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Review of Environmental Goals and Sustainable Prosperity Act

A submission to
the Nova Scotia Round Table on Environment and Sustainable Prosperity

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Round Table on Environment and Sustainable Prosperity
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To whom it may concern,

This letter is in response to the call for comments on the Government of Nova Scotia's 2011 review of the Environmental Goals and Sustainable Prosperity Act (EGSPA) (Nova Scotia Environment, 2011). The letter focuses on what the World Bank considers to be central to the economic and social wellbeing of any society, its energy security (World Bank, 2005).

Since the Second World War, Nova Scotia—like most developed jurisdictions—has grown increasingly reliant on readily available and affordable supplies of energy. Availability and affordability, together with growing concerns over the environmental acceptability of different energy sources, are the fundamental concepts used by the International Energy Agency in its definition of energy security, "the uninterrupted physical availability at a price which is affordable, while respecting environment concerns" (IEA, 2010). Availability, affordability, and acceptability can be employed as indicators for measuring the energy security of a jurisdiction (Hughes, 2011).

Over the past decade, production challenges, growing demand from emerging market economies, volatile energy prices, and the environmental impact of energy use have all contributed to energy security becoming a major issue in most developed jurisdictions. One such entity is the European Union, with limited internal energy sources, in which there is a growing concern over relying on Russia for supplies of natural gas (Bilgin, 2009) and the United States, where Canada's tar sands are seen as essential in meeting the goal of "continental energy security" and U.S. "energy independence" (Angevine, 2010; EISA, 2007).

Although the Act mentions "energy" in a number of locations and has two energy-related indicators, neither the Act nor its associated indicators directly address the need to improve Nova Scotia's energy security; instead, the focus is on electricity and energy efficiency. While undoubtedly important, the proposed changes to electricity supply and energy efficiency targets will do little to achieve EGSPA's two primary objectives (Nova Scotia Environment, 2011):

- "to demonstrate international leadership by having one of the cleanest and most sustainable environments in the world by the year 2020" , and
- "to improve the Province's economic performance to a level that is equal to or above the Canadian average by 2020".

Quite simply, by failing to address energy security, it is debatable whether either of these objectives will be achieved by 2020.

Energy systems, Nova Scotia, and energy security

All jurisdictions have an energy system (Hughes, 2011). A generic energy system converts sources of primary energy (such as crude oil, natural gas, and natural resources) into secondary energy (such as gasoline or electricity) for transportation and subsequent conversion into tertiary energy (such as kinetic energy to move an automobile or boiling water in an electric coffeemaker) to meet the needs of an energy service (such as mobility or a cup of coffee). The system is also associated with emissions from the conversion and distribution of energy.

The system consists of one or more energy chains connecting energy sources and energy services; each chain has a series of processes responsible for the conversion and transportation of an energy flow (Hughes, 2011). In addition to these flows of energy, processes also have emissions flows to the environment, which collectively are the system's emissions. Metrics associated with energy security indicators can measure changes to flows to determine their impact on the overall energy security of the system.

Nova Scotia's energy sources

Nova Scotia's two main primary energy sources are crude oil and coal, along with hydroelectricity and natural gas.[1] An estimate of the availability of these sources for Nova Scotia in 2009 is given in Table 1; while a number of the values in the table are estimates, they do give a sense of the current state of primary energy supply in the province.

Table 1: Primary energy availability in Nova Scotia (Statistics Canada, 2011) (in petajoules;[2] '*e*' denotes estimated)

Energy source	Imported	Nova Scotia production	Exports	Available	Percent
Crude oil	120.2	12.2	10.6	121.8*e*	46.4%
Coal	63.1	20.8*e*	0.0	83.9	32.0%
Natural gas	0.0	136.9	103.9*e*	33.0	12.6%
Renewables and imports	1.2	4.5	0.1	6.6	2.5%
Biomass	0.0	0.0	0.0	17.0*e*	6.5%
Total				262.3	100.0%

Almost all of Nova Scotia's crude oil comes from suppliers outside the province, many of whom are facing production problems or internal political conflict, or both; although Newfoundland and Labrador supply Atlantic Canada with crude oil, its fields are in decline and new production is not due on stream until much later this decade (Hughes, 2010a). As previously mentioned, growing world demand for crude oil, coupled with volatile energy markets is affecting its availability and affordability.

[1] For reasons of time, gas plant natural gas liquids have not been included in these calculations.

[2] A petajoule (PJ) is 10^{15} joules is a unit of energy. One petajoule is about equal to the amount of energy required to operate the Montreal subway for one year.

