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Energy security in the residential sector

Rapid responses to heating emergencies
Part 2: Nova Scotia

By Larry Hughes and Dave Ron

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Summary

Energy security is necessary for the wellbeing of any society. It entails ensuring that members of the community have access to secure supplies of affordable energy. A heating emergency can occur when the energy security of an individual, family, or entire community is put in jeopardy because the energy needed for space heating becomes unaffordable or unattainable because of rising energy costs, supply shortages, or both. If heating fuel costs rise too rapidly or there are shortages of energy supply, fuel budgets may be stretched to the breaking point where it is impossible for individuals or families to maintain a safe level of heating in their residence, leading to heating emergencies. In these cases, different levels of government need to assist those in need.

Ideally, heating emergencies would be rare events, an exception rather than the rule that could easily be addressed; however, unpredictable energy costs and the potential for shortages are expected to increase the threat of heating emergencies. Since long-term reduction and replacement policies are inadequate in these situations, these two reports discuss the need for policies to address immediate or short-term heating requirements.

The first report in this two part series, *Energy security in the residential sector: Rapid responses to heating emergencies, Part 1: Fundamentals,* describe actions that can lead to rapid and immediate assistance during a residential heating emergency that are not targeted to a specific jurisdiction. This report would be useful for any individuals, families, communities, or governments that want to understand the financial and health implications associated with changes in heating supplies and prices and the need for action.

This report, the second one of the series, focuses on the province of Nova Scotia. This report illustrates the specific ways that heating emergencies challenge jurisdictions and considers what factors either decrease or increase the likelihood of heating emergencies. It reviews Nova Scotia's present energy mix in terms of residential heating, examines existing programs, and recommends actions to address both immediate and future heating emergencies.

Key Findings

Nova Scotia is primed for heating emergencies. The housing stock in the province is old and often poorly insulated, with a large number heated by inefficient oil furnaces, resulting in high energy demand. For example, 22.9% of Nova Scotia's housing stock was constructed prior to 1947 compared to the 15.3% of the Canadian average.

Additionally, in recent years, Nova Scotia Power's ageing grid has been prone to brownouts and blackouts—increasing the likelihood of heating emergencies for many Nova Scotians as well as being detrimental to the provincial economy. The importance of electricity for space heating cannot be over emphasized. Electricity is used for electric space heating; although most homes in Nova Scotia still heat with fuel oil, the majority of new homes in the provinces are being installed with electric heating, while other heating systems, notably oil furnaces and pellet stoves, require electricity to operate.

Most of Nova Scotia's residential energy sources are insecure. Nova Scotia imports over 80 percent of its energy and each of the province's major suppliers is experiencing problems that currently do, or could, affect supplies. This is significant when some 63 percent of homes use oil products (primarily fuel oil); 23 percent, electricity (most of which is generated from imported coal, petroleum coke, and other oil products); about 12 percent, renewables, almost exclusively wood, and a limited amount of natural gas.

In addition, there is a lack of infrastructure to distribute natural gas throughout the province and Nova Scotia has no significant energy corridors to the rest of Canada.

A growing number of families in Nova Scotia are facing fuel poverty because they have to pay more than eight percent of their after-tax income for space heating.

The estimated percentage of after-tax income that will be spent on energy varies by income level and depending on the heat source. The percentage that households with the highest after-tax income (quintile five) spend ranges from 1.6 percent (wood) to 2.9 percent (low efficiency fuel oil furnace); whereas for households with the lowest after-tax income of $22,600 or less (quintile one), the minimum ranges from 6.4 percent (wood) to 11.2 percent (low efficiency fuel oil furnace) of after-tax income. All households with the lowest after-tax income and about half of the households with after-tax incomes between $22,600 and $36,800 that use fuel oil in a low-efficiency furnace or electric heating can be expected to spend over eight percent of their after-tax income on space heating alone during the 2008–09 heating season. As fuel prices rise or the need for space heating increases, the number of Nova Scotians falling into fuel poverty will increase, thus risking their exposure to a heating emergency.

The provincial government's heating emergency programs leave many families in need without enough support and are not adequately designed or targeted.

The provincial government's assistance programs related to heating emergency can be divided into two broad categories: those designed to help consumers reduce their energy consumption, and those that provide financial assistance to offset the costs.

Recommendations

Energy Reduction Programs

Most of the energy reduction suggestions expect access to tools and materials that may be beyond the reach of those on low-income. In addition, based on the long lead times associated with home energy audits and the Residential Energy Affordability Program's limited budget of $1.6 million, this program will do little to help Nova Scotians during heating emergencies.

- To help reduce the number of households facing future heating emergencies, it is necessary to increase the funding for programs targeting existing homes and to change the building code so that new homes require less energy for heating.
- There must be a concerted effort to replace existing, insecure sources of energy with ones that are secure. To meet these recommendations, college and university programs are required to train Nova Scotians on how to build houses requiring less energy, install energy systems that consume secure sources of energy, and develop new, secure energy supplies.

Financial Assistance Programs

Despite the development of several financial assistance programs ("Your Energy Rebate" Heating Assistance Rebate Program, Heat Smart, the Good Neighbour Energy Fund, and the Residential Energy Affordability Program), those in need of assistance may still face not being able to obtain sufficient levels of funding, while those not requiring assistance may receive benefits with the result that many individuals and families in real need fall further into fuel poverty.

- If rebates based upon electricity usage are to target those with electric heating, it is necessary to introduce the appropriate metering and billing. NSP's continued use of induction meters means that Nova Scotians are unable to benefit from new billing schemes, proper fuel rebates, and new uses of renewable electricity. The government should require NSP to record hourly residential energy consumption using interval or time-of-use meters. With this information, the daily consumption can be determined and taxed appropriately.
- In addition, viable alternatives exist to lump-sum payments, such as offering guaranteed fuel prices to those facing heating emergencies.

Energy Preparedness

The province's preparedness to provide essential services during heating emergencies is inadequate.

The provincial government's Emergency Management Act "allows" the province to oversee the production and distribution of production from Imperial Oil's refinery in Dartmouth, however, its ability to do so is questionable. In reality, if there is no crude oil supply, there would be no production to oversee, and moreover, provisions in the North American Free Trade Agreement (NAFTA) prohibit such actions.

- As an alternative in times of heating emergencies, the province could obtain diesel fuel from fuel stations that sell diesel and supply it to those in need.
- The province has identified a number of fire halls and churches that can become "Comfort Centres" during heating emergencies to allow people to drop by, have a meal, and obtain blankets. However, the proposed number of shelters, the facilities they offer, and their heating sources (insecure oil and propane) can be expected to do little during a prolonged heating emergency.
- Protocols should be established for any public centre, gymnasium, dormitory, fire hall, church building, or school to be converted to a Comfort Centre to ensure that all Nova Scotian residents have equal access to shelter during an outage or supply shortage. At a minimum, buildings for possible accommodation during heating emergencies should be equipped with furnaces that can use secure energy sources, such as biomass.

Conclusion

The report concludes that years of inaction and misguided energy policies have made Nova Scotia and Nova Scotians vulnerable to the vagaries of the energy market and extremely energy *insecure*. Without changes to improve the energy security of its residential sector, Nova Scotia will continue to face heating emergencies. This problem will grow more acute as energy markets become more volatile. In addition, current heating assistance programs and emergency management office leave the province ill-prepared for a heating emergency. Policies and programs are needed to address both immediate and future heating emergencies. Tackling the problem of heating emergencies means improving energy security, while at the same time having programs in place to help those who experience a heating emergency. Improving energy security requires changes to existing housing stock through policies and programs that reduce energy consumption and replace insecure energy sources with those that are secure.

1 Introduction

Energy security, the access to secure supplies of affordable energy, is necessary for the wellbeing of any society (IEA, 2001; World Bank, 2005). The disruption of supply, the failure of distribution infrastructure, or significant price increases can all contribute to the loss of energy security for an individual, family, community, or entire nation. During the heating season[1] in northern countries, energy security is of particular importance in the residential sector. Many individuals and families living in these jurisdictions are vulnerable to the vagaries of the energy market, often requiring them to spend a significant portion of their income on space heating and subsequently forcing them into "fuel poverty" or "energy poverty" (BERR, 2001; Chisholm, 2008). In more extreme situations, a heating emergency can occur when the energy security of an individual or family is put in jeopardy because the energy needed for space heating becomes unaffordable or unattainable (Hughes, 2009).

