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Energy security in the residential sector

Rapid responses to heating emergencies
Part 1: Fundamentals

By Larry Hughes



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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 due to 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 making it 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 must be prepared to assist those in need. Ideally, heating emergencies would be rare events, an exception rather than the rule that could easily be addressed; however, volatile energy markets and the growing potential for energy shortages are expected to increase the threat of heating emergencies. Given the long-term nature of existing energy reduction and replacement policies, there is a clear need for a strategy to address the immediate heating needs caused by a heating emergency.

This is the first of two reports that discuss policies for heating emergencies. The second report, *Energy security in the residential sector: Rapid responses to heating emergencies, Part 2: Nova Scotia*, focuses on the jurisdictional specific challenges faced by the province of Nova Scotia that has 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.

The first report describes government actions that can lead to swift and immediate assistance during a residential heating emergency. It is useful for any individuals, families, communities, or governments that want to understand the financial and health implications associated with rapid changes in heating supplies and prices and the need for action.

Key Findings

Financial Implications

Average energy costs have been on the rise; since 1999, the annual average cost of purchasing 2,500 litres of fuel oil during the heating season dou-

bled for all income levels in Canada. The percentage of average, after-tax income that would have to be spent by different Canadian economic families ranges from slightly over two percent for those in the highest income bracket to just under 19 percent for the lowest income bracket.

Rising energy prices can cause heating emergencies for those unable to afford the cost of heating their homes. When someone spends an unsustainable amount of their income on energy, they are said to be experiencing “energy poverty”. The point at which an individual or family is deemed to be energy poor varies by jurisdiction; regardless, individuals and families must be protected from having to make choices that can harm their health.

Health Risks

Heating emergencies can compromise the health and wellbeing of anyone, especially those on low-income, living in substandard housing, or who are very young or very old. Severe temperature drops can pose a serious health risk to many people and intensifying the risk for those who already experience a higher illness burden. These risks include house fires, caused by electrical devices being used as alternative heat sources; respiratory illness from burning unsafe materials; carbon monoxide poisoning from gasoline-powered generators and kerosene space heaters; accidents related to the absence of indoor lighting; frostbite, hypothermia, and other freezing and non-freezing cold-related injuries.

Governments must ensure their citizens are protected from heating emergencies during times of rising energy costs and energy shortages.

Improving the energy security of the residential sector to protect individuals and families from rising energy costs and supply shortages requires policies and regulations that reduce energy consumption and replace insecure fuel sources with ones that are secure. Governments can also prevent heating emergencies by

implementing policies to reduce the number of households facing energy poverty. However, such programs — to improve energy security, reduce energy consumption and address energy poverty — are typically long-term in nature, often requiring new infrastructure, and cannot address rapid or unexpected changes to a jurisdiction’s energy security. There are some options that can be implemented by a government in anticipation of or during a residential heating emergency.

Recommendations

Subsidize energy costs

One solution to rising heating costs is to subsidize the price of fuel for those deemed to be in need of assistance. Such a program must be designed to ensure that it targets only those who are in need. If fuel shortages occur, subsidies will not make up the shortfall; therefore governments must also consider other options.

Requisitioning alternative heating sources

If fuel shortages occur, governments could requisition diesel fuel intended for transportation and make it available for space heating purposes. Such an action would have to be carefully considered, as requisitioning fuel from those parts of the transportation system needed to maintain the health and welfare of society could have negative repercussions, meaning that a list of “essential users” of transportation fuel would need to be developed.

Rationing supply

If available supplies are unable to meet demand, governments may be forced to restrict energy supplies to ensure that all members of society have access to some heating fuels during the heating season. In these situations, the government must turn to rationing.

Emergency Shelters

In the most extreme heating emergencies, in which the above actions have been tried and are unable to offset prohibitive energy costs or widespread energy shortages, individuals and families may be forced to abandon their homes to seek shelter elsewhere. Possible shelters, heated by secure fuel sources and available for longer term accommodation, include schools, places of worship, and government buildings.