Although Nova Scotia does produce crude oil in the form of natural gas liquids, its supply is limited by the availability of natural gas; since the Sable field is in decline, Nova Scotia's production of crude oil is in decline as well. An estimated one-third of Nova Scotia's supply of coal is from domestic sources, with the remainder imported by ship from countries such as Colombia and the United States; much of this coal is low-sulphur to meet the province's air emissions regulations, on one hand making it more acceptable, while on the other, less affordable.

Nova Scotia's energy services

To understand Nova Scotia's energy system it is also necessary to consider its different energy end-uses or energy services. For example, some researchers discuss energy services in terms of transportation, heating (both space and process), and electricity (Lund & Mathiesen, 2009); Figure 1 shows the distribution of energy to Nova Scotia's energy services in 2009.

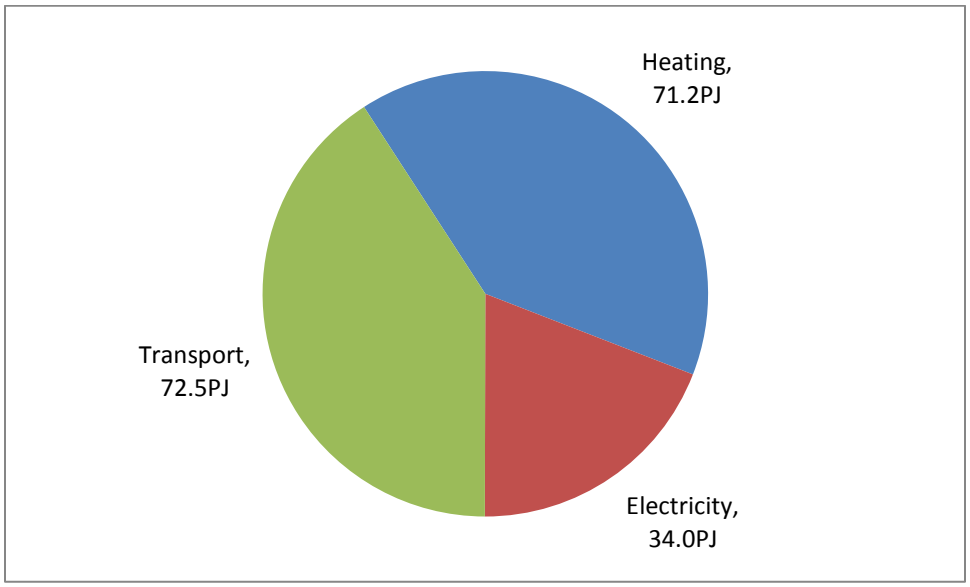

Figure 1: Energy requirements for Nova Scotia's energy services (Statistics Canada, 2011)

Transportation includes all forms of motorized transportation requiring a refined petroleum product (i.e., gasoline, diesel, and aviation fuel), while heating includes light and heavy fuel oil, biomass, electricity, natural gas, and coal. Electricity refers to any activity requiring the use of electricity, such as lighting, cooking, and motors.

Nova Scotia's energy processes

The province has a number of processes converting primary energy to secondary energy, including the Dartmouth refinery and NSPI's generating stations which are connected to local energy services through transmission processes consisting of a fleet of delivery trucks and the provincial grid, respectively. The reliance on insecure sources of energy and ageing infrastructure (both conversion and distribution processes) makes the services reliant on these chains vulnerable to changes in the availability, affordability, or acceptability (or some combination of all three).

Other conversion and transmission processes exist, such as that used for the extraction and distribution of natural gas. In the case of natural gas, the limited availability of interconnections (i.e., a transmission process) means that the vast majority of Nova Scotians are unable to benefit from it.

EGSPA and its energy-related indicators

EGSPA has two energy-related indicators of progress toward the Act's two overarching objectives of becoming "one of the cleanest and most sustainable environments in the world" and improving "the Province's economic performance to a level that is equal to or above the Canadian average" by the year 2020:

Electricity generated from fossil fuels per capita. The focus of this indicator is on electrical generation and the emission of greenhouse gases. According to the 2011 indicator results, Nova Scotia's emissions are at an "unfavourable level" because of "Heavy reliance on fossil fuels to date has limited Nova Scotia to only modest improvements".

The solution adopted by politicians, policymakers, and stakeholders has been to call for more generation of electricity from renewable sources, notably wind. This approach makes little sense for two reasons. First, although electricity generation accounts for about half the province's greenhouse gas emissions, it is not the only source; for example, space and process heating and transportation account for almost as much. Secondly, by concentrating on electricity production rather than the province's energy-services, the electricity supplier is forced to handle wind's significant variability using scarce provincial hydroelectricity, natural gas, and imported supplies of electricity.

