

Northern Housing

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The North has always captured the imagination of Canadians. It is a place of incredible beauty and many superlatives—the tallest mountain, the longest river, the longest summer days and longest winter nights, a land of extreme cold, and one of the most sparsely populated areas of the world.

For many Canadians, the North may seem distant and remote. Increasingly, however, national and international attention is being directed to the North with its world-class diamond mines, oil and natural gas exploration and production, the potential of multi-billion dollar natural gas pipelines and a vibrant and growing tourism industry. Concern over global warming has also focused attention on the North, with the potential of an ice-free Northwest Passage as early as 2012 and increased international traffic through Canadian waters.

Home to Aboriginal people for centuries, the North has attracted people from all over the world who now make their home in this remote part of the country. Some come for the adventure, some for economic opportunities and some for the opportunity to experience a true “last frontier”. For those who chose to live in the North, securing adequate, suitable and affordable housing can be a challenge, especially in the more remote and isolated communities.

FIGURE 7-1
IQALUIT, NUNAVUT



This is the highest the sun rises in winter in Iqaluit.

Credit: CMHC

This chapter takes a look at the North, the people who live there and their housing conditions. It explores the challenges of building housing in a part of the country faced with extreme conditions due to harsh climate, impacts of climate change, high costs, limited transportation infrastructure and some community capacity issues. It also looks at the initiatives taken to respond to these challenges, including some of the technical responses and funding arrangements in place to create housing that meets the needs of the people who live there and the rigours of the Northern environment.

FIGURE 7-2
THE CANADIAN NORTH



The four regions of Nunavut, Nunavik, Nunatsiavut and Inuvialuit in the Mackenzie Delta/Beaufort Sea area of the Northwest Territories make up the *Inuit Nunaat, the Inuit Homeland*.

The North

For the purposes of this chapter, the North is defined as the three territories north of the 60th parallel—Yukon, the Northwest Territories and Nunavut, as well as the Inuit region of Nunavik in northern Quebec and the Inuit region in Labrador, known as Nunatsiavut (see Figure 7-2). Taken together, these areas make up over 40 per cent of Canada's land mass. Nunavik is located north of the 55th parallel in the province of Quebec and includes 14 isolated Inuit settlements on the shores of Ungava Bay, Hudson Strait and Hudson Bay. Nunatsiavut is the Inuit area in northern Labrador and includes five communities along the coast. The four regions of Nunavut, Nunavik, Nunatsiavut and Inuvialuit in the Mackenzie Delta/Beaufort Sea area of the Northwest Territories make up *Inuit Nunaat, the Inuit Homeland*.

The North is a land of opportunity and a land of challenges

To the majority of Canadians who have never travelled “North of 60” or visited the remote regions of Nunavik (see Figure 7-3) or Nunatsiavut, the North is not well known. To those who have ventured north and have met the people and experienced the lure of the land and its unparalleled majesty and beauty, it is an unforgettable experience. To the Aboriginal people who have grown up in the North and have stewarded the land for centuries, it is their only homeland. To non-Aboriginal people born in the North or those who have adopted the North as their home, it is a place of adventure and opportunity, a place that shapes them, much more than they could ever shape the land. To housing researchers, technicians, and designers it is a place where technology and culture intertwine, a testing ground for adapting technologies and products for use in cold climates.

The North is not a homogeneous region—it is a diverse area with a culturally diverse population living in widely differing circumstances.

FIGURE 7-3
HOUSING IN NUNAVIK, QUEBEC



Credit: CMHC

The North is a place of rapid change and transformation

The North is a place of rapid change and transformation—economically, socially, environmentally and politically. The resource industries in the North are booming. Two diamond mines are in full operation, with a third scheduled to open in the near future. Petroleum exploration continues in the Beaufort Sea and Mackenzie Delta area and a natural gas pipeline down the Mackenzie Valley is awaiting completion of regulatory and environmental reviews.

The North has experienced massive social change over the past 50 years. Modern transportation and communications have brought the world to the North and the North to the world. Formalized education and job opportunities have impacted the lifestyles of Northern Aboriginal people and many of them have moved from living on the land (hunting, fishing and gathering) to working for wages.

Land claim agreements between the federal government and First Nations and Inuit in many areas of the North have shaped new directions for self-government. The division of the Northwest Territories in 1999 led to the creation of Canada's newest territory, Nunavut.

On December 1, 2005, Labrador Inuit celebrated the beginning of the Nunatsiavut Government. As a regional ethnic government in Newfoundland and Labrador, the Nunatsiavut Government has many of the responsibilities and rights of other governments, such as planning for sustainable economic development, protecting and preserving Inuit culture and implementing social programs on behalf of Inuit beneficiaries.

Climate variation has significant impacts on the housing sector. The permafrost¹ is melting, causing settling problems and structural damage to buildings, roads and other infrastructure. The warmer temperatures are impacting the use of winter roads and ice roads, reducing the already narrow window of time for transporting building materials to isolated communities.

The Population

The North is sparsely populated and home to about 115,000 people

In spite of its huge geographical area, the North is home to only 0.3 per cent of Canadians. The total population of the three territories in 2006 was just over 100,000. Nearly half the population lives in the three territorial capitals of Whitehorse, Yellowknife (*see Figures 7-4 and 7-5*) and Iqaluit. The remaining 58 per cent is spread out over 88 communities, many of which are remote and inaccessible by road.