Conclusion

Preparing for a heating emergency requires public education and adequate emergency assist-

ance programs to be in place. The public must be aware of the potential of heating emergencies and the government's plans to address it. Most jurisdictions have emergency assistance programs, parts of which could be applied to a heating emergency; however, these plans usually fall far short of the recommendations outlined in this report. All jurisdictions need to ensure that their emergency assistance programs include provisions to deal with heating emergencies. In many cases, they do not.

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. Individuals or families can fall into “fuel poverty” or “energy poverty” when they are unable to meet their energy needs because of financial circumstances or energy shortages caused by the jurisdiction failing to maintain or improve energy security.¹ In northern countries where occupants must heat their buildings during the heating season, energy security is of particular importance in the residential sector. When the energy needed for space heating becomes unaffordable or unattainable, thus jeopardizing the energy security of an individual or family, a **heating emergency** is said to occur.

In most jurisdictions, there is no quick fix to reduce the energy requirements for residential space heating, nor is it possible for rapid, wholesale shifts to secure energy sources.

This report discusses some of the options that a government can take in anticipation of or dur-

ing a residential heating emergency. The options presented are even more necessary given the inevitable rise in prices of anything based on low-cost energy, notably food and transportation.

The report does not consider long-term solutions to improve energy security — such as building retrofit programs or improved building codes — its purpose is to describe actions that can lead to rapid and immediate assistance needed to address rising energy prices, energy shortages, or both.

To illustrate how heating emergencies will challenge many jurisdictions, a companion report presents a case study of Nova Scotia, a jurisdiction with an overwhelming reliance on imported energy supplies, notably fuel oil and coal, for its residential (and commercial) space heating needs, an older housing stock, and some of the lowest incomes in Canada. The compendium shows how Nova Scotia’s existing heating assistance programs and emergency management office are ill-prepared for a heating emergency.

The remainder of this report is organized as follows. In the next section, the relationship between energy security and the built environment is discussed in light of the need for im-

proved building standards. Two of the impacts on residents of poorly constructed buildings in times of energy insecurity are financial and health, both of which are discussed in the third section. The fourth section considers a number of different policy options open to governments during a heating emergency, ranging from educational programs to the establishment of heating shelters. No government or jurisdiction can survive repeated heating emergencies — the fifth section recommends different legislative options available to governments to reduce the likelihood of future heating emergencies. The report

concludes with a summary of the findings and a call for governments to adopt policies that reduce energy consumption in the residential sector, replace existing insecure energy sources with secure ones, and restrict new energy demand to secure sources.

The focus of this report is on how governments can assist their citizens in a heating emergency, consequently it does not discuss actions that individuals and families can take to reduce the impact of a heating emergency. For a list of these suggested actions, please see (Hughes, 2009).

2 Energy security and the built environment

Governments can improve a jurisdiction's energy security by reviewing its energy supplies and end-uses, reducing energy consumption, replacing existing insecure sources of energy with secure ones, and restricting new demand to secure sources (Hughes, 2007a). Reduction and replacement are easier in some sectors of the economy than others; for example, in transportation, energy reduction can take place rapidly by driving at slower speeds, following the manufacturer's suggested vehicle maintenance program, and changing transportation modes.² Over the longer term, the energy efficiency of new vehicles can be improved; however, to make significant contributions to the energy security of a jurisdiction, vehicles must restrict their fuel consumption to secure sources of supply.

Since the turnover of a jurisdiction's building stock is typically slower than that of its vehicle stock, reduction, replacement, and restriction are more of a challenge in the built environment than in the transportation sector. Although new construction offers jurisdictions the opportunity to enact policies that require significant energy reduction while restricting consumption to secure energy sources, pressure from builders and

the public can result in building codes that fail to improve energy security.

In some jurisdictions, reduction and replacement policies target ageing or poorly constructed buildings that are significant consumers of energy. Building retrofit programs often attempt to reduce a building's energy consumption by improving its energy efficiency. Despite the benefits of such programs, their contribution to the improvement of energy security in a jurisdiction can be limited by:

- The quantity of building stock in need of retrofitting may be so large that there are insufficient numbers of qualified workers to perform the retrofits or the availability of materials may be in short supply, or both.
- A building that is retrofitted may see a reduction in energy consumption, but the cost of heating the building may still increase if it relies on insecure energy sources.

