Energy security and crude oil in Atlantic Canada

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Overview

- Unlike most of Canada which uses natural gas, Atlantic Canada relies heavily on light fuel oil for space heating
- Over 80% of the crude oil used for refining in Atlantic Canada is imported
- The majority of the region's crude oil suppliers (both domestic and international) are facing some sort of supply problems
- Western Canadian crude oil could improve Atlantic Canada's energy security
- Two possible routes of western Canadian crude to Atlantic Canada are via pipeline from Montreal to Portland and then by tanker or directly from Montreal by tanker

1 Introduction

Canada, like most of the developed world, converts a limited number of primary energy sources (notably crude oil, coal, natural gas, hydroelectricity, nuclear power, and combustible renewables) into secondary energy (oil products, natural gas, and electricity). This energy is then distributed for conversion into tertiary energy services, such as transportation, heating and cooling, and electricity (IEA, 2011). However, unlike most of the developed world, Canada is blessed with energy resources which allow it to be a net energy exporter.

Canada's energy resources are not evenly distributed, meaning that some provinces have an abundance of crude oil and natural gas while others are endowed with a geography that allows the development of renewable hydroelectricity. This uneven distribution of energy resources has resulted in some regions being unable to benefit directly from the nation's energy wealth. Perhaps this is best illustrated in eastern Canada (Ontario, Quebec, New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island) where upwards of 70% of the crude oil is imported to meet refining demand (Hughes, 2010).

The problem is particularly acute in Atlantic Canada since the region does not have access to western Canadian crude (either conventional or unconventional) and crude production from offshore Newfoundland and Labrador is in decline. As a result, the region relies on crude oil from jurisdictions with supply challenges or political uncertainty, or both, as well as increasing competition for supplies from new markets such as China.

This situation, coupled with the region's lack of significant hydroelectric potential and negligible natural gas resources, means that energy security is an issue in Atlantic Canada.

For the purposes of this paper, the definition of energy security is that developed by the International Energy Agency (IEA), "the uninterrupted physical availability at a price which is affordable, while respecting environment concerns" (IEA, 2010). This definition can be parsed into three energy security indicators: availability ("the uninterrupted physical availability"),

affordability ("a price which is affordable"), and acceptability ("respecting environment concerns") (Hughes, 2011). In Atlantic Canada's case, the rising price of crude oil and its refined products is making affordability an issue for many individuals and families. Over time, as the region's supplies of crude oil become more difficult to access, it is reasonable to assume that availability will also become an issue.

Given the importance of crude oil and its products to the region and the fact it dwarfs that of natural gas, the focus of this brief is on the uses of oil products, the crude oil suppliers, and ways in which the region's energy security could be improved.

2 Tertiary demand for refined petroleum products

Atlantic Canada's tertiary energy demand is met, as it is in the rest of Canada, from three secondary energy sources: oil products (such as gasoline, diesel fuel, and light fuel oil), natural gas, and electricity. As Figure 1 shows, what differs between Canada and Atlantic Canada is not so much the type of energy, but the amount available for consumption.

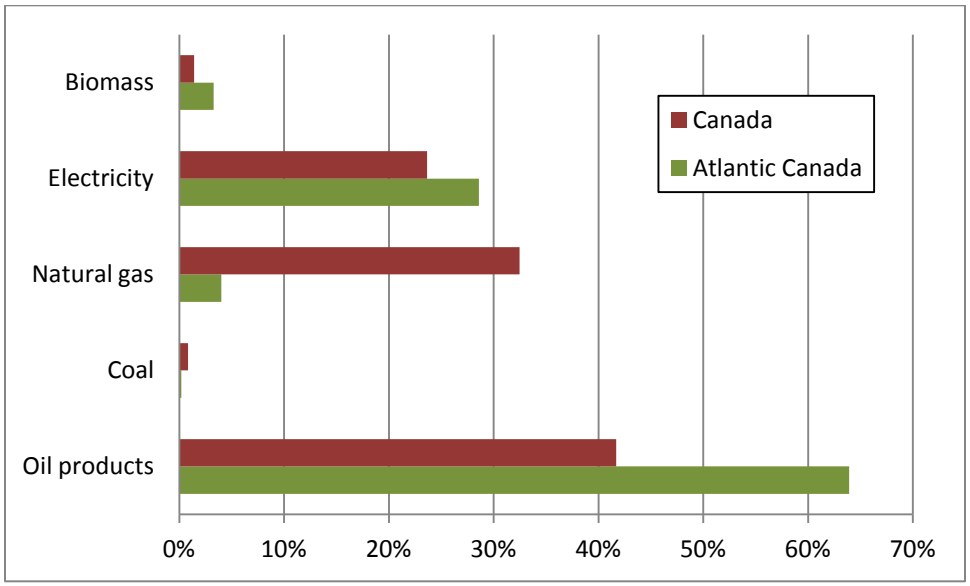

Figure 1: Secondary energy availability in Canada and Atlantic Canada (Statistics Canada, 2011) (Biomass estimated from (NRCan, 2011))