FIGURE 7-4
OLDER HOUSING IN TUKTOYAKTUK,
NORTHWEST TERRITORIES



Credit: CMHC

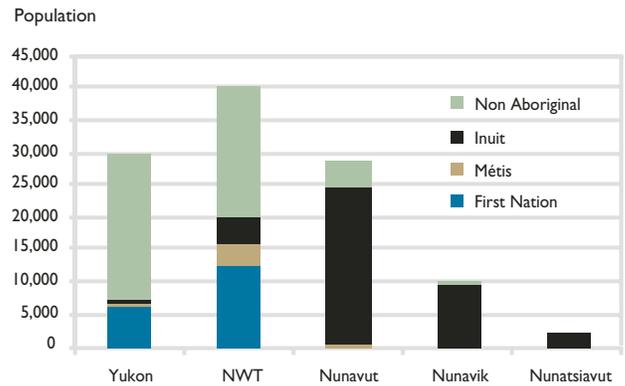
1 The term permafrost is used to describe any ground that has been below freezing for more than one year.

FIGURE 7-5
YELLOWKNIFE, NORTHWEST TERRITORIES



Credit: Patrick Kane

FIGURE 7-6
POPULATION OF CANADA'S NORTH, 2006



Source: CMHC, adapted from Statistics Canada (Census of Canada unpublished data)

The population of the North is growing rapidly, increasing by over nine per cent between 2001 and 2006, with the Northwest Territories and Nunavut growing at approximately twice the rate of Canada as a whole (11 per cent and 10 per cent, compared to just over five per cent). The growth rate in Yukon was lower, at just under six per cent. Nunavik, the largest of the Inuit regions outside the territories, had a population of 10,784 in 2006, an increase of 12 per cent from 2001 and Nunatsiavut had 2,414 residents in 2006, a decline of eight per cent from 2001² (see Figure 7-6).

Nearly 60 per cent of the population is Aboriginal

In 2006, 57 per cent of the population was First Nations, Métis or Inuit (see Figure 7-6). The proportion of Aboriginal to non-Aboriginal varies across the North, with Yukon having the lowest proportion at 25 per cent. In the Northwest Territories, one-half of the population is Aboriginal with the majority being First Nations and the balance split between Métis and Inuit (the latter living primarily in Inuvialuit). Nunavut, Nunavik and Nunatsiavut all have 85 per cent or more Inuit.

The population is young, especially the Aboriginal population

The median age of the Northern population is much lower than that of Canada as a whole. Only Yukon, with a median age of 38.4 is close to the national median of 39.5. Nunavik has the youngest population, with a median age of 19.6, followed by Nunavut at 23.1, Nunatsiavut at 27.8 and the Northwest Territories at 31.2.

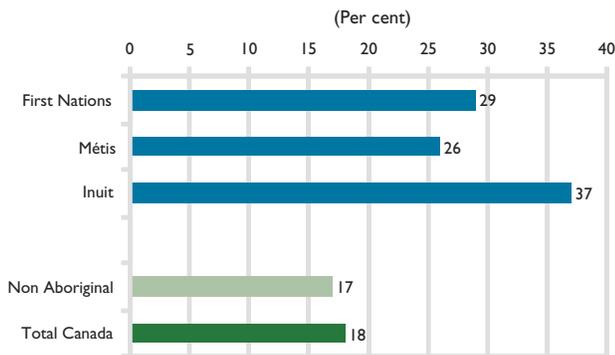
The Aboriginal population in the North, especially the Inuit, is very young. Over one-third (37 per cent) of Inuit are under 15, compared to 17 per cent of the non-Aboriginal population, and 18 per cent of the Canadian population as a whole. One-half of Inuit are under age 25. While not as young as Inuit, the First Nations and Métis population are also much younger than the non-Aboriginal population (see Figure 7-7).

In Nunavut, the birth rate in 2006/2007 was the highest in Canada (24.1 births per 1,000), more than double the national rate.³ The Northwest Territories had the second highest rate in the country at 16 births per 1,000.

2 Statistics Canada cautions that comparisons with 2001 data may be misleading in Nunatsiavut due to boundary changes between the 2001 and 2006 Censuses.

3 *Births and birth rate, by province and territory*, Catalogue no. 91-213-X (Ottawa: Statistics Canada, 2007).

FIGURE 7-7
POPULATION UNDER AGE 15 IN THE NORTH, 2006



Source: CMHC, adapted from Statistics Canada (Census of Canada unpublished data)

The housing situation in the North

Households are much larger, especially in Nunavut and Nunavut

In 2006, there were more persons per household in Northern communities than in the rest of the country. Average household size was largest in Nunavut, at 4.1 persons per household, well above the size of the average Canadian household of 2.5 persons. In the Northwest Territories, the average size was 2.9, in Nunatsiavut, 3.5 and in Nunavut, 3.7. Only in Yukon was the average household size of 2.4 persons close to the Canadian average (see Figure 7-8).