These retrofit programs and other similar programs, usually intended to address climate

change, encourage the adoption of alternative fuels (such as natural gas in place of fuel oil) but fail to consider the energy security implications of such a switch. Ideally, climate change and energy security can be addressed together. With respect to energy reduction, the policies can be identical. However, when considering energy replacement, this need not be the case. For example, a jurisdiction faced with a shortage of natural gas, may find it necessary to replace natural gas with domestic (secure) coal for its electrical generation. Here, the replacement may be more secure but results in detrimental effects on the climate. In short, public and economic pressure

can lead to policies that result in climate change taking second place to energy security.

To improve the energy security of the residential sector, and thus protect individuals and families from rising energy costs and supply shortages, policies and regulations that reduce energy consumption and replace insecure fuel sources with secure ones are needed (Hughes, 2007a). However, such programs are typically long-term in nature, often requiring new infrastructure, and cannot address rapid or unexpected changes to a jurisdiction's energy security. Energy insecurity is then a critical contributing factor to heating emergencies.

3 Impacts of heating emergencies

Heating emergencies can have several different impacts; this section considers two of them: financial and human health.

3.1 Financial

The cost of fuels used for space heating, notably heating oil, natural gas, and electricity were relatively stable throughout the 1990s, increasing dramatically at the turn of the century, as shown in Figure 1.

The growth in energy prices is perhaps best illustrated when considering the percentage of after-tax income that must be spent on 2,500 litres of no. 2 heating oil (the average volume of heating oil used by Canadians for residential space heating) during the heating season (taken as September to May). The percentage of average, after-tax income that would have to be spent by different Canadian economic family quintiles is shown in Figure 2, ranging from slightly over two percent for quintile 5 (highest income bracket) to just under 19 percent for quintile 1 (lowest income bracket).

Since 1999, the annual average cost of purchasing 2,500 litres of fuel oil during the heating

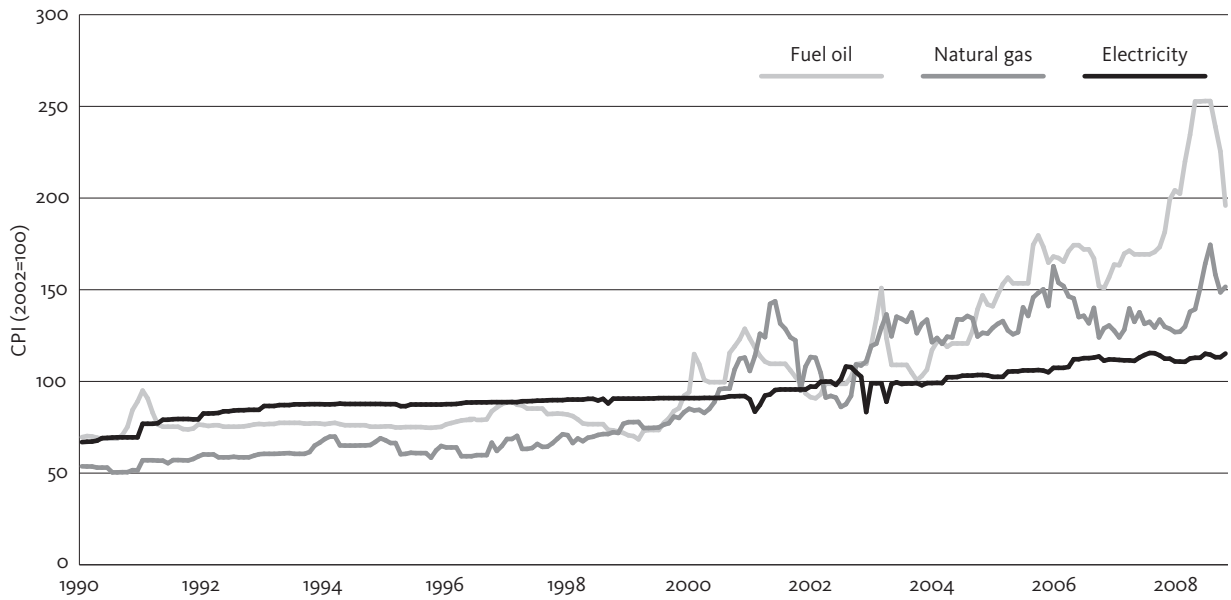
season has doubled for all quintiles. Although the price of fuel oil in 2008 peaked during the summer, its average cost during the year (January to May and September to December) was still markedly higher than other years. The precipitous fall in the price of crude oil between September and December 2008 will reduce the impact on those in quintiles 1 and 2.