Tackling the problem of heating emergencies means improving energy security, while at the same time having programs in place to help those who experience a heating emergency. Improving energy security requires changes to existing housing stock through policies and programs that reduce energy consumption and replace insecure energy sources with those that are secure. New construction offers an opportunity to reduce energy consumption through the introduction of stringent building codes, ideally exceeding that of the existing housing stock, and by restricting heating sources to secure energy supplies.

As energy prices and supplies become more volatile, individuals, families, communities, and jurisdictions, especially those with a building stock constructed during times of inexpensive energy, will still need to prepare for heating emergencies. This report considers the likelihood of heating emergencies in the Canadian province of Nova Scotia, one with an older building stock, a significant population of elderly and low-income families, and which obtains over 80 percent of its primary energy from insecure and potentially insecure sources. It reviews Nova Scotia's present energy mix in terms of residential heating, examines existing programs, and recommends actions to address both immediate and future heating emergencies.

2 Background

Nova Scotia is one of the three Maritime Provinces located on Canada's east coast. It is Canada's second smallest province (52,840 square kilometres) with a population of about 934,400 (Nova Scotia Finance, 2007). With limited domestic energy sources (much of which is exported to the United States), Nova Scotia imports over 80 percent of its energy from a variety of suppliers, including Venezuela (oil and coal), Colombia (coal), the United Kingdom (oil), the Middle East (oil), and Newfoundland and Labrador (oil) (Hughes, 2007a). Each of the province's major suppliers is experiencing problems that currently do, or could, affect supplies: political instability (Venezuela, Colombia, and the Middle East), declining production (United Kingdom and Newfoundland and Labrador), and contractual disputes (Colombia and Venezuela).

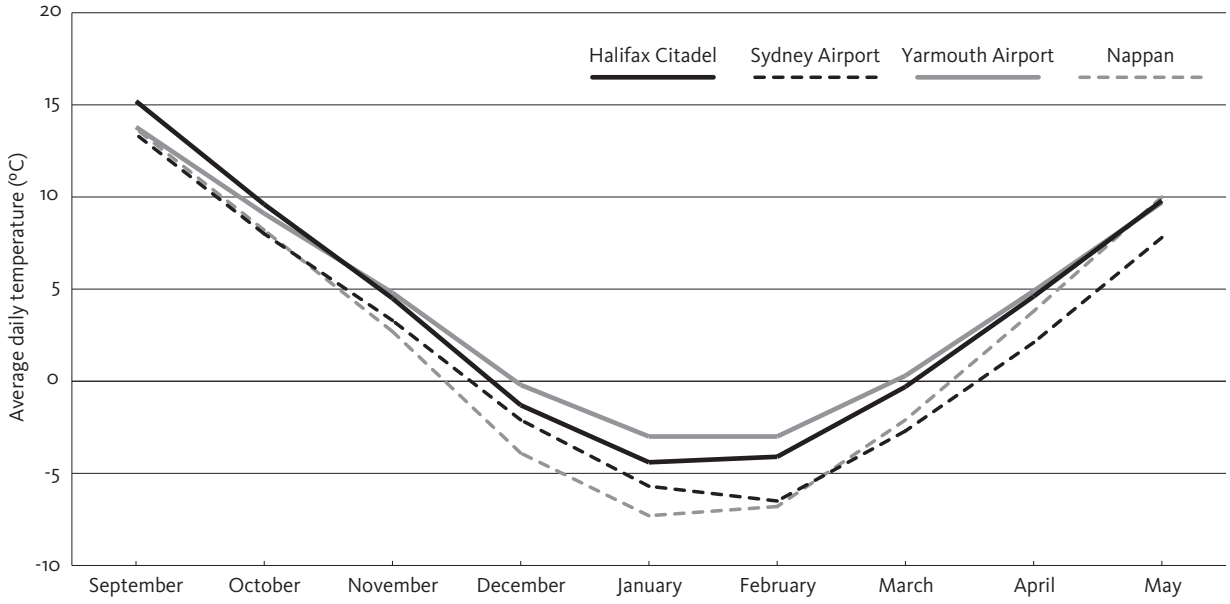
Despite Canada's apparent abundance of energy resources, Nova Scotia has no significant energy corridors to the rest of Canada (Hughes, 2007a). An interconnection with the neighbouring province of New Brunswick allows Nova Scotia Power (NSP) to import and export up to 300 MW of electricity. The Maritimes and Northeast (M&NE) pipeline carries natural gas from Nova Scotia to points west and south, notably New Brunswick and New England.

In 2006, Nova Scotia had an estimated 379,610 households (Survey of Household Spending (SHS), 2006).[2] These households are divided into quintiles; in Nova Scotia, each quintile consists of 75,920 households. The household size varies per quintile, meaning that the total number of

TABLE 1 **Population per quintile** (Columns 2 and 3 from SHS, 2006)

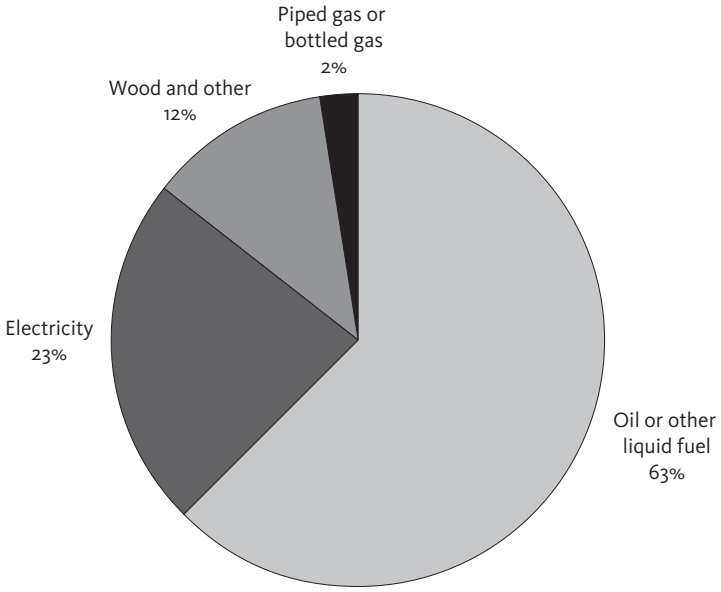
Quintile	Household size	Pre-tax upper income limit	Quintile population
1	1.34	$22,600	101,733
2	1.98	$37,680	150,322
3	2.46	$56,000	186,763
4	2.82	$85,000	214,094
5	3.34		253,573

FIGURE 1 **Average daily temperatures for various locations in Nova Scotia**



SOURCE Environment Canada, 2008

FIGURE 2 **Nova Scotia's principal heating fuels**

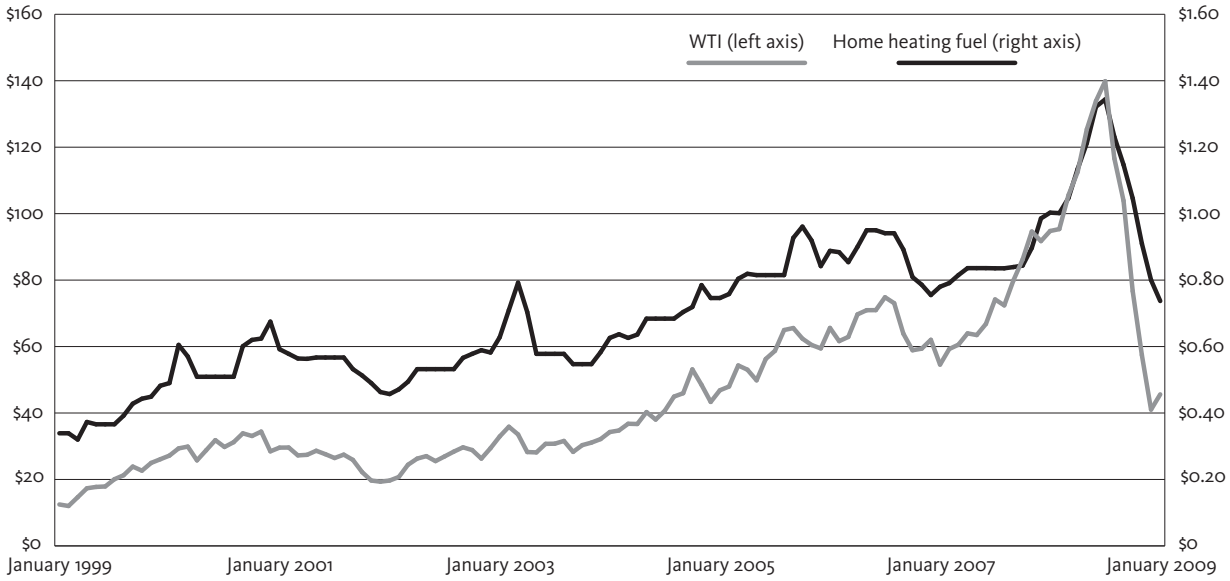


SOURCE OEE, 2007b

people per quintile is not constant, nor are the incomes, as shown in Table 1.