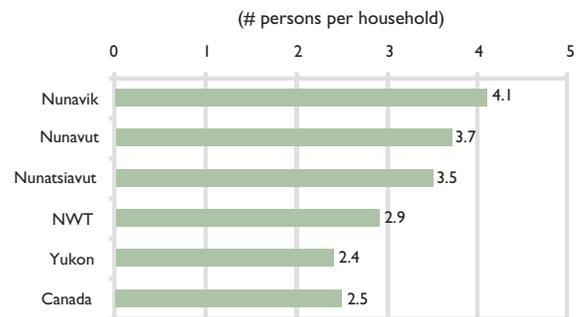
Overall, there were fewer single-person households in the North. The exception, again, was Yukon where nearly 31 per cent of households consisted of people living alone, above the national average of approximately 27 per cent. Nunatsiavut had the smallest percentage of single-person households at just over 14 per cent. Nunavik, Nunavut and the Northwest Territories also had fewer single-person households than the national average (18.5 per cent, 18.3 per cent and 21.6 per cent, respectively).

Many households in the North consist of more than one family. This is especially true in Inuit communities where close to one in six households in Nunavik and one in eight households in Nunavut are multi-family households. This is much higher than in Canada as a whole where less than one in fifty households consists of multiple families. In the North, single individuals and lone-parent families often live with their parents or relatives. One of the reasons for this is the high cost of housing and another is the shortage of housing in many communities. In Nunavut, the territorial government is projecting a need for between 253 and 305 new housing units per year, just to meet the growth in population.⁴

There is very little private rental housing

Outside of Whitehorse and Yellowknife, there is very little private rental housing. In Yukon and the Northwest Territories, only Whitehorse and Yellowknife are considered to be “market housing” communities.⁵ The average apartment vacancy rate in Yellowknife⁶ in April 2008 was 0.6 per cent and in Whitehorse⁷ the vacancy rate was 4.1 per cent as of March 2008. While there is some private rental housing in Iqaluit, there is not enough to constitute a rental market. There are no communities with active rental markets in Nunavut, Nunavik or Nunatsiavut.

FIGURE 7-8
AVERAGE HOUSEHOLD SIZE, ALL HOUSEHOLDS, 2006



Source: CMHC, adapted from Statistics Canada (Census of Canada unpublished data)

⁴ *Nunavut Ten-Year Inuit Housing Action Plan*, (Iqaluit, Nunavut: Government of Nunavut and Nunavut Tunngavik Inc., September 2004).

⁵ Luigi Zanasi, December 2006. *Expiry of federal funding for Social Housing: Implications for the Territorial Housing Corporations*, p. 20.

⁶ Rental Market Report Yellowknife Highlights (Ottawa: CMHC, Spring 2008).

⁷ Yukon Rent Survey (Yukon: Yukon Bureau of Statistics, March 2008).

Most communities outside the major centres do not have an economic base. The majority of rental housing is either government staff housing or social housing, as there is also very little private non-profit housing. There is a large stock of social housing in the North, including First Nations housing in Yukon. In Nunavik, nearly all the housing is social housing. In Nunavut, social housing represents 73 per cent of the rental stock. In the Northwest Territories, excluding Yellowknife, social housing represents 63 per cent of the rental stock and in Yukon, excluding Whitehorse, it accounts for 53 per cent.⁸

The rate of homeownership is lower than in southern Canada

Although the territorial housing corporations, the Société d'habitation du Québec in Nunavik and the Newfoundland and Labrador Housing Corporation in Nunatsiavut have supported Northerners to access homeownership through assistance programs, the rate of homeownership is still low, compared to the rest of Canada.

In all areas of the North, homeownership rates in 2006 were lower than in Canada as a whole where 68 per cent of households were homeowners. Yukon had the highest homeownership rate in the North at just under 64 per cent,

followed by Nunatsiavut at 61 per cent and the Northwest Territories at nearly 53 per cent. The homeownership rate was the lowest in Nunavik where only 2.5 per cent of households owned their homes, followed by Nunavut at 23 per cent (see Figure 7-9).

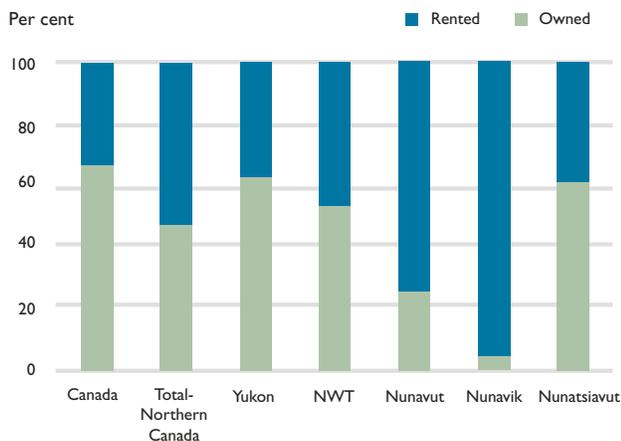
There is a higher incidence of core housing need

In 2001, close to a quarter of households in the North (23.3 per cent) were in core housing need (see text box *Acceptable Housing and Core Housing Need*), compared to 13.7 per cent for Canada as a whole. In Nunavut and Nunavik, nearly 40 per cent of households were in core housing need and in Nunatsiavut, just over 30 per cent.

Overall, just over one-third of Aboriginal households in the North were in core need in 2001, almost three times the level for non-Aboriginal households (see Figure 7-10).