3.2 Heating related health issues³

In addition to the financial implications, rapidly rising energy costs or fuel supply shortages can compromise the health and wellbeing of residents, particularly those on low-income, living in substandard housing, or who are very young or very old. Severe temperature drops can pose a serious health risk to many people.

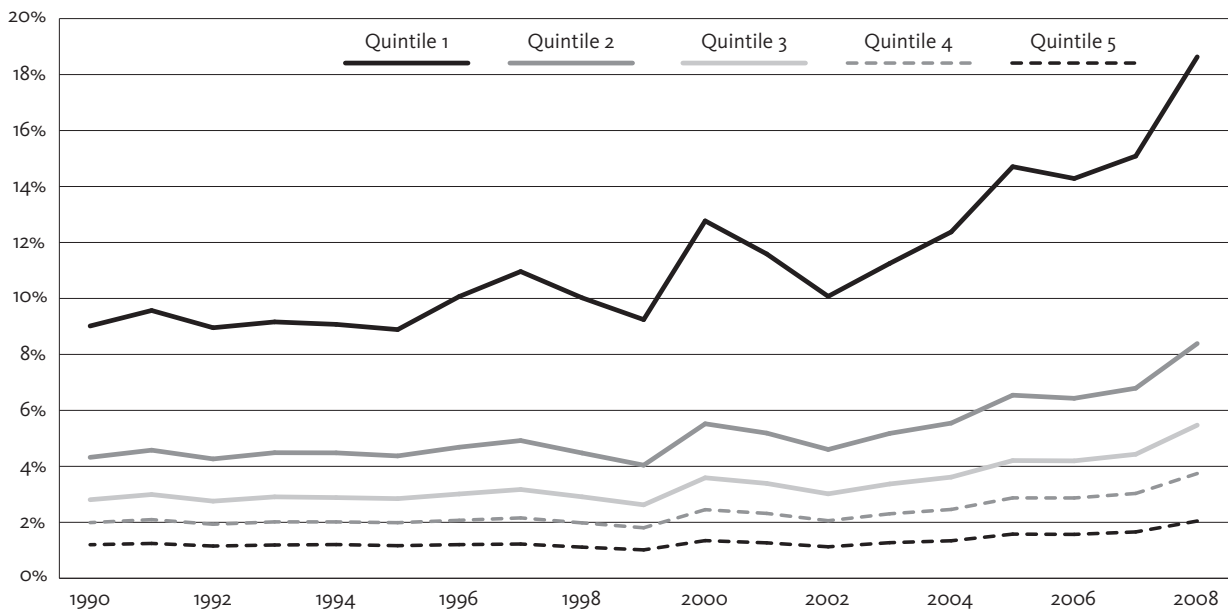
Energy-related health risks include house fires, caused by electrical devices; respiratory illness from the unsafe combustion of materials; carbon monoxide poisoning from gasoline-powered generators and kerosene space heaters; accidents related to lack of visibility from the absence of indoor lighting; frostbite, hypothermia, and other freezing and non-freezing cold-related injuries

FIGURE 1 Changes in Canadian energy prices between 1990 and 2008



SOURCE Cansim, 2008c; Cansim, 2008d; Cansim, 2008e

FIGURE 2 Percent of after-tax income required to purchase 2,500 litres of no. 2 heating oil