The most glaring difference is the lack of natural gas availability in Atlantic Canada, forcing the industrial, residential, and commercial and institutional sectors to rely on oil products, electricity, and biomass for process heat and space heating. With the significant price differential between oil and natural gas, this affects Atlantic Canada's economy.

Of the two energy services that rely most heavily on oil products in the region (transportation and space heating), the most significant differences in oil consumption are for heating, where natural gas dominates in Canada, whereas heating oil and to a lesser extent, electricity, are the sources available to Atlantic Canadians. The differences are highlighted in Figure 2.

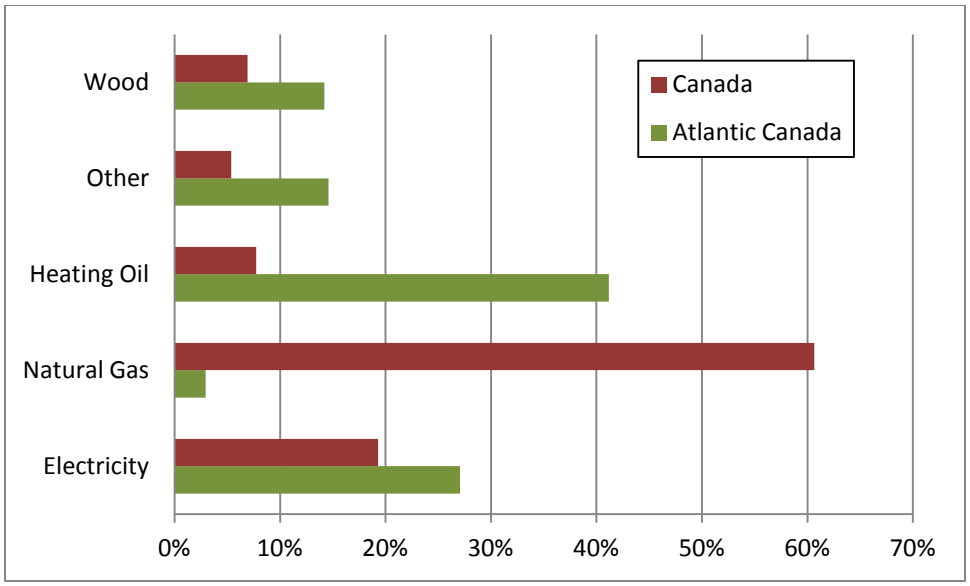

Figure 2: Percentage energy use for space heating in Residential and Commercial/Institutional buildings in Canada and Atlantic Canada (NRCan, 2011)

In the transportation sector, there appear to be few differences between fuel consumption in Atlantic Canada and Canada since the same type of vehicles are used across the country, although Atlantic Canadians drive cars and light trucks longer distances, whereas in Canada, medium and heavy trucks are driven longer distances. These differences are shown in Table 1.

Table 1: Characteristics of vehicle in Canada and Atlantic Canada (NRCan, 2011)

Vehicle type	Canada			Atlantic Canada		
	Distance (km)	Fuel consumption (L/100km)		Distance (km)	Fuel consumption (L/100km)	
		Gasoline	Diesel		Gasoline	Diesel
Cars	17,629	8.7	6.4	18,776	7.6	5.4
Passenger Light Trucks	17,722	11.8	10.8	18,049	12.0	11.5
Freight Light Trucks	20,507	12.0	11.3	18,369	12.1	11.7
Medium Trucks	22,652	25.4	24.4	19,071	25.1	24.4
Heavy Trucks	82,863	-	33.4	49,870	-	34.4

2.1 Energy security implications

Of the three energy security indicators, neither availability nor acceptability are that significant a factor in Atlantic Canada at present since there have been few fuel oil supply problems and despite the growing awareness of climate change issues, petroleum is used for both transportation and heating. However, the same cannot be said of affordability, as the rising prices of the energy products used in the region are resulting in the price rise of both oil products and electricity.