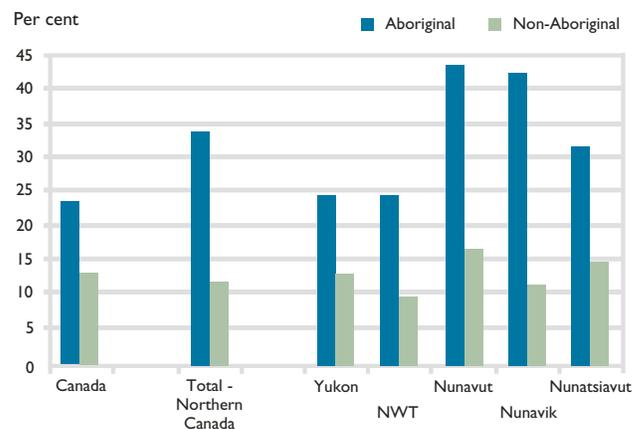
In 2004, 14 per cent of households in the Northwest Territories and 39 per cent of households in Yukon in core housing need reported adequacy problems.⁹ In Nunavut, adequacy is also a problem, but suitability is even more of a problem with many households living in overcrowded conditions.¹⁰

FIGURE 7-9
HOUSING TENURE, ALL HOUSEHOLDS, 2006



Source: adapted from Statistics Canada, 2006 Community Profiles

FIGURE 7-10
PERCENTAGE OF HOUSEHOLDS IN CORE HOUSING NEED, 2001



Source: CMHC (census-based housing indicators and data)

8 Luigi Zanasi, op. cit p. 9.

9 Northwest Territories Housing Corporation and Northwest Territories Bureau of Statistics, March 2004. 2004 NWT Community Survey: Community Needs Overall Results.

10 Luigi Zanasi, op. cit.

Acceptable Housing and Core Housing Need

The term **acceptable housing** refers to housing that is adequate in condition, suitable in size, and affordable.

- **Adequate** dwellings are those reported by their residents as not requiring any major repairs.
- **Suitable** dwellings have enough bedrooms for the size and make-up of resident households, according to National Occupancy Standard (NOS) requirements. Enough bedrooms based on NOS requirements means one bedroom for each cohabiting adult couple; unattached household member 18 years of age and over; same-sex pair of children under age 18; and additional boy or girl in the family, unless there are two opposite

sex children under five years of age, in which case they are expected to share a bedroom. A household of one individual can occupy a bachelor unit (i.e. a unit with no bedroom).

- **Affordable** dwellings cost less than 30 per cent of before-tax household income.

Households which occupy housing that falls below any of the dwelling adequacy, suitability or affordability standards, and which would have to spend 30 per cent or more of their before-tax income to pay for the median rent of alternative local market housing that meets all three standards, are said to be in **core housing need**.

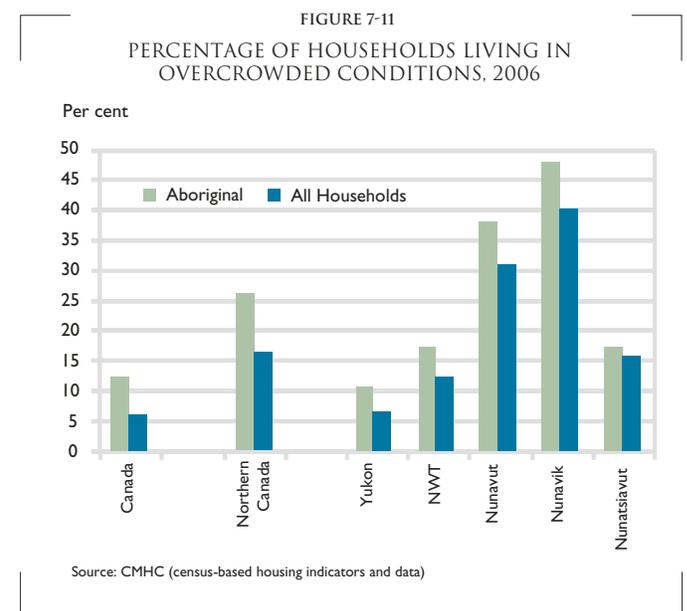
Overcrowding in Nunavik and Nunavut

In the North, over 16 per cent of households lived in overcrowded dwellings in 2006. According to the National Occupancy Standard, a dwelling is of suitable size if it has one bedroom for each cohabitating adult couple; unattached household member 18 years of age and over; same-sex pair of children under age 18; and additional boy or girl in the family, unless there are two opposite sex siblings under 5 years of age, in which case they are expected to share a bedroom. A household of one individual can occupy a bachelor unit (i.e. a unit with no bedroom). If the dwelling has fewer bedrooms than the household requires then it is considered to be crowded.

This compares to just over six per cent in Canada. In Nunavut, 31 per cent of households lived in overcrowded housing and in Nunavik, 40 per cent of households were overcrowded (see Figure 7-11).