SOURCE Cansim, 2008b; Cansim, 2008f; Cansim, 2008a

(Lipscombe, 2004; Nicoll, 2004). According to the Canadian Housing and Renewal Association, poor quality housing for lower income quintiles can pose a serious threat to health, which is only further intensified during the heating season,⁴ “Housing in disrepair leads to higher risks of injury and accidental death in the home and unhealthy, indeed sometimes fatal, exposure to extremes of heat and cold. Exposure to dampness, moulds, fungus (e.g., from poor insulation... poor heating and ventilation systems) can cause a wide range of pathologies, including asthma and other respiratory diseases” (CHRA, 2004). As the rate of poverty increases, inadequate heat supply will affect a disproportionate number of women because of substandard living conditions, homelessness, and health effects related to the heating season (CWHN, 2008).

In some situations, an approved supplementary heating system for offsetting temperature losses is unaffordable and occupants may resort to unconventional heating methods posing health and safety risks: burning refuse or wood openly in the home, leaving cooking stoves and ovens on for long periods of time, and using supplemental heaters. In the U.S., supplemental heaters are the cause of 120,000 fires (22 percent of all residen-

tial fires), killing 600 people every year (CPSC, 2008). When a household is forced to choose between heating by unsafe means or enduring the cold, few people choose to remain cold.

Exposure to cold can lead to hypothermia, an abnormally low body temperature, which occurs when the body loses heat faster than it can replace it. Although it occurs most often at very cold temperatures, hypothermia can occur at temperatures above 4°C if a person becomes chilled by rain, sweat, or immersion in cold water; victims of hypothermia are often elderly people with inadequate food, clothing, or heating (CDC, 2005). The very young and elderly are particularly susceptible to the cold; according to the U.S. Centers for Disease Control and Prevention (CDC, 2005):

- Infants less than one year old should never sleep in a cold room because infants lose body heat more easily than adults, and unlike adults, infants cannot produce enough body heat by shivering.
- Older adults often generate less body heat because of a slower metabolism and less physical activity.

4 Policy options

For the past several years, many jurisdictions around the world have experienced volatile energy prices and energy shortages, which as discussed above, can have serious implications. The rising cost of kerosene for cooking has hurt the poor in countries such as the Philippines, Egypt, and Indonesia (BBC, 2008), while the rapid rise in the cost of gasoline and diesel during the first half of 2008 had a significant impact on transportation in many western nations including the UK, France, and the United States.

Energy for space heating has not been immune from volatile prices and shortages. Fuel oil costs have risen sharply over the past few years — had it not been for the collapse in the price of crude oil in mid-2008, heating emergencies would have become widespread in the 2008–09 winter. In January 2009, many countries in the European Union experienced serious natural gas shortages because of a dispute between Russia and Ukraine over the cost of natural gas and pipeline access (BBC, 2009).

This section considers actions that governments can take to protect its citizens from heating emergencies during times of rising energy costs and energy shortages. It does not consider long-

term policies that attempt to reduce the number of households facing energy poverty.

Minimizing the impact of a heating emergency requires a recognition by the government (or levels of government) that an emergency could occur. It is necessary to identify those groups most vulnerable and the services that they and the community will need during the heating emergency. Governments must also make the members of the community aware of the potential for a heating emergency and any plans to address it. For example, the material discussed in this section (and the previous) should be made available to the public.

4.1 Awareness and emergency assistance programs

As a first step, educational programs should be established before the onset of the heating season. Such programs can offer advice on how to reduce energy demand (see (Hughes, 2009)) as well as to make citizens aware of the dangers of cold weather, signs of hypothermia, and ways of protecting against the cold. Media outlets can be advised of potential cold weather systems

approaching the jurisdiction. Emergency assistance can be given to those in need by establishing telephone numbers that anyone can call who is facing a heating emergency or by someone concerned about the wellbeing of a neighbour.⁵

Governments can be proactive by identifying individuals or families who are potentially in need or at risk by considering their income, housing type and vintage, and principal fuel source. Compiling such a list prior to the start of the heating season would enable government or volunteer services to move rapidly in a heating emergency.

4.2 Fuel subsidies

As shown in Figure 2, as heating fuel prices increase, the percentage of income needed to cover fuel costs will increase, putting an additional burden on anyone responsible for meeting the heating needs of the building. One solution to this problem is to subsidize the cost of fuel for those deemed to be in need of assistance.