With the exception of the 2007-08 heating season when a variety of factors caused world oil prices to increase significantly, there has been a steady increase in the price of light-fuel oil in

the region (see Figure 3). For example, between the 2005-06 and the 2011-12 heating seasons,[1] the price of light-fuel oil increased by more than 34% in Charlottetown.

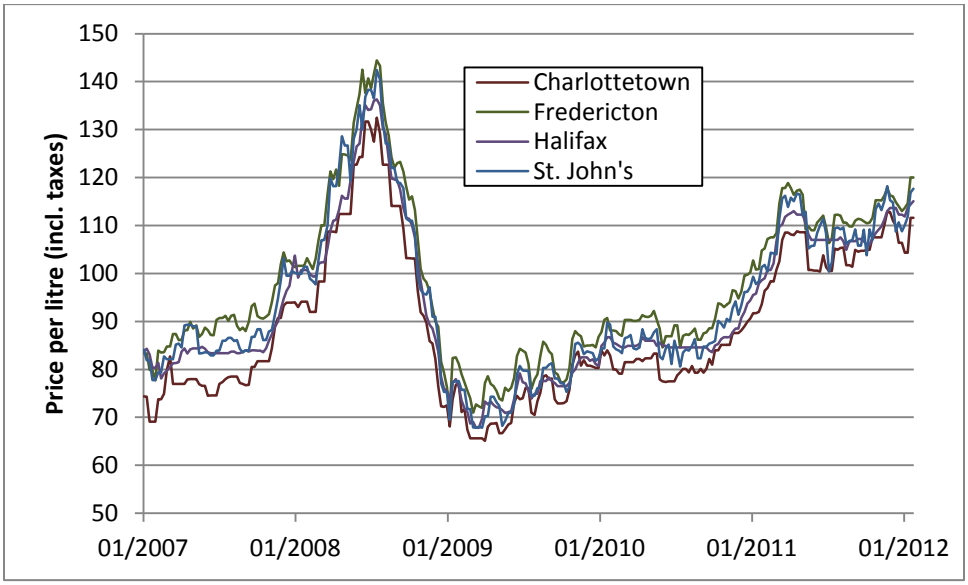

Figure 3: Weekly prices for fuel oil in four provincial capitals (NRCan, 2012)[2]

Changes to affordability can also be examined in terms of their effects on end-users of the service (e.g., household, commercial, or industrial) and their ability to pay; consider, for example, the percentage of household income required for heating and electricity. Table 2 is a comparison of average household energy affordability for Atlantic Canada and Canada; although shelter costs are lower in Atlantic Canada than Canada as a whole, the reliance on light fuel oil for heating, the cost of electricity, and the lack of availability of natural gas means that energy takes a larger percentage of shelter costs (from about 20% to 27% as compared to 14%).

Table 2: Average-household energy costs in Canada and the four Atlantic Canadian provinces for 2009 (annual) (Statistics Canada, 2011e; Statistics Canada, 2011d)

	NB	NL	NS	PE	Canada
Total shelter costs	$10,627	$9,534	$11,524	$11,107	$14,095
Total shelter-related energy costs	$2,507	$2,573	$2,293	$2,768	$1,946
Percent of shelter costs for energy	23.6%	27.0%	19.9%	24.9%	13.8%
After-tax income (all family units)	$43,100	$44,900	$42,100	$46,400	$48,300
Percentage of after-tax income for energy	5.8%	5.7%	5.4%	6.0%	4.0%

Although the percentage of after-tax income required for energy is higher in the region than in Canada as a whole, in some provinces such as PEI, it is getting close to the 8% to 10% cutoff

[1] The heating season refers to those months during which home heating is required; in PEI this spans from September to December in one year and January until May in the next.

[2] It is important to remember that the prices in this graph are for urban as opposed to rural communities. Salaries are often higher while oil product prices (for both fuel oil and transportation fuels) are typically lower in urban centers, adding to the cost of these products for rural consumers.

used to determine if a household is in energy poverty (Boardman, 2009). Recent research suggests that by this definition, some households in Nova Scotia are in a state of energy poverty (Hughes & Ron, 2009).

Although there has been a gradual shift away from fuel oil for space heating (driven in part by liability issues associated with leaking fuel oil tanks) to electric heating and wood in the residential sector over the past few years, both electricity and wood are experiencing price increases: electricity because of rising cost of coal and oil products for thermal generation and rising fuel costs for wood harvesting. Furthermore, both depend on sources of imported crude oil, oil products, and coal.