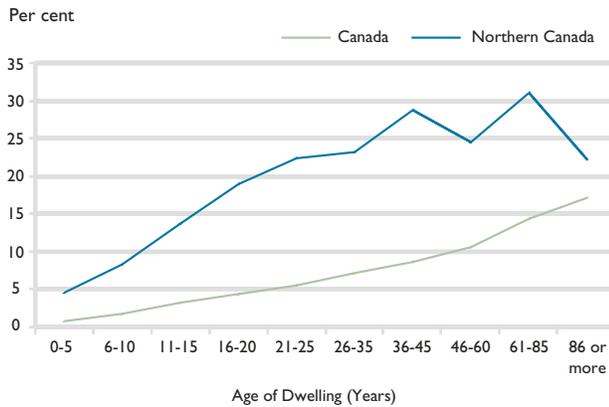
The challenges of providing housing in the North

The overcrowded housing conditions and the rapidly growing population are driving the need for more housing in the North. The combination of geographic, climatic, social and economic factors creates multiple challenges in responding to this need. The geography and climate,



complicated by climate change, present physical challenges due to limited transportation infrastructure, permafrost conditions and a harsh climate, along with overcrowding which contributes to premature aging of the dwelling, and relatively large need for major repairs (see Figure 7-12).

FIGURE 7-12
PERCENTAGE OF DWELLINGS REQUIRING MAJOR REPAIRS, BY AGE OF THE DWELLING, CANADA AND NORTHERN CANADA, 2006



Source: CMHC, adapted from Statistics Canada (Census of Canada unpublished data)

In 2006, 18.6 per cent of households in the North were in need of major repair compared to 7.5 per cent in Canada. The high cost of building and operating housing make housing unaffordable for a large portion of the population without government support and intervention.

The Northern geography creates challenges for transportation of materials and supplies

Many small communities in the North are remote and inaccessible by road. Building materials and supplies must be shipped in from southern Canada or from major centres in the North as they are not available locally. Supplies are sent once a year by barge or ships (see Figure 7-13) during the late summer months or, in some communities, by seasonal ice roads (see Figure 7-14) in the winter or by air. The remote geography and existing infrastructure often make the transportation of materials and supplies difficult and expensive.

The seasonal transportation systems drive the construction process for most Northern communities. In Nunavut, construction of housing is a two-year process—the building materials are shipped in one year and stored over the winter, ready for construction to begin the following year.

This adds significantly to the cost of construction with the need for interim financing to pay for materials and also adds to the risk of materials being damaged or stolen.

FIGURE 7-13
SEA LIFT, IQALUIT, NUNAVUT



Credit: CMHC

FIGURE 7-14
ICE ROAD



Credit: Northwest Territories Housing Corporation

The harsh climate and permafrost present construction challenges

The winters in Canada's North are long (up to eight months a year in some communities) and temperatures go below -40 degrees Celsius. The cold climate limits the construction season, dictates the need for building materials that can withstand extreme temperatures and contributes to high home heating and electricity costs. North of the tree line, strong winds, gusting up to 160 kilometres per hour can create huge snowdrifts, banking the snow up and over houses and other buildings

(see Figure 7-15). A slightest crack in the exterior of the building allows freezing air to enter the home, adding to the heating costs.

FIGURE 7-15
SNOW AT HOME ENTRANCE,
ARVIAT, NUNAVUT



Credit: CMHC

The permafrost, covering large areas of the North, presents challenges to foundation designs. Although permafrost provides a very stable foundation as long as it remains frozen, any melting of the permafrost can cause serious settlement problems and structural damage to the

building. Houses must be built on piles or gravel pads so the loss of heat from the base of the house does not melt the permafrost below.

The existence of permafrost makes it impossible to install piped water or sewer systems in the ground. In Iqaluit and Inuvik, above ground, heated “utilidors” have been constructed to provide water and sewer systems for some of the housing in the community (see Figure 7-16). However, in most communities in the far North, water needs are met through water delivery trucks and sewage is removed by sewage trucks.

Climate change effects on the housing sector

Warmer temperatures can melt the permafrost, destabilizing buildings, roads and other infrastructure (see Figure 7-17). In Sanikiluaq, a small community in Nunavut, the permafrost has completely melted, damaging foundations and destabilizing houses. Although most of the Arctic coastline is not considered to be in danger of rising sea levels, parts of the Beaufort Sea coast, including the outer Mackenzie Delta and Tuktoyaktuk Peninsula, are an exception.¹¹ In the small community of Tuktoyaktuk, Northwest Territories, water levels are already rising, impacting the safety of buildings.

FIGURE 7-16
UTILIDOR IN INUVIK, NORTHWEST TERRITORIES



Credit: Maurice Smith/Nickle's New Technology Magazine

FIGURE 7-17
EFFECTS OF MELTING PERMAFROST
ON BUILDINGS IN DAWSON CITY, YUKON



Credit: CMHC

11 *Climate Change Impacts and Adaptation: A Canadian Perspective*. [online] (Ottawa, Natural Resources Canada, 2004). Available: http://www.adaptation.nrcan.gc.ca/perspective/summary_8_e.php. [July, 2008].

Warmer temperatures will affect the transportation system by reducing the narrow window of time available for travel on winter roads and ice roads, adding to the cost of transporting building materials to those communities dependent upon the winter road system.

A shortage of skilled labour in many Northern communities

There has always been a shortage of skilled labour in the remote Northern communities and construction crews have been flown in from southern Canada or other areas of the North. The cost of transporting and accommodating construction crews from outside the community adds to the high cost of construction.