While one could argue that this is an indicator of energy security acceptability, it is insufficient, as almost every other energy service in the province uses an energy chain that contributes to greenhouse gas emissions. In other words, all greenhouse gas emissions need to be addressed.

Energy productivity. This indicator is a measure of the province's GDP per terajoule of energy consumption; in other words, energy efficiency. According to the 2011 indicator results, energy productivity is at a "favourable level" because the "Growth rate (05-09) leads the country and is above the Canadian average".

The choice of energy productivity (efficiency) as an indicator at such an aggregated level as GDP is not meaningful because of the heterogeneous nature of the output (USDOE, 2008). Furthermore, the type of energy used in an activity is not considered, nor is the fact that different provinces have different economies and, for as trivial as it may seem, different climates. In short, energy productivity in terms of GDP should not be used as an indicator.

Improving Nova Scotia's energy security

Based upon the above discussion regarding Nova Scotia's energy system, one can conclude that it is necessary to improve the province's energy security for the following reasons: its overwhelming reliance on imported energy; the scale and nature of some domestic renewable sources and the state of its infrastructure (availability); the rising cost of energy in international markets and upgrading existing infrastructure (affordability); and the consequences of using

some of these energy chains (acceptability). If EGSPA is to live up to its objectives, it needs to be amended and include regulations based upon policies that recognize the nature of Nova Scotia's energy system.

In (Hughes, 2009), the basics of energy security policy are discussed; while in (Hughes, 2011), they are explained in terms of energy processes and flows. The following is a brief summary of the three categories of energy policies that need to be incorporated into EGSPA in order to improve the province's energy security to help achieve its future sustainability; before policies can be implemented, it is necessary to **review** the system, its chains, processes, and flows:

Reduction. Reduction policies are those that reduce the amount of energy required by a process to perform a task; neither the process nor the type of energy it converts or distributes is changed. Lowering a room's temperature during the heating season is an example of an energy reduction.

Replacement. A replacement policy is one that changes a process or the energy used by the process, but not both; regardless of the change, the energy flow from the process remains unchanged. Examples of these policies include actions such as replacing a subcritical coal-generating facility with a supercritical or ultra-supercritical facility or replacing an ageing grid with a new upgrade.

Restriction. Policies that change both the process and the energy flow to the process are referred to as restriction policies. The energy produced by the restricted process is the same as that of its predecessor; for example, converting a coal-fired thermal generating station into a gas-turbine with the output flows being electricity in both cases.

Policies themselves are not measureable; however their outcomes are. The effectiveness of any energy security policy can be measured in terms of changes to the flows in terms of their availability, affordability, and acceptability.

In Nova Scotia, policies need to begin by considering the energy services and the energy chains used to meet the energy demands of these services. From there, secure processes can be matched with secure sources. Since domestic energy sources are typically more secure than imported ones, every effort must be made to keep the energy the province produces within the province instead of exporting it (as has taken place in the past with crude oil in the 1990s, natural gas and wood chips over the past decade, and now talk of exports of wind-energy to New England). As an example, rather than simply producing more electricity from variable sources such as wind and exporting it, uses of the variable electricity should be identified first and then the necessary chains developed; matching wind with storage heaters is one such example (Hughes, 2010b; Hughes, 2010c).

Examples of other potential policy recommendations for improving energy security in Nova Scotia can be found at http://lh.ece.dal.ca/enen.

Summary

Although one can argue that Nova Scotia's energy sources are secure at the moment; increasing demand for all sources of primary energy, unstable energy prices (caused by both energy supplies and infrastructure), and environmentally unacceptable uses of energy are putting

additional strains and burdens on a growing number of Nova Scotian families (for example, see (Hughes & Ron, 2009)). A shock to the energy system—such as the unexpected loss of availability of an energy flow or a sudden price spike in an energy flow—would impact many Nova Scotians. The province is ill-prepared for such an eventuality. As has been shown in many jurisdictions worldwide, a decline in energy security will result in a decline in the economic and social wellbeing of the province.

The title of the Act under review is "Environmental Goals and Sustainable Prosperity Act". Unless the province undertakes actions to improve the province's energy security, there is little likelihood of the province achieving "sustainable prosperity" by 2020. EGSPA and its associated regulations should be amended to reflect this necessity.

Yours sincerely,

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