3 Crude oil supply

When compared to the rest of Canada, Atlantic Canada relies disproportionately on oil products, primarily for space heating. Furthermore, the regions' three refineries rely principally on supplies of crude oil from foreign as opposed to domestic suppliers (the same holds true for Quebec's refineries, while Ontario has access to crude oil from western Canada) (Hughes, 2010). In itself, there is nothing wrong with relying on foreign supplies of crude oil, as long as the supplies are secure (i.e., available, affordable, and acceptable); this is well illustrated with the push in the United States to replace crude from Saudi Arabia (amongst others) with that from Canada.

In 2010, Atlantic Canada's refineries used 157.96 million barrels of crude oil, about 83% of which was imported; the remainder came from offshore Newfoundland and Labrador (27.09 million barrels) (Statistics Canada, 2011). As Figure 4 shows, since 2000, there has been little change in the countries that supply the region with crude oil, although the volume supplied by each has changed; the increase in supply in the early part of the last decade was to meet the refinery expansion in Saint John.

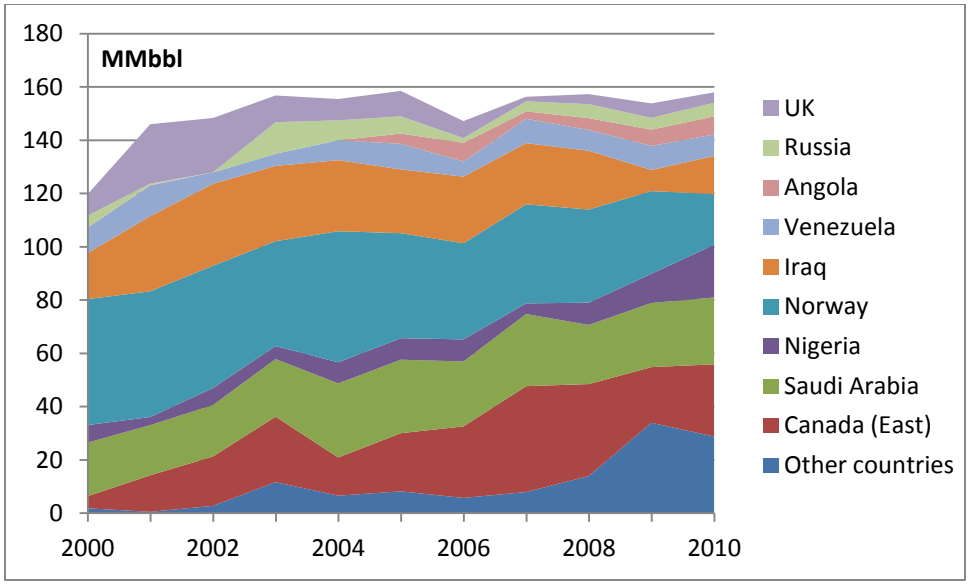

Figure 4: Crude oil suppliers for Atlantic Canada (Statistics Canada, 2011)

Atlantic Canada has a diverse range of suppliers, which is considered by many energy analysts to be a sign of a secure supply (for example, see (Yergin, 2006)); however, there is more to

security than diversity. A cursory examination of Figure 4 shows that the availability of supply from most suppliers is changing; production from offshore Newfoundland and Labrador's (Canada (East)) four fields peaked in 2007 at 134.48 million barrels with two of the fields (Terra Nova and White Rose) appearing close to abandonment (CNLOPB, 2012). Like eastern Canadian crude, production from several of the region's suppliers has peaked, notably Norway (2001), U.K. (1999), Russia (1987), and Venezuela (1970) (BP, 2011).

In addition to changing availability, the political (as opposed to environmental) acceptability or risk associated with the region's suppliers is another factor affecting the long-term security of the region. Table 3 lists the risks and year of peak production of each of the region's foreign suppliers: the two most secure (Norway and the U.K.) peaked about a decade ago, while the others all exhibit some form of domestic security risk or political stability risk, or both. The risks and production challenges faced by these suppliers, coupled with growing demand for crude oil and its products in China and emerging market economies (IEA, 2011), can be expected to affect the availability of crude oil to the region. For example, growing sectarian violence in Nigeria and political instability in the Middle East could lead to sudden and unexpected shortfalls in its availability.

Table 3: Risks associated with foreign suppliers (from (Hughes, 2010))

Country	Domestic security risk	Political stability risk	Production peak year
Norway	A	A	2001
U.K.	A	B	1999
Angola	B	C	N.R.
Saudi Arabia	C	C	Plateau
Russia	C	C	1987
Venezuela	D	D	1970
Nigeria	E	C	Plateau
Iraq	-	-	N.R.