The high costs and limited employment opportunities, especially in small communities, create economic challenges—for Northerners and for their governments

The cost of living in the North is significantly higher than in southern Canada. In 2007, a typical food basket for a family of four for one week costs between \$195 and \$225 in southern Canada and between \$350 and \$450 in the North.¹² A study of housing costs in the Northwest Territories in 2005 shows that average annual utility costs in most communities were more than double the Canadian average (\$4,328 compared to \$2,140).¹³ The cost of home heating has substantially increased over recent years and is expected to continue to climb over the foreseeable future, due to high global demand for fuel oil and tight supplies.

In the larger centres where private rental housing is available, the rents are high. Average rent in 2007 for a two-bedroom unit in Yellowknife was \$1,364¹⁴ and in Iqaluit, \$2,104,¹⁵ compared to \$647¹⁴ in Montréal or \$958¹⁴ in Edmonton.¹⁶ In Yukon, the average rent of \$700¹⁷ for a two-bedroom unit was closer to rent levels in southern Canada.

Construction costs are high. The Nunavut Housing Corporation reports construction costs per square metre in Nunavut of more than three times those in southern Canada for comparable homes.¹⁸ The Société d'habitation du Québec reports a similar ratio for the cost of construction in Nunavik compared to the rest of Quebec.¹⁹

While average weekly earnings are higher in the North than in southern Canada, the difference is not enough to compensate for the higher cost of living. Unemployment rates are also higher in the North, especially in Inuit regions—18 per cent in Nunavut in 2006, and 32 per cent in Nunatsiavut. Consequently, median total personal incomes are significantly lower in these two regions than in Canada as a whole. Median total personal income in Nunavut was \$20,982 in 2005, which is 18 per cent lower than the Canadian median of \$25,615. In Nunatsiavut, median total personal income in 2005 was \$18,763.

Northern residents are also more dependent on government transfer payments for their income, with almost one-third of total personal income²⁰ in 2005 coming from this source in Nunavut and one-quarter in Yukon, compared to just over one-seventh for Canadians as a whole.²¹

12 Revised Northern Food Basket - Highlights of Price Survey Results for 2006 and 2007. [online] (Ottawa, Indian and Northern Affairs Canada), Available: <http://www.ainc-inac.gc.ca/ps/nap/air/hpsr0607-eng.asp>. [July, 2008].

13 *Spending patterns in Canada*, Cat. No. 62-202-XWE (Ottawa: Statistics Canada, 2007) Table 2.

14 Average rents are for privately initiated apartment structures of three or more units.

15 Average rents include all types of rented units.

16 *Northern Housing Outlook*, (Ottawa: CMHC, 2007) and *Canadian Rental Market Survey*, (Ottawa: CMHC, 2007).

17 Average rents are for apartment structures with four or more units.

18 Government of Nunavut and Nunavut Tunngavik Inc., op. cit.

19 Société d'habitation du Québec, *Housing in Nunavik*, (Gouvernement du Québec, November 2001).

20 Personal income does not take into account the value of fish or wildlife harvested for food for personal consumption.

21 Indian and Northern Affairs Canada, *Northern Indicators 2006*, [online], Available: <http://www.ainc-inac.gc.ca/pr/sts/ni06-eng.asp> [July, 2008].

The high costs and low average incomes translate into high operating deficits for the territorial social housing portfolios. For instance, in the fiscal year 2005-2006, the total annual expenses for social housing in Yukon, including capital and upgrading costs was \$8,447,776. Income from rents and subsidized mortgage payments was \$2,746,971, leaving a shortfall of \$5,700,805, or \$8,638 per unit. In the Northwest Territories, for the same year, the net deficit was \$19,475 per unit and in Nunavut, it was \$28,899.²² As there is a large stock of social housing, these per unit deficits translate to large operating deficits for the social housing portfolio in the North. The territorial governments spend relatively more on housing than their provincial counterparts.²³

Obtaining mortgage financing can be a challenge due to land tenure complications

There are many different forms of land tenure in the North, some of which can be mortgaged and some not. Land claim agreements reflect the traditional Aboriginal view that land cannot be bought and sold, and, in some instances, do not allow the land to be mortgaged. For instance, the Gwich'in Settlement Lands in the Northwest Territories cannot be mortgaged or given as security for a loan.

In the Northwest Territories, there are six forms of land tenure. In addition to private ownership and land claims areas, there are Commissioners' Lands, Federal Lands, Indian Affairs Branch Lands and Indian Reserves. In Nunavut, there are at least three forms of tenure in addition to private ownership, and in Yukon, there are four.

The preferred forms of land tenure for securing mortgage financing from banks or other institutions are fee simple (i.e. private land ownership) or long-term leasehold. Much of the land in the North does not neatly fit into these categories, severely limiting access to mortgage financing, and thereby limiting homeownership. This impacts the take-up of government-funded homeownership assistance programs. For instance, the Northwest Territories Housing Corporation (NWT HC) is finding it a challenge to deliver all its Affordable Housing Trust units (see below) due to land tenure issues.