Nova Scotia's heating season runs from September to May. Figure 1 shows the average dai-

FIGURE 3 **Monthly heating fuel vs. crude oil costs**



SOURCE Economagic, 2008; NRCan, 2008

ly temperatures for four communities around the province; in all locations, the average daily temperature falls below zero between December and March.

Nova Scotia's energy insecurity becomes readily apparent when the principal residential heating fuels consumed in the province are considered: some 63 percent of homes use oil products (primarily fuel oil);[3] 23 percent, electricity (most of which is generated from imported coal, petroleum coke, and other oil products); about 12 percent, renewables, almost exclusively wood, and a limited amount of natural gas (see Figure 2).

The dilemma facing many Nova Scotians is the fact that most of the energy sources used for space heating cannot be considered secure. Figure 3 shows the relationship between the cost of heating fuel in Halifax and the cost of a barrel of West Texas Intermediate (WTI) light crude; not surprisingly, the two track closely, with some variations due to seasonal effects.

The chart also highlights the effect of the spike in the cost of fuel oil between June 2007 and June 2008, with fuel oil passing the dollar-a-litre mark late December 2007, when the price of WTI was about $94 a barrel. Since the mid-year highs in 2008, the prices of crude oil and fuel oil have fallen by 70 percent and 44 percent, respectively.

One of the principal reasons for crude oil falling in price faster than fuel oil is that heating oil is one of a number of petroleum products referred to as a distillate (other distillates include kerosene and diesel). Worldwide, the demand for distillates, especially diesel, has increased as a result of a higher demand for diesel vehicles and the use of diesel as a fuel for electrical generation (IEA, 2008). For example, this year, China and Chile turned to diesel to overcome the loss of hydroelectricity because of earthquakes and low rainfall, respectively. As long as worldwide demand for distillates remains strong, there will be continued pressure on the heating oil market.

3 Residential heating

In Nova Scotia, there are about 390,000 residential structures, ranging from single-detached homes to apartments to mobile homes; the data for 2005 is shown in Table 2.[4]

The age, quality, and energy intensity of the housing stock varies greatly; recently constructed buildings typically have lower energy intensities than their older counterparts (Table 2 also highlights the fact that Nova Scotia's housing stock is considerably older than Canada's).[5] The energy intensity of the housing stock has clearly improved over time, as shown in Table 3; however, the benefits have been offset somewhat by the modern trend to build larger houses (NRCan, 2006).

As can be expected, the type of housing in which people live depends upon their income, as higher income households (quintile five or Q5) are more likely to occupy single detached houses than those with lower incomes (quintile one or Q1). On the other hand, there are more lower-income households living in apartments; this distribution is shown in Figure 4.

The space heating requirements for an average Nova Scotia home is about 70 GJ per year (OEE, 2007b).[6] The annual cost of heating such a residence will depend upon the price of the fuel

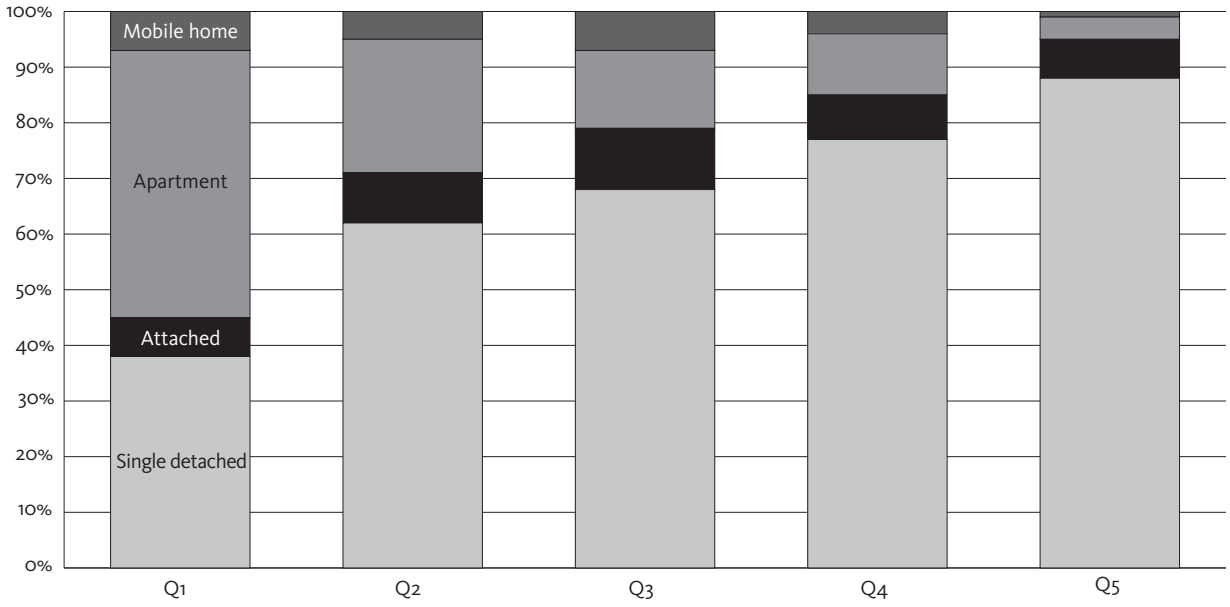
TABLE 2 **Nova Scotia's housing stock** (OEE, 2007a; OEE, 2007b)

Vintage	Single detached	Single attached	Apartments	Mobile homes	Total	Nova Scotia	Canada
Pre-1946	61,140	5,111	19,332	3,858	89,441	22.9%	15.3%
1946–1960	24,300	2,027	7,642	1,553	35,522	9.1%	10.6%
1961–1977	52,668	4,403	16,653	3,323	77,047	19.7%	21.9%
1978–1983	33,940	2,837	10,729	2,143	49,649	12.7%	12.6%
1984–1995	56,589	4,730	17,893	3,571	82,783	21.2%	21.7%
1996–2000	20,316	1,698	6,424	1,282	29,720	7.6%	8.6%
2001–2005	18,195	1,521	5,753	1,148	26,617	6.8%	9.3%
Total	267,148	22,327	84,426	16,878	390,779	100.0%	100.0%

TABLE 3 **Housing stock energy intensity (GJ/m²)** (OEE, 2007b)

Vintage	Single detached	Single attached	Apartments	Mobile homes
Pre-1946	0.64	0.57	0.45	0.89
1946–1960	0.59	0.53	0.41	0.83
1961–1977	0.48	0.43	0.34	0.68
1978–1983	0.48	0.43	0.34	0.68
1984–1995	0.37	0.33	0.26	0.52
1996–2000	0.35	0.32	0.25	0.50
2001–2005	0.34	0.31	0.24	0.48

FIGURE 4 **Distribution of housing types by quintile**



SOURCE SHS, 2005

and the efficiency of the heating system. Table 4 shows the average fuel costs per heating season in Halifax for 2006–07 and 2007–08, as well as an estimate for 2008–09. The anticipated growth in both the cost of energy and connection-charges for the heating seasons between 2006–07 and 2008–09 is also shown.

