging opportunities for green power export to the US and Alberta. BC's desire to transition to a low-carbon economy stipulates that new power supplies must be from renewable and emission-free sources.

Although BC's power supply is dominated by large hydro dams, additional opportunities are offered by geothermal energy, small hydro (run-of-river) and wind power projects for the Province to diversify its renewable energy resources and technologies, especially in the northern regions where the livelihood of communities and industrial growth is strained because of scarcity of sufficient local energy sources. The proposed NGW pipeline can potentially open a corridor for accessing significant renewable energy resources such as run-of-river, geothermal, and wind in this region (Figures 1–4).

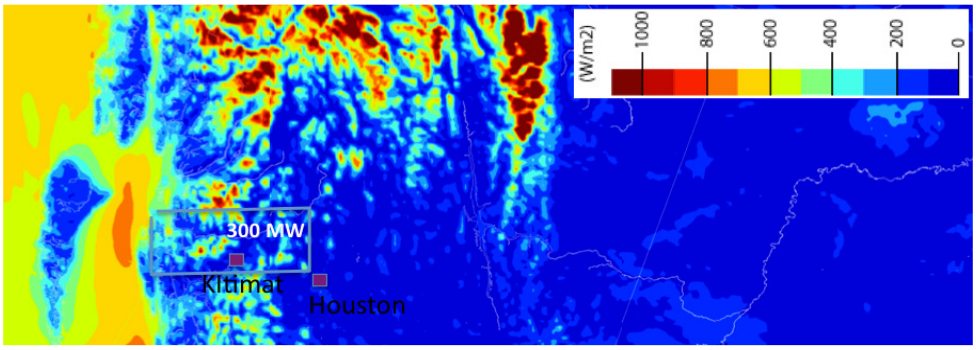

Figure 3 – Wind power resources assoicated with the NGW corridor are mostly concentratred near the western section of the Corridor (between Kitimat and Houston). After Canadian Wind Energy Atlas.

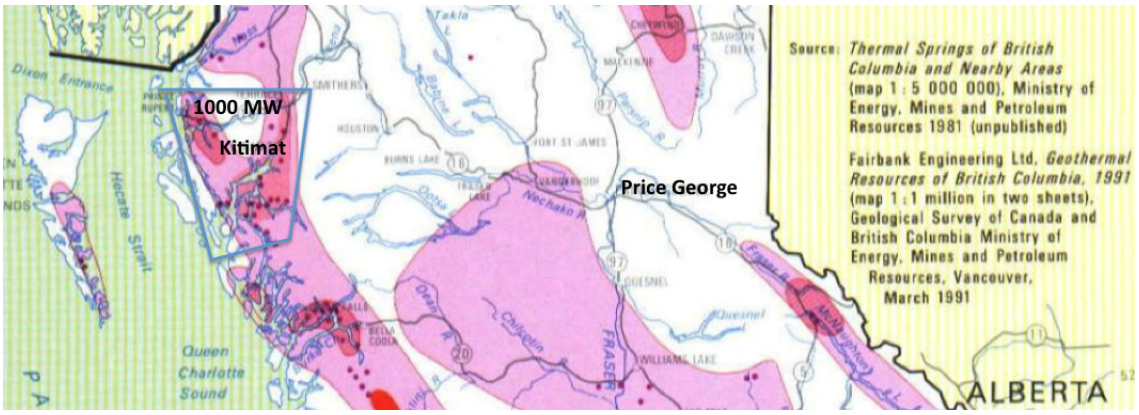

Figure 4 – High-grade geothermal power resources close to the corridor are mostly concentrated near the Pacific Coast. The resources near Alberta border are medium grade (which can be developed at higher cost using EGS technology). After British Columbia Geothermal Resource Map (Fairbank, 1991).

Run-of-river resources are present in both western and eastern sections of the corridor, with a potential of 800 MW (about 600 MW in the west and 200 MW in the east). Wind resources (Fig. 3), which would be accessible through the western portion of the pipeline (i.e., from Kitimat to Burns Lake), are estimated at 300 MW (Figure 3). High-grade geothermal resources are almost totally in the western section of the corridor (closer to Kitimat and Terrace) (Figure 4). The potential geothermal power resources in the western section of the corridor are estimated at 1000 MW. In the eastern section of the corridor, there are

significant medium-grade geothermal resources (Figure 4), which can be developed using enhanced geothermal systems (Arianpoo et al., 2009; Ghomshei, 2010).

These renewable energy resources along NGW can provide an opportunity for generation of more than 2000 MW of power to be added to the regional power supply. Most of this power is in the western section, which can help the energy-intensive mining industry to secure its power demand for healthy and sustainable growth.

Development of regional energy sources is also needed to allow local communities to become more prosperous and expand their economy, demography and culture in a sustainable manner. Development of renewable energy resources not only leads to a healthy growth of northern BC communities, but also contributes significantly to the Canadian energy mix to make it greener and more sustainable.

First Nation communities in northern BC can especially benefit from renewable resources and therefore be able to contribute to developing them. During thousands of years, local First Nations have developed a sound and sustainable relationship and understanding with Mother Earth. For First Nations, geothermal energy, wind and small hydro is a gift and a blessing to provide a sustainable source of clean heat and power to local people who wish to live in harmony with nature.

GREENHOUSE GAS (GHG) EMISSION OFFSET

Large emitters – those that emit > 100,000 tonnes per year of GHG (such as industrial emitters in the Alberta oil sands region) – must meet mandatory reduction targets. Emission from Alberta oil sands is 9% more than that of oil from Saudi Arabia. According to a study by HIS (2013), GHG emissions from mining and upgrading Alberta oil sands is presently around 80–115 kg/barrel of oil; the Canadian Association of Petroleum Products gives a lower (and more realistic) estimate of 75 kg/barrel (CAPP, 2012). Using the CAPP value, the total emission for the 525,000 bpd (of NGW capacity), is estimated at 39,000 tonnes/day (equivalent to 14 million tonnes/year). Considering a price of $35/tonne, the emission cost of the oil carried by the pipeline will be close to $500 million/year. This cost can be offset by carbon credits from renewable energy resources, which can be developed in association with the pipeline.

Each 100 MW of net renewable energy capacity can offset as much as 600,000 tonnes of GHG. To offset the carbon emissions related to the oil running through the proposed NGW pipeline, the proponents should invest in 2300 MW of net carbon-free power capacity. Considering a capacity factor or 90% for geothermal, 30% for wind and 70% for run-of-river, a mix of 1200 MW of geothermal, 800 MW of hydro and 300 MW of wind can offset up to 75% of the emissions related to the oil flowing in the pipeline.

CONCLUDING REMARKS

The proposed NGW oil pipeline project creates an excellent opportunity to become a corridor that can seed renewable energy projects in northern BC and Alberta. It is estimated that close to 2,500 MW of commercially viable wind, geothermal and run-of-river power resources are present in the proximity of the proposed pipeline corridor.

The total GHG emission for the 525,000 bpd (of the NGW capacity), is equivalent to 14 million tonnes of CO_2 per year. A mix of 1200 MW of geothermal, 800 MW of hydro and 300 MW of wind power can be commercially developed along the BC section of the pipeline to offset up to 75% of the emission related to the flowing oil.

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