Responding to the challenges

Developing sustainable responses to these complex challenges is a difficult task. The federal, territorial and provincial governments have responded to the need for government intervention and have funded social housing and homeownership programs in the North since the early 1950s. Initially provided through the Department of Indian Affairs and Northern Development (DIAND), then through joint-agreements with territorial/provincial housing corporations and CMHC, and, more recently, through funding from the territorial/provincial governments and the federal Northern Housing Trust and Aboriginal Housing Trust,²⁴ thousands of houses have been constructed.

Government funding for Northern Housing

In May 2006, the federal government allocated funding for three new housing trusts – the Northern Housing Trust, the Affordable Housing Trust and the Aboriginal Housing Trust.

The Northern Housing Trust provides \$300 million for housing in the three territories

A total of \$300 million was set aside under the Northern Housing Trust to increase the supply of affordable housing in the North. Fifty million each was allocated to the Northwest Territories and Yukon, with \$200 million allocated to Nunavut, in recognition of its particularly urgent housing needs.

The Nunavut Housing Trust Initiative will fund the construction of 725 housing units across the territory, by 2010. Every one of the 25 communities in Nunavut is scheduled to receive new housing. In addition to the new construction, funding will also be used to build capacity in the trades by training approximately 35-40 new tradespeople. The territorial government is committed to breaking down construction contracts into components to increase the opportunity for local contractors to secure contracts to provide the labour component. In the past, contracts have often been issued on the basis of “supply, ship and erect”, making it difficult for small local contractors to compete.

22 Zanasi, op. cit. pp. 13-15.

23 Zanasi, op. cit. pp. 13-15.

24 See Department of Finance Canada <http://www.fin.gc.ca/fin-eng.html> [June 3, 2008].

The Northwest Territories government matched the federal contribution of \$50 million. The combined \$100 million is expected to fund the construction of over 500 new units during 2007-10. Some of these will be delivered through the Northwest Territories Housing Corporation's homeownership programs and others will replace older public housing units.

The Yukon government allocated 65 per cent of the funds (\$32.5 million) from the Northern Housing Trust to First Nations for their own housing priorities. The balance is being used to support other residential projects, including a 30-unit housing complex in Whitehorse to reduce waiting lists for social housing, particularly for women.

The Affordable Housing Trust provides \$800 million to increase the supply of affordable housing

The \$800 million is being allocated over the three-year period 2006/07 to 2008/09 and distributed to all provinces and territories on a per capita basis. The three territories will receive a total allocation of \$2.58 million over the three years. Quebec will receive \$187.4 million and Newfoundland and Labrador will receive \$12.6 million. The funding is intended to be used to relieve short-term pressure including transitional and supportive housing. Provinces and territories have the flexibility of drawing down the funds as they need them.

The Aboriginal Housing Trust provides \$300 million for off-reserve Aboriginal housing

In May 2006, the federal government also established the Aboriginal Housing Trust. Three hundred million dollars is being distributed from this fund to the provinces based on their share of the Aboriginal population living off-reserve. Quebec will receive \$38.2 million and Newfoundland and Labrador, \$8.2 million. The Aboriginal Housing Trust funds are not available to the three territories, for which the Northern Housing Trust was created (see above).

Federal funding put in place for an integrated Northern strategy

In the 2007 Speech from the Throne, the federal government announced an integrated northern strategy with four priorities:

- Strengthening Canadian sovereignty in the Arctic.
- Protecting the fragile Northern environment.
- Promoting economic and social development.
- Improving and devolving governance, so that Northerners have greater control over their economic and political destinies.

A \$120 million trust fund was created to support initiatives in the three territories to advance the objectives of the Northern Strategy, with \$40 million allotted to each territory.

New funding allocated to provide community infrastructure in the North

In February and March 2008, framework agreements were announced that provide each of the three territories with over \$240 million for infrastructure investment to 2014. The funding comes from three sources: the Building Canada Fund, base funding of \$25 million (available to all provinces and territories) and gas tax funding. The investment will be used to address core infrastructure needs in the territories, including public transportation corridors, bridge replacement, airports, regional marine facilities and improving infrastructure for essential community services such as water, wastewater and green energy alternatives.

Nunavik receives \$140 million for new housing

Nunavik is currently in the third year of a five-year, \$140 million agreement for the construction of 275 housing units. This agreement between the Government of Canada, the Government of Quebec and the Inuit of Nunavik follows on the heels of the James Bay and Northern Quebec Agreement (JBNQA). The \$140 million costs are funded in equal parts by the Quebec government and the Government of Canada. The Government of Canada is financing the construction of housing and Quebec is underwriting operating deficits related to housing units for a 20-year period. Makivik Corporation, the Inuit development corporation, is the principal contractor for the construction of the housing, while the Kativik Municipal Housing Bureau will become the owner and manager of the units, once construction is completed.

The Northwest Territories Housing Corporation consolidates its homeownership support programs

In 2007, the Northwest Territories Housing Corporation unveiled *Housing Choices*, a consolidated program designed to foster self-reliance and assist residents of the Northwest Territories to become successful homeowners. *Housing Choices* includes four programs:

- STEP - Solutions to Educate People (education and counselling to prepare qualifying applicants for homeownership, including financial skills, the process of purchasing a home and basic home maintenance skills).
- HELP - Homeowner Entry Level Program (transition program for people who may wish to become a homeowner but aren't able to do so on their own).²⁵
- PATH - Providing Assistance for Territorial Homeownership (assistance in the form of a forgivable loan to construct or purchase a modest home).
- CARE - Contributing Assistance for Repairs and Enhancement (financial assistance to homeowners to make necessary home repairs).