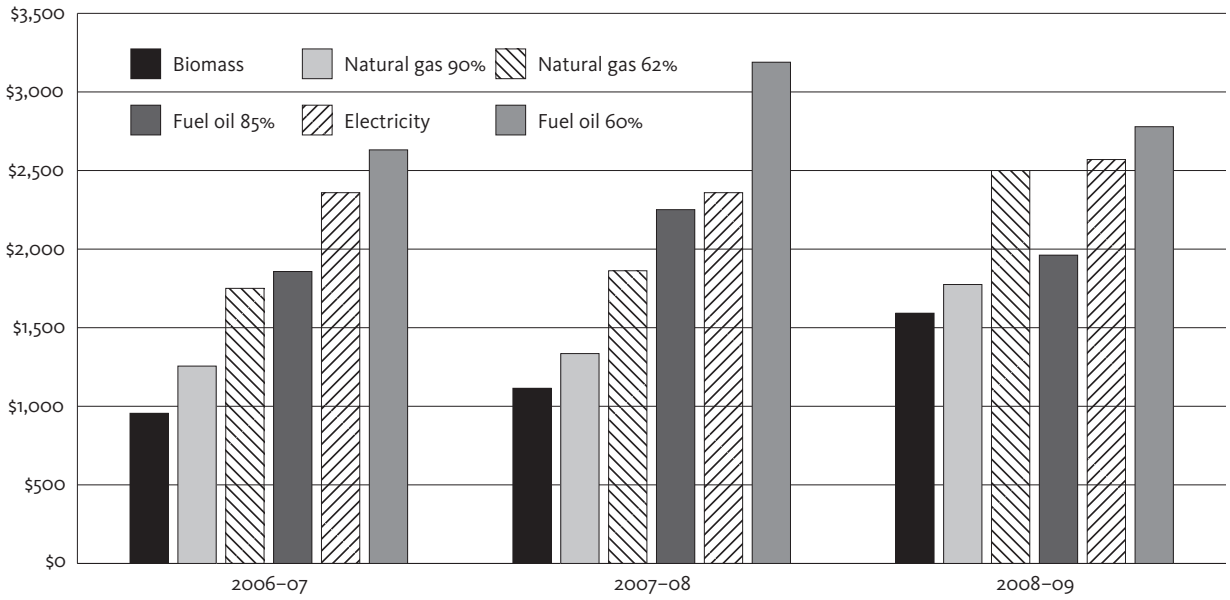
Although the cost of crude oil has been increasing steadily since 1999, the rapid growth between mid-2007 and mid-2008 was unexpected, as was the cost of fuel oil during the 2007–08 heating season. The fall in the cost of crude oil since mid-2008 has brought the cost of fuel oil more in-line with its recent values. Of the four heating fuels listed in Table 4, fuel oil exhibits the lowest rate of growth between the 2006–07 and 2008–09 heating seasons.

Figure 5 shows the total heating fuel costs for a residence that requires 70 GJ of heat during three heating seasons in Halifax (2006–07 through 2008–09). The rapid run-up in the cost of crude oil from mid-2007 to mid-2008 is reflected in the cost of fuel oil in the 2007–08 heating season and the cost of biomass in the 2008–09

TABLE 4 **Average heating season fuel costs**[7,8,9]

Fuel	Service	Heating season fuel cost 2006–07	2007–08	2008–09	Growth
Biomass	Energy (per cord)	$150	$175	$250	66.7%
Electricity	Connection (per month)	$10.83	$10.83	$10.83	0.0%
	Energy (per kWh)	$0.1067	$0.1067	$0.1168	9.5%
Natural gas	Connection (per month)	$12.50	$13.13	$13.13	5.0%
	Energy (per GJ)	$13.16	$14.02	$19.30	46.7%
Fuel oil	Energy (per litre)	$0.821	$0.995	$0.867	5.6%

FIGURE 5 **Heating fuel costs for three heating seasons** Includes federal tax only



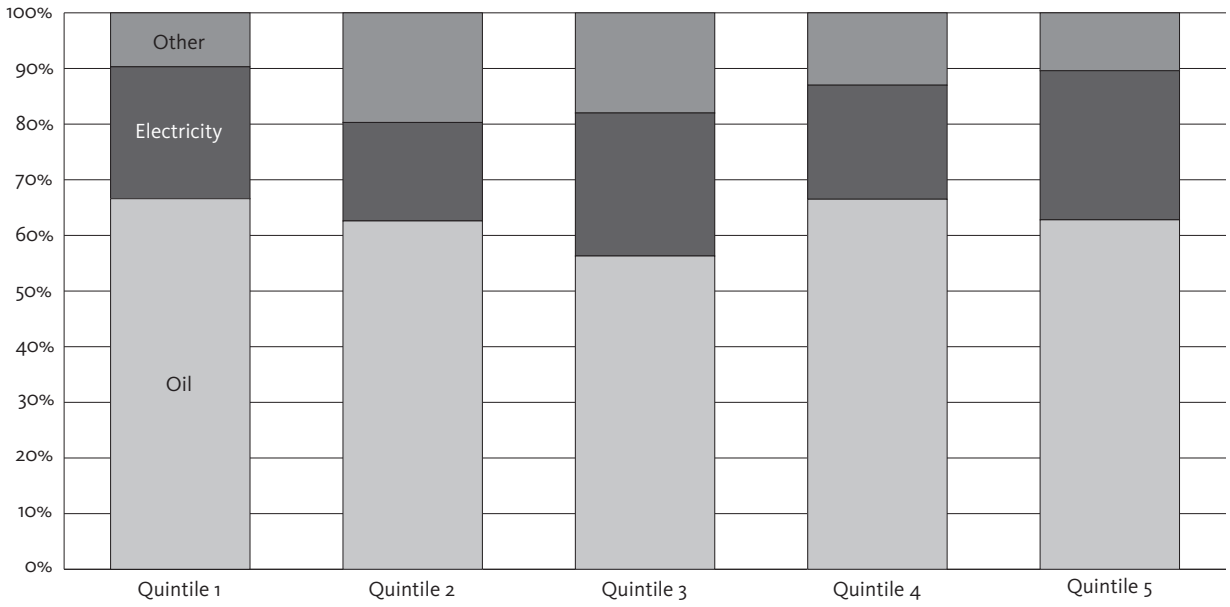
SOURCE Economagic, 2008; NRCan, 2008

heating season.[10] In the 2008–09 heating season, biomass, high efficiency (90 percent) natural gas furnaces, and high efficiency (85 percent) oil furnaces (because of the drop in the price of fuel oil) have comparable costs. On the other hand, low efficiency (62 percent) natural gas furnaces, electric heating, and low efficiency (60 percent) oil furnaces all have comparable costs in 2008–09.[11]

As previously mentioned, the two predominant heating sources are fuel oil and electricity. Despite the range in fuel costs, the choice is relatively uniform across all economic family quintiles (see Figure 6).

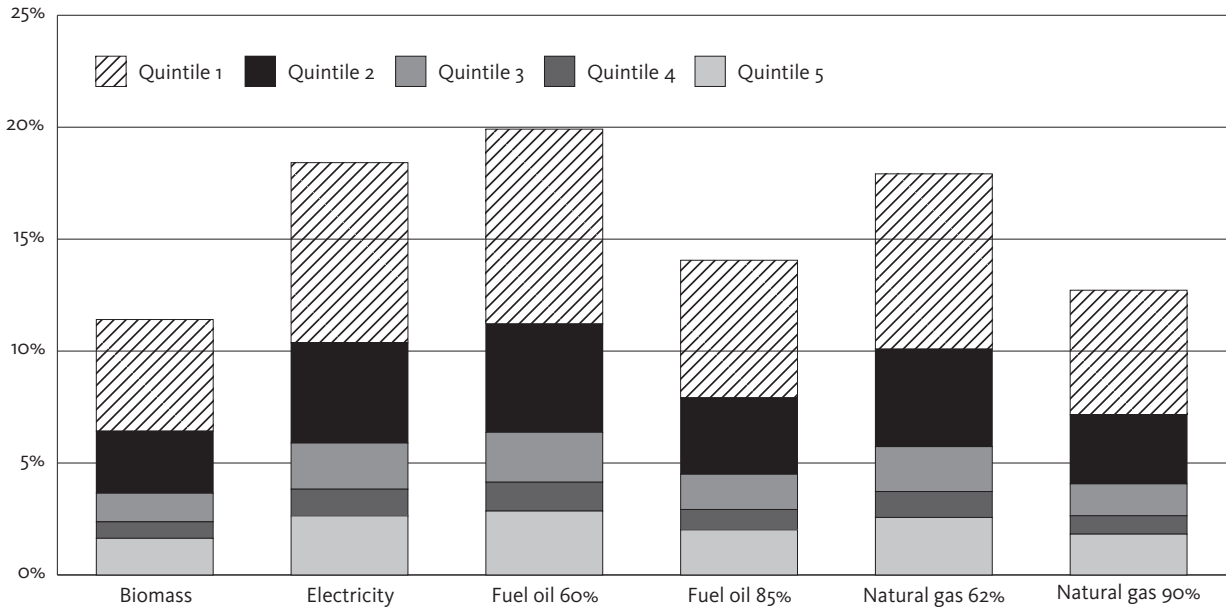
The estimated percentage of after-tax income that will be spent on different space heating sources during the 2008–09 heating season for a household requiring 70 GJ of energy for heat appears in Figure 7. The maximum for quintile five ranges from 1.6 percent (biomass) to 2.9 percent (low efficiency fuel oil furnace); whereas for a quintile one household purchasing a heating source, the minimum ranges from 6.4 percent (biomass) to 11.2 percent (low efficiency fuel oil

FIGURE 6 **Heating fuel consumption by quintile** 2005 data



SOURCE SHS, 2005

FIGURE 7 **Estimated percentage of income required for space heating in 2008–09**



furnace) of after-tax income. The maximum percentage of after-tax income required for each fuel source in quintile one is not known.