Some ways in which fuel subsidies can be applied include (Hughes, 2006):

Lump-sum payment. A lump-sum payment, typically at the start of the heating season, can offset the cost of heating fuel. If the payment is insufficient, the recipient may still be unable to meet their heating requirements. If the payment is not needed or if there are inadequate controls, the payment may be spent on activities other than heating.

Guaranteed price. A guaranteed price places a cap on the amount the recipient is expected to pay for fuel. The government covers fuel prices that exceed the cap. As fuel prices increase, the amount covered by the government also increases.

Refunds. A variation on the guaranteed price is for governments to refund consumers a certain percentage of the cost of the fuel; however, in some instances the rebate is issued after the

fuel has been purchased, potentially putting an additional financial burden on those having difficulty paying for the fuel. As with the guaranteed price, as fuel prices increase, the amount refunded increases.

All of these programs can be manipulated to political gain, often defeating their original purpose. For example, refunds can be offered to anyone who pays a heating bill, regardless of income. Although this may appear “fair”, it reduces the funds that can be made available to those truly in need.

In rented accommodation, subsidies pose an additional challenge. If subsidies are given to the landlord, they must be applied to the purchase of fuel; furthermore, the landlord must guarantee a minimum level of heating. If the subsidies are given to the tenants (and the landlord pays for heating), the landlord should be allowed to raise the rent to cover the additional cost of the heating fuel. How these requirements are enforced is another matter.

During times of fuel price volatility, fuel subsidies can be a challenge to governments, as it becomes difficult to budget funds for the subsidy programs. Programs that determine who is subsidized based upon the percentage of income needed for heating face the prospect of an ever increasing number of recipients — another factor that can play havoc with the budget.

If fuel shortages occur, subsidies will not make up the shortfall.

4.3 Requisitioning fuel supplies

In jurisdictions where heating fuel oil is in short supply, governments could requisition diesel fuel intended for transportation and make it available for space heating purposes. Such an action would have to be carefully considered, as requisitioning fuel from those parts of the transportation system needed to maintain the health and welfare of society could have negative repercus-

sions, meaning that a list of “essential users” of transportation fuel would have to be established by the government (for examples of essential users, see (ACIL Tasman, 2004)). Of course, there needs to be a sufficient supply of fuel that a government can requisition.

Since diesel fuel and no. 2 heating oil are both distillates, they are essentially interchangeable; their principal differences being sulphur content (diesel is lower) and price, since some jurisdictions apply a road tax to diesel. In some cases, a dye is added to furnace oil and kerosene to allow authorities to catch anyone substituting untaxed furnace oil or kerosene for diesel (CCH Editorial Staff, 2005). Any use of diesel for space heating would naturally lead to a reduction in the road taxes collected.

4.4 Rationing

If available supplies are unable to meet demand, this may force governments to restrict energy supplies to ensure that all members of society have access to some heating fuels during the heating season. In these situations, the government must turn to rationing.

The purpose of rationing is to allocate a scarce resource to a population based upon some set of criteria. During the Second World War, food, clothing, and oil products were rationed in the combatant countries in order to ensure supplies of food and material to the troops (Imperial War Museum, n.d.). In December 1973, the Arab oil embargo, coupled with coal miners and power station workers refusing to work overtime caused the Heath government in the U.K. to put British industry on a three-day work week — the government was on the verge of rationing petroleum products and stopping people from heating more than one room in their homes (Travis, 2004).

Rationing transportation fuels like gasoline and diesel is a relatively easy task when compared to rationing heating fuels, as there may be many different heating fuels and not all of these fuels

are necessarily in short supply. For example, fuel oil may be scarce but biomass may be plentiful. Moreover, the very act of rationing may lead to unforeseen pressures on other fuel sources as people switch to fuels that are not rationed.

If rationing is implemented, it then becomes a problem of determining how the energy source or sources are to be allocated:

Past consumption. If past records exist for a given building, the allocation could be based upon a fraction of past consumption. One problem with this approach is that not everyone maintains the records of past consumption and there would clearly be an incentive to inflate estimates of prior consumption.