Finally, the crude oil used in Atlantic Canada's refineries is based on Brent (i.e., Atlantic Basin) as opposed to WTI (North American) prices. Although both have increased significantly over the past decade, they have decoupled and Brent prices are higher, thereby affecting affordability.

4 Discussion

When compared to the rest of Canada, Atlantic Canada relies disproportionally on imported crude oil for the production of its oil products and light fuel oil for space heating. Oil market volatility driven by production challenges and rising global demand means that steps need to be taken to improve energy security in Atlantic Canada; this can be done through energy reduction, replacement, and restriction policies (Hughes, 2009).

4.1 Reduction

Reduction policies are those that result in a reduction in consumption of a particular energy flow without actually changing the type of energy used or the means of its combustion. Low cost examples, often referred to as conservation methods, include driving at slower speeds, trip

chaining, and lowering average room temperatures. If funds are available, other energy-reduction actions are possible; for example, buildings can be retrofitted with energy reduction technologies.

The purpose of these methods is to improve the overall affordability of the energy since less is consumed. Changes affecting the availability of the energy source negatively will still affect the consumer.

4.2 Replacement

Replacement policies are those that change how the energy is consumed or change the source of the energy flow (but do not change its type). Existing automobiles or oil furnaces could be replaced with more fuel efficient models. As with energy reduction, replacing the process but not the fuel source will lead to improvements in affordability but ultimately offer no improvement in availability.

Replacement policies that improve availability require entirely new sources of energy (in this case, crude oil) from secure suppliers. Since most of Atlantic Canada's crude oil suppliers have reached a plateau or are in decline or are facing some form of political instability, or both, it is necessary to find a secure replacement. An examination of the world crude oil market would suggest that there are few alternatives that can be secure, other than Canada.

Production of western Canadian crude oil from unconventional sources (notably the tar sands) is increasing and, given that it is a domestic source, is secure in terms of its availability and affordability, although some question its acceptability. The problem, as shown by many, is moving the crude from western sources of production to Atlantic Canada; for example, a new pipeline from Montreal to refineries in New Brunswick and Nova Scotia is considered to be too expensive (Mintz, 2011). There are however, alternatives to a new pipeline.

4.2.1 Montreal-Portland-Atlantic Canada

One alternative is to ship western Canadian crude oil to Montreal through Enbridge's Line 9 from Sarnia, then to Portland via the Portland-Montreal pipeline, and finally to Atlantic Canadian refineries by tanker. Much of this route has already been proposed by Enbridge with its Trailbreaker project in 2008, which required reversing both Line 9 and the Portland-Montreal pipeline; up to 150,000 barrels per day of western Canadian crude oil would then be available in Portland for shipping by tanker to U.S. Gulf Coast refineries (Calgary Herald, 2008; Enbridge, 2008).

Although Atlantic Canada's refineries required 157.96 million barrels of crude oil for their operation in 2010 (about 432,800 barrels a day) to produce some 468,000 barrels a day of refined product, only 64,000 barrels a day of this product were consumed in the region (Statistics Canada, 2012); meaning that in terms of capacity, this alternative would more than meet the region's demand for crude oil. However, the quality of the crude (that is, bitumen or synthetic crude) could dictate whether some of the region's refineries would require modification (Mintz, 2011).

4.2.2 Montreal-Atlantic Canada

Enbridge shelved the Trailbreaker project in 2008 because of delays in tar sands development (Calgary Herald, 2008). However, in the summer of 2011, Enbridge applied to the National Energy Board to begin the process with the reversal of Line 9; this resulted in public opposition

in both Canada and the United States (i.e., it is an acceptability issue) (Vanderklippe, 2011). However, this does not preclude the use of western Canadian crude in Atlantic Canada; a second, all-Canadian alternative is to ship western Canadian crude oil to Montreal and then via tanker to Atlantic Canadian refineries. Since crude oil is already shipped to Montreal by tanker via the Saint Lawrence throughout the year, the conditions for shipping crude oil in the reverse direction from Montreal to Atlantic Canada already exist. As with the Montreal-Portland route, changes could be required to some of the region's refineries in order to process the crude.