Fuel poverty refers to the state a household enters when its total costs for all energy sources exceed six percent (Chisholm, 2008) to ten per-

cent (BERR, 2001) of their after-tax income. All households in quintile one and about half of the households in quintile two that use fuel oil in a low-efficiency furnace or electric heating can be expected to spend over eight percent of their after-tax income on space heating alone during the 2008–09 heating season; this excludes any costs associated with water heating or electricity for lighting or appliances. Although outside the scope of this report, these other energy costs can be expected to push more households into the region of fuel poverty. If the cost of living, other than energy prices, were stable, perhaps these additional expenditures could be absorbed; however, the price of many goods and services is increasing, thereby putting greater strain on those in the lower two quintiles. As fuel prices rise, the number of Nova Scotians falling into fuel poverty will increase, thus risking their exposure to a heating emergency.

4 Residential Tenancy Act

Not all Nova Scotians live in their own homes; for example, about 20 percent of economic families live in apartments (SHS, 2005), the majority of these in quintiles one and two, while the remainder lease other types of residential buildings. Depending upon the nature of the lease, either the landlord or the tenant may be responsible for paying the cost of space heating.

In Nova Scotia, anyone living in leased accommodation is subject to the Residential Tenancy Act, which claims to provide "landlords and tenants with an efficient and cost-effective means for settling disputes" (Residential Tenancies Act). The Act makes one reference to energy supply in the Statutory Conditions (Section 9(1).2) which outlines the services a landlord is required to provide for tenants (Residential Tenancies Act):

> Services—Where the landlord provides a service or facility to the tenant that is reasonably related to the tenant's continued use and enjoyment of the premises such as, but not so as to restrict the generality of the foregoing, heat, water, electric power, gas, appliances, garbage collection, sewers or elevators, the landlord shall not discontinue providing that service to the tenant without proper notice of a rental increase or without permission from the Director.

Unlike other jurisdictions where the minimum accommodation temperature is stated,[12] Nova Scotia has no such requirements. As a result, an unscrupulous landlord could reduce the heat supplied to the tenants and still be within the law. Although this loophole must be addressed, the fact remains that, in a heating emergency, the situation could arise where neither the landlord nor tenant has access to energy supplies.

5 Fuel replacement

At present, Nova Scotia has four principal heating fuel sources: fuel oil, electricity, biomass, and natural gas (coal is also included because it is still being used in a few homes, primarily in Cape Breton). The relative security of each of these sources is shown in Table 5, in terms of supply and infrastructure.

Of these sources, biomass is the most secure in terms of supply and infrastructure; however, switching to biomass may not be viable partway through a heating season because the wood may be unseasoned. Similarly, despite the low cost of burning natural gas in high efficiency furnaces, the limited distribution network means it is beyond the reach of most Nova Scotians.[13]

The importance of electricity for space heating cannot be over emphasized. Electricity is used for electric space heating (although most homes in Nova Scotia still heat with fuel oil, the majority of new homes in the provinces are being installed with electric heating (Dodge, 2008)), while other heating systems, notably oil furnaces and pellet stoves, require electricity to operate. In recent years, NSP's ageing grid has been prone to brownouts and blackouts—increasing the likelihood of heating emergencies for many Nova Scotians as well as being detrimental to the provincial economy.

TABLE 5 **Security of Nova Scotia's heating fuel supply**

Fuel source	Supply	Infrastructure
Fuel oil	Supplies are insecure	Widespread, with a refinery and distribution network
Electricity	Supplies are insecure, limited secure sources (hydroelectricity)	Widespread, but with an ageing grid
Biomass	Supplies are secure but seasonal	Not all residences can burn biomass
Natural gas	Supplies are secure but limited and in decline	Limited distribution network
Coal	Supplies are secure but limited with few coal mines operating	Not all residences can burn coal

6 Government programs

This section examines Nova Scotia's energy reduction information, energy assistance programs, and its emergency preparedness.

6.1 Energy reduction information

Conserve Nova Scotia has a number of "how-to" brochures and videos that offer instructions on reducing residential energy consumption; for example, by sealing air leaks and adding insulation (see (Conserve NS, 2007a)). Most of the energy reduction suggestions expect access to tools and materials that may be beyond the reach of those on low-income.

Conserve Nova Scotia has also published a brochure on ways to reduce consumption for various fuel sources (Conserve NS, 2008). Many of the recommendations focus on replacing existing equipment with newer, more efficient models—information that would be of little value during a heating emergency. There are also useful suggestions on how to reduce the cost of water heating, some of which could be implemented during a heating emergency.

6.2 Energy assistance programs

Nova Scotia has five programs that attempt to address the rising cost of heating fuels, the first four deal with fuel costs, while the fourth is intended to reduce energy consumption.

6.2.1 "Your Energy Rebate"

"Your Energy Rebate" was introduced in 2006 and originally returned to the consumer the eight percent provincial portion of the 14 percent HST on home heating fuel, natural gas, propane, firewood, wood pellets, coal, kerosene, and electricity. In the program's original form, all Nova Scotians received the eight-percent rebate on all electricity both during and outside the heating season; this policy was changed in the 2008–09 provincial budget when the province announced that only those who consumed more than 10,000 kWh per year would qualify for the rebate. The revised program now states, "Nova Scotian households will continue to be eligible to receive the residential electricity rebate if they have used an amount over 27.4 kWh per day multiplied by the number of days charged from September 1 onward" (NS Finance, 2008).

By changing the electricity requirements, the cost of the program is projected to decline from $75 to $47 million. According to the provincial government, this program will mean, "home-heating savings to about 300,000 Nova Scotian households. The typical rebate per year for oil would be $240 and for electricity would be $190" (NS Finance, 2008).

There are several issues regarding this program that need further consideration:

- As energy prices increase, so does the amount of the rebate; as a result, the cost of the program could exceed the amount budgeted. Should this occur, it will reduce funds available for other programs.
- Despite the declared purpose of the program, it covers energy uses other than space heating. For example, any fuel for water heating will also be included in this total, as will fuels used for cooking, notably electricity and natural gas.
- The new method of calculating the electrical rebate is misleading and highlights one of the problems with the way NSP bills its residential consumers. NSP's residential induction meters calculate total energy consumption over the 60-day billing period only, rather than daily, meaning it is impossible to determine how much a customer has consumed on a daily basis. As a result, the province also states that anyone consuming more than 1,644 kWh per billing period (60 days × 27.4 kWh/day) is eligible for the rebate on any electricity consumed in excess of 1,644 kWh, which means:
  - Consumers who do not use electric heating can obtain the rebate if they exceed 1,644 kWh per billing period.
  - Consumers who use electric heating can fail to get the rebate if their consumption is less than 1,644 kWh per billing period.
  - By removing the tax for consumption above 1,644 kWh, the government has created a declining block rate—the more you use, the less you pay. In a time of potential heating emergencies, Nova Scotians should be discouraged from using more energy rather than being rewarded for increased consumption.[14]

All of these limitations can be overcome by requiring NSP to record hourly residential energy consumption using interval or time-of-use meters. With this information, the daily consumption can be determined and taxed appropriately (Hughes, 2008).

6.2.2 Heating Assistance Rebate Program and Heat Smart

In their April 2008 budget, the provincial government announced the "Heating Assistance Rebate Program" (HARP), a $200 rebate for oil, propane, or natural gas costs, or $150 rebate for electric, wood, wood pellets, or coal for single Nova Scotian residents with an annual income of less than $15,000 or families with a combined income of less than $25,000. The rebate amount is reduced by $25 for each additional $500 income, to a maximum of $2,000. The program budget is $10 million and is intended to assist about 50,000 Nova Scotian households (NS Finance, 2008).