Energy per building. The energy requirements of every building could be determined and the fuel allocated based upon this calculation. This approach could allocate more energy than justifiable — large homes with few occupants would get more fuel than small homes with many occupants.

Energy per person. Perhaps the simplest approach is to allocate heating supplies on a per-person basis. How this energy would be used would be the responsibility of those allocating the energy.

Other approaches to rationing include rolling blackouts to reduce electricity consumption equitably during given periods of the day — rolling blackouts were introduced in California in 2000 by Governor Davis as a means of addressing electricity supply shortages (Frontline, 2001).

4.5 Heat shelters

In the most extreme heating emergencies, in which the above actions have been tried and are unable to offset prohibitive energy costs or widespread energy shortages, individuals and families may be forced to abandon their residential accommodation to seek shelter elsewhere.⁶ One possibility is for those in need of shelter to be

billeted in residences that have sufficient heating supplies, another is to establish communal “heat shelters” at schools, town halls, or places of religious worship. Heat shelters would be responsible for supplying individuals and families with food and a place to stay warm until the emergency could be resolved. The decision to open a shelter would probably be based on financial considerations — if the cost of supplying fuel was more than the cost of sheltering individuals and families, the shelter would be opened.

Communal shelters have been used during wartime and times of potential conflict, as governments often offer their citizens air raid or civil defense shelters. Probably the best-known communal shelters were established in the London Underground during the Blitz (Cooper, 2006). In fact, heat shelters are not a new idea — most major cities run shelters for the homeless during the heating season. (Chicago runs both cooling and warming shelters for those having difficulty staying cool in the summer or warm in the winter (Roche, 2008).) Temporary shelters were established during the 1998 ice storm that hit parts of Ontario, Quebec, and the Maritime provinces to assist those without electricity.

After Hurricane Katrina destroyed parts of New Orleans, the U.S. Federal Emergency Management Administration (FEMA) made hundreds of temporary trailers available to those displaced. These trailers were not made available immediately, nor were they intended for cold climates. In the case of a heating emergency, constructing and distributing trailers and obtaining energy for them is not something that could be done rapidly.

Most heating and cooling shelters supported by cities such as Toronto and Chicago are intended for those who live on the street, not for families forced out of their homes due to extreme cold. Furthermore, if a building is abandoned because it cannot be heated — because of costs or

shortages — the occupants of the building may not be able to return to it until it can be heated. Heating shelters would therefore have to be more than simple soup kitchens or temporary overnight shelters — they would have to handle the following:

- Long-term accommodations. Without heat, occupants could not be expected to return to their residences, meaning that the shelter would require space to support long-term accommodations.
- Bathing and washing. As with the accommodations, bathing and washing facilities would be required. The shelter would have to handle the potable and waste-water requirements of all its occupants.
- Feeding. Without heat, it is unlikely that a shelter’s occupants could access their home’s kitchen, meaning that the shelter would be responsible for feeding its occupants as well. If the occupants could purchase and cook their own food, it would be necessary to have sufficient kitchen space in the shelter to prepare meals. On the other hand, if the meals were prepared by the shelter, it would be necessary to determine who would cover the costs of the meals.
- Secure fuel supplies. Perhaps most important, every heating shelter must have access to secure fuel supplies. If the fuel used to heat the shelter is also in short supply, the occupants of the shelter could be at further risk. To ensure the safety of those in the shelter, each shelter should be supplied with a secure fuel source; for example, a dual-fuel furnace, allowing operation with either oil or biomass.

5 Bridges to future heating seasons

Given sufficient lead-time, governments can take actions to reduce the impact of heating emergencies in future heating seasons, including legislation that requires:

- The creation of emergency contact numbers to allow those in need to contact authorities for assistance.
- Minimum heating standards for all buildings.
- Decreasing energy intensity of new and existing buildings.
- The use of secure heating sources for new and existing buildings.
- Proper metering of all energy consumed by any building.