The direct route from Montreal to Atlantic Canada by tanker offers a number of advantages over a pipeline. First, other than the possible construction of port facilities in Montreal, no other construction is required. Second, it will not be subject to the same objections that confronted the proposed reversal of the Portland-Montreal pipeline. Third, it offers flexibility; should demand for crude oil change in Atlantic Canada (see section 4.3), the cost of change will be minimal. Finally, it is way of improving energy security in Atlantic Canada.

4.3 Restriction

Restriction policies are those that change both the type of energy and the method of conversion; in this case, space heating would be restricted to sources other than light fuel-oil and conversion processes other than oil furnaces. At present, there are few alternatives to light fuel-oil:

Natural gas. The availability of natural gas in the region is limited primarily to a few locations in Nova Scotia and New Brunswick which have spurs from the M&NE pipeline running between the Sable offshore project to Guysboro and New England. In Nova Scotia, Sable production is in decline and there have been repeated delays in bringing EnCana's Deep Panuke on-stream (CNSOPB, 2012). Another possible source of natural gas is from Newfoundland and Labrador. An LNG facility proposed for Nova Scotia was cancelled (Daily Commercial News, 2010). An LNG facility exists in Saint John which uses the Brunswick pipeline to supply the natural gas to New England markets (Emera, n.d.). The lack of infrastructure means that there is little opportunity to make significant progress in improving energy security with natural gas in the region.

Biomass. As shown in Figure 2, there is already a considerable use of biomass in the region for space heating, although most of this is limited to the residential sector as opposed to the commercial/institutional (NRCan, 2011). Wood chips and pellets are produced in the region; however, much of this is exported and has led to shortages in the past. Nova Scotia Power was considering the use of biomass co-firing with coal, but abandoned the project. If biomass is to be used for heating, provincial energy policies will be required to encourage the development of the industry.

Electricity. There has been a push for modern-renewables (that is, renewables that supply electricity) over the past decade in the region; as a result, a growing number of wind-farms are being developed, primarily in Prince Edward Island and Nova Scotia. These sources are variable, meaning that they cannot be relied upon to produce a continuous, stable supply of electricity. Although they do not produce greenhouse gases directly, for electricity suppliers to incorporate wind into their energy mix, it is necessary to have some form of backup (typically gas turbines or hydroelectricity) to meet any shortfalls. In some cases, when there is excess

wind it is not exported, rather thermal stations continue operating, negating the greenhouse gas reduction benefits associated with renewable electricity.

As with both fuel-oil and biomass, the region uses more electricity for heating than the national average. Since most of this is for electric baseboard heating, both the federal and provincial governments are encouraging the use of electric heat pumps. While heat pumps are undoubtedly efficient, they require a stable supply of electricity, something that variable renewables do not offer.

Non-traditional approaches. The region has a district heating system in Charlottetown which heats the university, hospital, and some commercial buildings. Although there has been limited interest in district heating elsewhere in the region, the lack of density in urban areas is hampering its development.

The City of Summerside has its own wind-farm that produces electricity for the community. In order to minimize exports of excess wind, the City is developing a wind-heating program in which wind-electricity is stored in electric-thermal storage units for heating (Hughes, 2010). This allows buildings to be heated with a secure source of energy which is available from a domestic source, is affordable when compared to oil heating, and is acceptable as it produces few emissions.

5 Summary

Despite Canada being one of the world's major oil producers, much of the country relies on imported crude oil to meet domestic demand for refined petroleum products. Growing world demand for crude oil and increasing production challenges means that rising prices for crude oil are making affordability an energy security issue in many jurisdictions, including regions of Canada.

One such region is Atlantic Canada, which relies on fuel oil for space heating in residential, commercial, and institutional buildings rather than natural gas as in the case of much of the rest of Canada. As a result, rising crude oil prices are affecting the affordability of space heating, adding to the financial burdens of Atlantic Canadians.

A longer-term concern is the region's reliance on non-domestic supplies of crude oil since some of the suppliers are facing production problems, political problems, or both. With the rise in demand for crude oil in non-OECD countries in Asia such as China, supply problems could affect the availability of crude oil for the region.

By replacing insecure supplies of non-domestic crude oil, Canadian crude oil from the tar sands could address the long-term availability problem facing the region. For example, crude oil could be shipped from Alberta to Montreal by pipeline and then to Atlantic Canada by tanker.

While energy importing jurisdictions are looking for supplies of energy that are available, affordable, and acceptable, energy exporters are looking for stable markets that can pay for the product. With its focus on energy exports, Canada seems to have forgotten that it is both an exporter and importer of energy. It is time to address the issue of energy security and Canadian energy imports.

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