In September 2008, after record increases in the price of heating oil during the summer of 2008 (see Figure 3), the provincial government announced "Heat Smart", an "enhanced" version of HARP (Heat Smart, 2008b). Heat Smart increases the rebate for oil, propane, and natural gas consumers by $250 to $450, and raises the income limits to $25,000 (individuals) and $40,000 (families) (Heat Smart, 2008c), while the budget increases by $19.2 million to an estimated $29.2 million (Heat Smart, 2008a). Heat Smart offers no additional assistance to those

TABLE 6 **Changes in the cost of space heating** (From Table 4)

				Change in heating cost	
Fuel	**2006–07**	**2007–08**	**2008–09**	**2007–08 to 2008–09**	**2006–07 to 2008–09**
Biomass	$955	$1,114	$1,592	$478	$637
Electricity	$2,359	$2,359	$2,570	$211	$211
Fuel Oil 60%	$2,631	$3,189	$2,779	-$410	$147
Fuel Oil 85%	$1,857	$2,251	$1,962	-$290	$104
Natural gas 62%	$1,750	$1,862	$2,500	$638	$750
Natural gas 90%	$1,256	$1,335	$1,775	$439	$519

who heat with other sources such as electricity or wood. There is also an "energy efficiency" component to Heat Smart that offers zero-interest loans of $5,000 for home insulation and repairs (Heat Smart, 2008d) and $500 for the purchase of Energy Star oil furnaces or water heaters (Heat Smart, 2008c).[15]

In the original version of HARP, the number of Nova Scotians who could benefit from the program was estimated at 50,000, essentially anyone paying for energy in quintile one, and a limited number in quintile two. Despite raising the income limits, the number of individuals who qualify under Heat Smart is now 52,000 (MacDonald, 2008). This figure appears to be low and could be closer to 90,000, as the income limit now includes all economic families in quintiles one and two (see Table 1), most of whom heat with fuel oil (see Figure 6). If all those who qualify apply for assistance, the Heat Smart budget will be exceeded—putting additional strains on the provincial budget.

The actual benefit to anyone who pays for heating will depend upon what the cost was for the energy consumed and the family's income. To illustrate the effect of HARP and Heat Smart, Table 6 shows the expected change in the cost of heating a residence requiring 70 GJ of heat (the values in Table 6 exclude the provincial portion of the HST, meaning that the "Your Energy Rebate" program has been taken into account).

Although the price of fuel oil has been increasing over the past several heating seasons, its sudden price rise in the 2007–08 heating season was anomalous. This fact is illustrated by the change in the cost of heating with fuel oil between the 2007–08 and 2008–09 heating seasons, when the collapse in the price of crude oil could be expected to *reduce* the cost of supplying a home with 70 GJ of fuel oil by between $290 and $410. It is more meaningful to compare the change in the cost of heating between the 2006–07 and 2008–09 heating seasons.

The $450 from HARP and Heat Smart is intended for users of fuel oil and natural gas; this amount far exceeds the anticipated increase in fuel oil costs ($104 to $147), whereas it falls short for natural gas consumers ($519 to $750). When considering electricity and biomass, the $150 HARP rebate (Heat Smart is excluded for these fuels) does not cover the increase in electricity costs ($211) and fails to come close to the increase in cost for users of biomass ($637).

The provincial government's decision to offer lump-sum payments based upon the type of fuel overlooks the shortcomings of this kind of policy: those in need of assistance may not obtain sufficient levels of funding, while those not requiring assistance may receive benefits. Viable alternatives exist to lump-sum payments, such as offering guaranteed fuel prices to those in the first category (Hughes, 2006).

6.2.3 Contributions to the Good Neighbour Energy Fund

Nova Scotia Power's Good Neighbour Energy Fund—administered by the Salvation Army—uses donations to cover the costs of heating fuel (including firewood, coal, fuel oil, propane, and electricity) for those facing a heating emergency (Salvation Army, 2007). Qualified applicants can receive $300 once every five years (CBC, 2008). Midway through the 2007–08 heating seasons, a combination of more families in need of the service and rising fuel costs resulted in the Good Neighbour program running short of funds. In February 2008, after considerable reluctance on the part of the Premier, the province donated $200,000 to the program (CBC, 2008).[16] In the 2008–09 provincial budget, the province doubled its donation to $400,000 (NS Finance, 2008). The Heat Smart program doubled this amount again, to $800,000 (Heat Smart, 2008b).

6.2.4 Residential Energy Affordability Program

A third program, the Residential Energy Affordability Program (REAP) is intended for those Nova Scotians unable to afford the cost of a home energy audit and the up-front costs associated with other home energy upgrade programs (Conserve NS, 2007b). Over the past two years, the program, administered by Conserve Nova Scotia, has upgraded, or plans to upgrade, 305 homes at an average cost of $5,500 (Conserve NS, 2007b). Based on the long lead times associated with home energy audits and REAP's limited budget of $1.6 million, this program will do little to help Nova Scotians during heating emergencies.

6.3 Emergency preparedness

Nova Scotia has a central Emergency Management Office (EMO) and municipal EMOs in the counties, major towns, and cities of the province. The central body, a division of the Nova Scotia Department of Community Services, is mandated by the Emergency Management Act, "to ensure the safety and security of Nova Scotians, their property and environment by providing for a prompt and coordinated response to an emergency" (Emergency Management Act).

Each municipality's EMO functions independently, developing protocols for responses to regional emergencies and appointing a municipal committee and coordinator, though all are governed by the Emergency Management Act and may take direction from the provincial EMO. The Act states that "upon a state of emergency being declared in respect to the Province or…in respect to a municipality or an area thereof, the Minister may…do everything necessary for the protection of property and the health or safety of persons therein and, without restricting the generality of the foregoing, may…cause the acquisition or utilization of personal property by confiscation or any means considered necessary" (Emergency Management Act). The EMO has the authority, for example, to assume control over restaurants and other private establishments in the event of an emergency. The EMO's responsibilities during a heating emergency are discussed in the following two sections.

6.3.1 Oil supplies

Pursuant to the Act, there is an agreement for the EMO to oversee the means of production and distribution of supply at the Dartmouth Imperial Oil refinery, for an undefined period, during a state of emergency when fuel shortages abound (Webb, 2008). According to the provincial EMO coordinator, the refinery would be restricted from exporting any supply and the oil would be reserved for the explicit purpose of accommodating hospitals, emergency vehicles, and any crucial civil infrastructure.

However, any such protectionist arrangement is highly discretionary and has no historical precedence in the current trade climate; especially with the contractual and legislative obligation Canadian energy producers have to

their clients in the United States under NAFTA (NAFTA, 2002a; NAFTA, 2002b; Hughes, 2007a). Furthermore, a refinery such as the one in Dartmouth does not guarantee a supply of petroleum products; if supplies of crude oil were unable to reach the refinery, its output would cease.

In times of heating emergencies, the province could obtain diesel fuel from fuel stations that sell diesel and supply it to those in need. In Nova Scotia, there are 294 of these, each with a capacity of between 15,000 and 25,000 litres of diesel, meaning that the province has between 4.4ML and 7.4ML of storage (SNSMR, 2005). If these tanks were full, the province would have access to between 1 and 1.5 percent of the total volume of fuel oil required by the residential sector during a typical heating season. This would be the volume of fuel oil required to meet the province's maximum space heating demand for about 14 to 20 hours.

6.3.2 Comfort Centres

Temporary heat shelters, referred to as "Comfort Centres" by the EMO, are being coordinated by municipal organizations with the support of the EMO municipal offices and community groups. Comfort Centres originally began as ad hoc refuges in Nova Scotia during the power outages in the winter of 2004 and throughout tropical storm Noel in November 2007 (Hoegg, 2007).

Comfort Centres are fire halls and churches that are converted into shelters where people can drop by, have a meal, and access such essentials as blankets. While some are equipped with cots, most Comfort Centres have no proper bathing facilities and are not intended to be overnight shelters. Each Centre is to have an average capacity for between 100 and 200 people. Thus far, at least ten of these Centres are being planned for Cape Breton, Inverness, Colchester, and parts of the Valley, with five specifically planned for the Eastern Shore of HRM. Comfort Centres will be provided with generators or be supplied with propane heaters on a case-by-case basis (Webb, 2008; EMO, 2005).