- All buildings used as heat shelters to install heating systems that rely on secure fuel sources.
- Petroleum storage facilities to stockpile heating fuels for use during the heating season, assuming that petroleum can be obtained to fill the facilities.
- Collection of “waste fuels” for use as fuel, including non-merchantable trees and waste oils from vehicles for use during heating emergencies.

Even with such actions, heating emergencies are still likely to occur. One of the effects of rising energy costs will probably be increasing inflationary pressures, as people demand higher wages to offset the costs associated with higher energy prices.

6 Concluding Remarks

Heating emergencies will result if governments fail to ensure adequately the energy security of their citizens. Years of low-cost energy, substandard building construction, and increased volatility in energy markets have put many consumers at risk when it comes to space heating. Until jurisdictions can break their reliance on insecure sources of energy and its associated infrastructure, their citizens will be at the mercy of rising energy costs and possible energy shortages. These will affect a growing number of people who live in countries with significantly long heating seasons. There is no simple solution to this problem, especially in jurisdictions that have limited access to secure supplies of energy. To permit people to remain living in these countries, policies are needed, both to reduce energy consumption and to switch to secure energy supplies. This report focused on an important third issue, notably how to meet residential heating needs during a heating emergency, when fuel supplies are too expensive or in short supply, or both.

In the right circumstances, individuals or families can reduce their heating demand, protect themselves against the cold, and obtain sources of alternative heating fuels; however, a point can

be reached where the occupants of a building are unable to meet their heating needs and a heating emergency occurs. When this happens, it will be the responsibility of local jurisdictions to help.

The report has identified a number of approaches that governments can take in these situations, including subsidies and rationing. In the most extreme cases, when individuals and families are unable to either pay for the energy they need or there are shortages of energy, it will be necessary to find safe, secure, and warm shelters for those affected. Due to the nature of heating emergencies, people in need may be forced to evacuate their homes for lengthy periods, meaning that these shelters will require facilities for cooking, sleeping, and bathing.

Running shelters such as the ones described here will be a financial burden on any jurisdiction. Therefore, jurisdictions must also introduce policies that reduce the need for shelters by:

- Reducing overall energy consumption in the residential sector,
- Replacing existing insecure energy sources with secure ones, and

- Restricting new energy demand to secure sources.

These actions should be prescribed and targeted separately. Residential energy programs that focus on energy reduction without considering the possible sources of energy used for heating can lead to situations where a house may have low energy intensity but relies on an insecure energy supply.

This report has focused solely on the residential sector and how to protect people during heating emergencies. It has not considered the impact of rising energy costs and energy shortages on the commercial and institutional sectors. These, along with energy security in the transportation sector, must be examined as well, for the shutdown of any of these sectors would be a blow to the jurisdiction's economy and the overall wellbeing of its citizens.

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Notes

1 The point at which an individual or family is deemed to be in fuel poverty varies by jurisdiction; for example, in the UK, it is households that spend more than 10 percent of their income to keep the living room at 21°C and other rooms at 18°C (BERR, 2001), whereas in Canada, some groups have put the figure at six percent and include all household energy use (i.e., space and water heating) (Chisholm, 2008).

2 Addressing transportation energy consumption during fuel shortages has been extensively studied; for example, *Saving oil in a hurry* focuses on member countries of the IEA (Noland, 2004), a report to the Australian National Oil Supplies Emergency Committee (ACIL Tasman, 2004), and a review of oil supply disruptions after the UK fuel blockades in 2000 and the aftermath of Hurricane Katrina (Leotta, 2007).

3 This section was written with the assistance of Mr. Dave Ron, an MASC student in the Energy Research Group.

4 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.

5 In Chicago, the energy heating and cooling emergency telephone number is 3-1-1 (CDHS, 2007).

6 Such a decision can have serious implications. First, there is the threat to water-pipes. Some residents may not know how to locate and operate the main shut-off valve or how to drain their water-lines. If this is not done properly with taps left open, then there is the potential for damage to the pipes. If the house is left unattended with pressurized pipes then there is the potential for catastrophic water damage. Second, food and other items may freeze and burst, though they may survive in a basement. There may also be insurance and liability issues which should be considered prior to leaving one's home.

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