Comfort Centres as proposed fall far short of the type of emergency heating shelter needed to help those unable to heat their homes for a variety of reasons:

- There is an insufficient number of Centres throughout the province. To put the size of the problem into perspective, there are about 200,000 Nova Scotians in quintiles one and two who are paying more than eight percent of their after-tax income on space heating and could be facing a heating emergency this winter. Ten Comfort Centres sheltering 200 people each could assist one percent of this total.
- With limited sleeping, cooking, and bathing facilities, the Centres are not intended for lengthy stays.
- The proposed infrastructure to be employed for heating and lighting the Centres (propane heaters and gasoline or diesel generators) relies on insecure energy supplies. Without these, it could be a challenge for the Centres to respond to supply shortages and not be immobilized by them.

Protocols should be established for any public centre, gymnasium, dormitory, fire hall, church building, or school to be converted to a Comfort Centre to ensure that all Nova Scotian residents have equal access to shelter during an outage or supply shortage. There are approximately 300 public and private schools in Nova Scotia, serving students from primary to secondary levels; most of these have gymnasiums or other large athletic facilities, many offer cafeterias and washing facilities (NSO, 2008). Such spaces, spread out across the province, could serve as makeshift heating shelters during heating emergencies.

7 Reducing the impact of future energy emergencies

Rising energy prices, coupled with the number of buildings having high energy intensities means that Nova Scotia will continue to rely on fuel oil for many years to come, even if an aggressive four 'R's campaign (review, reduce, replace, and restrict) were introduced. This section considers possible alternative sources of petroleum supplies and the use of biomass as a heating source.

7.1 Petroleum

With the exception of Canada, the International Energy Agency (IEA) demands that its member countries secure a 90-day supply of oil.[17] The IEA requires Canada to simply maintain "emergency response mechanisms" for the distribution of oil supplies through data collection and market monitoring (IEA, 2000). Canada, however, is under no obligation—international or otherwise—to maintain a stock-draw reserve; the rationale is that, as a net exporter of oil, Canada has the oil supply to compensate for any shortage triggered by an import-disrupting event.

Since over 60 percent of Nova Scotia's residential structures are heated with fuel oil, it will take well over a decade to replace existing sources of oil with more secure sources of energy in the majority of these homes (Hughes, 2007a). In the interim, supplies of fuel oil will still be needed; this will present the province with several challenges, notably finding:

- Facilities to store the heating fuel.
- Suppliers of the heating fuel.
- The funds to purchase the heating fuel.

7.1.1 Storage Facilities

It is important to prioritize the fuel type for storage and refinement during any emergency. For example, during a winter cold snap, light fuel oil for residential heating might be of higher importance as home heating costs increase than petroleum for the transportation sector. Fuel stations (discussed in section 6.3.1), geological formations, tanker ships, and train tanker cars can provide some or all of the storage needs to secure supplies during a shortage.

Nova Scotia has 20 salt deposit caverns with an estimated underground storage capacity of 30 billion cubic feet near Alton. These natural, subterranean geological formations can store natural gas, crude oil, or other petroleum dis-

tillates. When storing petroleum in caverns, it is necessary to maintain a pressure of 400 PSI; otherwise, as the product is withdrawn, brine will mix with the petroleum and foul the reserve (Hilland, 2008). Alton has sufficient capacity to meet Nova Scotia's current home and business space heating fuel oil requirements for a millennium.

Permanently mooring product tankers in the port of Halifax's harbour is another option for short-term storage. These ships, ranging in capacity from 10,000 to 320,000 tons of deadweight, would allow an estimated reserve of between 85 to 2,700 ML (Hayler, 2003).

Train tanker cars are another storage alternative for short-term petroleum supplies; they range in size from 15,000 USG (56,780 litres) to 20,000 USG (75,710 litres) to 30,000 USG (113,560 litres) (Barkana, Ukkusuri, & Waller, 2007). About 40 of the largest tankers could store 4.5ML, which is about 14 hours worth of oil consumption if all homes heated with oil were operating at maximum capacity. Although tanker cars have the advantage of being on rails and moveable, the recent history in Nova Scotia of line abandonment leaves a limited number of regions in the province that could be supplied directly by train.

7.1.2 Secure suppliers

Supplies from Western Canada are problematic for a number of reasons. First, the only oil pipeline transporting western Canadian crude to eastern Canada stops in Sarnia, Ontario. Second, extending the pipeline to the Maritimes has never been considered necessary since demand in the region can be met by international suppliers. Third, NAFTA requires Canada to maintain its export levels—any export decline must be met by an equivalent level of reduction in national consumption—whether Canadians outside the Maritimes would agree to this is another issue entirely.

Oil supplies from Newfoundland and Labrador are more secure, although subject to some constraints as well. In addition to limitations imposed by NAFTA, much of the oil from Newfoundland and Labrador is intended for Quebec. Newfoundland and Labrador's production is expected to increase after 2010, peak by 2017, and then decline (NEB, 2007). Tapping into this new supply may help Nova Scotia reduce some of its dependence on imported foreign fuel oil for heating during the bridge to secure energy sources.

Although there is no pipeline from Western Canada to the Maritimes, the Calgary-based oil and natural gas pipeline company, Enbridge, has proposed shipping 230,000 barrels of crude oil from Alberta's tar sands to Sarnia, Montreal, and then Portland, Maine (McKinnon, 2008). The proposal includes reversing two existing pipelines (Sarnia to Montreal and Montreal to Portland) and building two 150,000 barrel storage tanks in Montreal. An estimated 80,000 barrels a day would be kept in Montreal, with 150,000 barrels being shipped from Portland to refineries on the U.S. Gulf coast. By directing some of these shipments to Nova Scotia, a portion of Nova Scotia's heating fuel needs could be addressed.

Barring NAFTA restrictions, western Canadian oil could be shipped from Montreal or points farther west by rail. In the most extreme case, meeting all of Nova Scotia's present demand by rail would require anywhere from 80 to 160 fifty-tanker train trips, depending on the tanker size (see section 7.1.1 above). Transporting oil by rail is an expensive operation when compared with pipelines (Trench, 2001).

If a heating emergency in Nova Scotia was part of a larger "national emergency caused by shortages or market disturbances and affecting the national security and welfare and the economic stability of Canada", the federal Energy Supplies Emergency Act could be invoked. Providing "a means to conserve the supplies of energy within Canada during [these] periods…", the Act establishes an Energy Supplies Allocation Board and sets out its duties, which include the assignment, rationing, and pricing of energy

products. The Board can rescind environmental legislation to ensure energy production and may "direct the Canadian Transportation Agency to order railway cars, motive power, or other railway equipment to be allotted, distributed, used, or moved as required by the Board and to order railway lines and railway facilities". (Energy Supplies Emergency Act)

7.1.3 Purchasing

A provincial or even regional heating fuel reserve would require governments to compete on the open market for petroleum products—potentially driving the price higher and causing supply shortages. In a volatile oil market, if the price of the stored petroleum were higher than that on the open market, it might be necessary to sell it at a loss—a danger of hedging.

7.2 Biomass

It is estimated that about 12 percent of Nova Scotian households use biomass as a source of energy for space heating (OEE, 2007b). Determining the actual amounts of firewood and fuel wood is difficult and often imprecise as a result of the number of small suppliers in Nova Scotia, and the fact that wood transactions often happen informally without any paper trail. Officially, approximately 450,000 green tonnes (i.e., undried biomass material) of firewood was used by Nova Scotia's residential sector in 2004 (Dhaliwal & Joseph, 2007).

In 2006, Nova Scotia harvested about 5.2 million m3 of softwood and hardwood (4.56 million m3 of softwood and 0.64 million m3 of hardwood) a decline of 1 million m3 from its average for most of this century (Nova Scotia Finance, 2007). Nova Scotia's forest products industries—primarily pulp and paper, lumber, and Christmas trees—are in decline because of the strong Canadian dollar in 2007–08 and competition from countries whose trees have shorter growing cycles. A thriving wood pellet industry has been established in the province; its principal market is Europe.

How much more biomass could be directed to the residential sector for space heating is unclear, in view of the near-unsustainable level of biomass harvest in the province and the competition for biomass from pulp and paper mills and the Brooklyn Energy Centre. If Nova Scotia's average annual biomass harvest was diverted entirely to energy, it would meet about one-quarter of Nova Scotia's primary energy demand. On the other hand, all of Nova Scotia's space and water heating demand could be met from biomass with just 25 percent of the biomass harvest residues.[18]

Since biomass will probably be an important energy source in the future, a strong argument can be made for the creation of woodland reserves as a source for bioenergy. In the past, Nova Scotia had woodland reserves—protected tracts of mature forest that could be harvested during firewood supply shortages. These were eventually phased out due to liability issues: community members, inexperienced and unequipped for logging, entered the forests took what they could despite the associated hazards. Arguments can be made to bring back woodland reserves as they can be managed to avoid destructive forest harvesting practices.

8 Conclusion

Despite the province's 2001 Energy Strategy, the creation of a Department of Energy, and a "renewed" Energy Strategy announced in 2007, years of inaction and misguided energy policies have made Nova Scotia and Nova Scotians vulnerable to the vagaries of the energy market. Quite simply, Nova Scotia, which imports over 80 percent of its energy, is extremely energy *insecure*.

This paper has reviewed Nova Scotia's present heating policies and has made suggestions for how they could be improved. With so much of the province's space heating requirements being met by insecure sources of fuel oil, it is imperative that the province have policies in place to respond rapidly to heating emergencies. Rebate schemes such as HARP and Heat Smart are typically political in nature, with the result that many individuals and families in real need fall further into fuel poverty. As energy prices continue to increase, the numbers in this group also rises, putting additional strains on the provincial budget (Hughes, 2006).

If rebates based upon electricity usage are to target those with electric heating, it is necessary to introduce the appropriate metering and billing. NSP's continued use of induction meters means that Nova Scotians are unable to benefit from new billing schemes, proper fuel rebates, and new uses of renewable electricity.

Heat shelters may be needed if large numbers of people are unable to heat their homes. Without facilities for eating, sleeping, and bathing, the proposed "Comfort Centres" will be of little use to anyone in need during a heating emergency. Furthermore, Comfort Centres, as well as facilities that could be used for lengthy stays, are reliant on insecure energy sources such as fuel oil, gasoline, and propane. At a minimum, buildings for possible accommodation during heating emergencies should be equipped with furnaces that can use secure energy sources, such as biomass.

Prior to the start of every heating season, those Nova Scotians most at risk of a heating emergency should be identified by the government from databases of income quintiles, housing type, housing vintage, and principal space heating fuel. These people in particular, and all other Nova Scotians in general, should be made aware that heating emergencies are possible and that the government has policies to deal with

them, including fuel requisitioning, rationing, and heating shelters.

Despite Canada's great energy wealth, access to heating fuels (notably oil and natural gas) from other parts of Canada could prove a challenge, in view of NAFTA restrictions and limited infrastructure. If a heating emergency in Nova Scotia were considered a national emergency, access to some fuels might be possible.

As discussed earlier, energy prices will fluctuate, but their general direction is up—this is one "oil shock" that will not disappear. Programs, such as Heat Smart's $500 furnace rebate do nothing to help replace existing, insecure energy sources with ones that are secure. Accordingly, it is imperative that the province develop a strategy to reduce its reliance on insecure sources of energy and to protect Nova Scotians from the vagaries of higher fuel prices; for example, building codes could be rewritten so that (Hughes, 2007b):

- All new buildings reduce their energy intensity by 50 percent by 2020.
- All existing buildings reduce their energy intensity by 30 percent by 2020.
- All new buildings meet 40 percent of their heating from secure sources by 2020.
- All existing buildings meet 15.5 percent of their heating from secure sources by 2020.

Without changes to improve the energy security of its residential sector, Nova Scotia will continue to face heating emergencies. This problem will grow more acute as energy markets become more volatile. Policies, such as the ones described in this paper, are needed to address this issue now.

Glossary

Emera — the parent company of Nova Scotia Power

GJ — gigajoule, a unit of energy equivalent to one billion or 10^9 joules

kWh — kilowatt-hour

MJ — megajoule, a unit of energy equivalent to one million or 10^6 joules

ML — megalitres, one million litres

MWh — megawatt-hour

NAFTA — North American Free Trade Agreement

NSP — Nova Scotia Power

PSI — Pounds per square inch

USG — US gallon

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Notes

1 The heating season is defined as those months when the average monthly temperature is below 18°C. In most parts of Canada, the heating season runs from September until May.

2 For the purposes of this report, Statistics Canada's Survey of Household Spending (SHS) data for 2006 is used. SHS divides the population into "economic families" consisting of one person (individual) or two-or-more people occupying a household.

3 Nova Scotia consumes between 700ML and 800ML (megalitres) of fuel oil annually (Nova Scotia Finance, 2007), primarily for space heating in the residential, commercial, and institutional sectors. Of this, about 460 ML are used in the residential sector (OEE, 2007b).

4 The number of residential structures exceeds the number of economic families (households) because of vacancies; for example, apartments for rent or houses for sale.

5 In the built environment, energy intensity refers to the energy required for heating per unit area of floor space. Energy reduction campaigns attempt to lower the energy intensity of a building as this means less energy required per square metre.

6 This is the average for space heating only. It does *not* include the energy required for water heating, running appliances, or lighting—if this energy were included, the total energy costs would be higher.

7 Biomass: the summer 2008 cost quoted in various media outlets. Electricity: NSP's most recent rate case (2008) is calling for connection-charges to remain unchanged and, after an agreement with the UARB, increasing residential rates by about 9.5%. Natural gas: Both connection-charges and energy are Heritage Gas's July 2008 numbers—energy charges can be expected to increase this winter.

Fuel oil: At the time of writing this report, data for the price of fuel oil for the first four months of the heating season (September to December) were known. Between 2 September 2008 and 30 December 2008, the weekly average price of fuel oil in Halifax dropped from $1.194 to $0.76 per litre. The weekly fuel costs for the remaining five months of the heating season are projections based upon the weekly minimum and maximum fuel price changes relative to the last week of December for the years 2000 and 2002 through 2007. The average minimum and maximum fuel prices for the 2008–09 heating season were calculated to

be $0.818 and $0.916, respectively, giving an average of $0.867 per litre.

8 All fuel suppliers charge for the energy consumed, some also have a connection charge. In Nova Scotia, electricity and natural gas include a monthly charge for connecting to their supply network.

9 Not surprisingly, the impact of rising fuel costs are also being felt by owners of leased residential structures who pay heating costs. For example, Killam Properties, a Halifax real estate company, reported a second quarter loss in 2008, in part because "Killam's heating oil and natural gas costs increased by 63 percent and 35 percent, respectively, during the second quarter of 2008, compared to the second quarter of 2007" (Chronicle-Herald, 2008). The cost increases differ slightly from those shown in Table 4 because the values in the table refer to an entire heating season (September to May), not a quarter (in this case, the second quarter or April through June).

10 The rising cost of biomass in 2008 was attributed in large part to the cost of refined petroleum products used in harvesting (chainsaws and tractors) and delivery (trucks). To meet the 2008–09 heating season requirements, biomass harvesting took place when petroleum products prices were rising throughout 2007 and 2008.

11 The majority of oil furnaces in Nova Scotia are low efficiency (OEE, 2007b).

12 For example, in Chicago, landlords must ensure that building temperatures do not fall below 68°F (daytime) and 66°F (nighttime) (CDHS, 2007).

13 Kerosene heaters are still used in parts of Nova Scotia for emergency heating, despite their history of problems related to fires and carbon-monoxide poisoning (Joseph, 2008).

14 An alternative to the declining block rate, the inverted block rate—the more you use, the more you pay—is well known and was proposed to the province in 2004 (Hughes, 2004). BC Hydro has adopted the inverted block rate for its residential customers (BC Hydro, 2008).

15 The furnace rebate raises a number of questions. First, why were furnace tune-ups, a quick, simple, and inexpensive way of improving a furnace's efficiency not included in Heat Smart? Second, why does the province cover the cost of oil furnaces that continue to require the use of insecure sources of fuel oil?

16 Successful requests for assistance from the Good Neighbour Energy Fund have increased from "over 500 families" in 2004 (NSPI, 2005) to 945 families in 2006 (Salvation Army, 2007).

17 The U.K and Norway were the IEA's other exporting members—in both cases, they established petroleum reserves. Now that the U.K. is a net importer of oil products, the decision to establish a petroleum reserve proved prescient. In Norway, oil companies within its jurisdiction are required to maintain a quota of oil reserves for use in emergency situations; the rationale for this being that domestic resources should first accommodate the needs of the region's populace before addressing those of outside jurisdictions (Hubbard, 1985).

18 The non-merchantable biomass residues left after harvest are referred to as residues—it is generally agreed that some residues should be left behind to supply nutrients to the forest. The recommended minimum is 25 percent (Dhaliwal & Joseph, 2007).

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