Housing Choices offers a simplified and flexible program structure to improve access and support for successful homeownership.

Responding to technical challenges

Often referred to as “matchboxes” due to their compact size, the early Northern housing of the 1950s often had no electricity or running water, providing only basic shelter from the elements. In the 1960s and 1970s the quality of housing improved considerably but fell short in addressing issues specific to the northern environment and lifestyles. Based on southern designs and technology, some of these houses developed structural deficiencies, requiring expensive structural upgrading to extend their life expectancy.²⁶

Thanks to research initiatives by universities, circumpolar agencies, governments, CMHC and other agencies with an interest in the North, the housing built today has improved technological standards that are better suited to the harsh climatic conditions of the North, with designs that better reflect the cultural needs of the people of the North. Research and monitoring of pilot projects has resulted in features such as improved foundation designs to withstand permafrost conditions, enhanced ventilation systems to improve indoor air quality, high performance building envelopes, and the design of culturally appropriate housing for First Nations and Inuit communities. CMHC, Natural Resources Canada, the Canadian Circumpolar Institute in Alberta, the Cold Climate Housing Research Centre in Fairbanks, and other agencies continue to conduct research in the North with a focus that has broadened over the years from an emphasis on energy conservation to include the design and construction of healthy, sustainable housing designed to meet the needs of the occupants.

Some of the progress made is described below.

Innovations in design and materials improve energy efficiency of housing

The search for ways to reduce housing costs by improving energy efficiency continues in the North. Highly insulated double-wall construction systems and triple-glazed windows with insulated fibreglass frames are examples of improvements that have enhanced building envelope performance. Whatever approaches are used, an emphasis is placed on innovation, adaptability and careful consideration of local capacity in installation and use. Installation requirements designed for the south may need to be revised to fit the context of extreme northern conditions.

An example of an approach that addresses some of the challenges of building in the North is the use of structural insulated panels (SIPs) (*see Figure 7-18*). SIPs can be used for floors, walls and roofs. They typically consist of two panels (skins) of oriented strand board (OSB) sandwiching a core of rigid foam insulation. The panel gets its strength from the integral connections between the OSB and the foam acting as a structural element.

25 Assistance is provided through a lease on a NWT HC home to those eligible. Those assisted contribute 20 per cent of their gross income toward rent and shelter costs (power, water delivery, etc). After successfully completing a two-year period those assisted are eligible to receive an equity contribution towards the purchase of a home (see http://www.nwthc.gov.nt.ca/pgm_HELP.html) [July, 2008].

26 Royal Commission on Aboriginal Peoples, 1996. http://www.ainc-inac.gc.ca/ch/rcap/sg/si40_e.html.

The technology is not new, being first used in 1950, but its use in building in the Canadian North is relatively recent. Successful testing and evaluation of the use of SIPs for building in Canadian Arctic communities was initially carried out in the late 1990s in Naujaat,²⁷ an Inuit settlement on the shore of Hudson Bay in Nunavut. The evaluation and subsequent use have shown a wide range of advantages in using SIPs to address Arctic building challenges compared to traditional wood frame construction:

FIGURE 7-18
BUILDING WITH STRUCTURAL
INSULATED PANELS (SIPS)



Credit: CMHC

- **Time-saving:** a weather-tight structure can be put together in a few days, allowing interior work to continue irrespective of the weather.
- **Ease of use:** techniques are easy to learn, so the need for skilled tradespeople is reduced.
- **Comfort:** the system can be relatively air tight, thereby reducing drafts.
- **Reduced construction cost:** labour hours are reduced and material cost is competitive.
- **Reduced operating costs:** heating cost for the Naujaat house for a 13 month period was 25 per cent less than for similar homes in the community.
- **Reduced financing costs:** interim financing costs can be reduced as the possibility of an immediate start to construction eliminates the need for storing materials over the winter.
- **Withstanding challenges due to settling:** the structure is more resistant to the twisting and torquing of the foundation during the seasonal freeze-thaw cycle.

CMHC's About Your House North Series¹

The *About Your House* North series is specifically designed around day-to-day Northern solutions as well as innovative building practices for cold climate conditions. This series complements the CMHC research reports on Northern housing.² The series includes:

- Building with Structural Panels in Repulse Bay (Naujaat, Nunavut).
- Snowshoe Inn, Fort Providence Co-Generation Model.
- Eagle Lake Healthy House.
- Arctic Hot Roof Design.
- How to Prevent Plumbing and Heating Vent Stack Freeze-Up.
- Fancoil Integrated Combination Heat and Domestic Hot Water Systems.

1 See: http://www.cmhc-schl.gc.ca/en/ab/noho/noho_023.cfm.

2 See: <http://www.cmhc-schl.gc.ca/en/corp/li/horetore/rerelisu/index.cfm>.

27 Building with Structural Panels - Repulse Bay, About Your House, North Series 1, (Ottawa: CMHC, 2001).

Innovative foundation designs respond to the challenges of building on permafrost

Innovative foundation techniques have been developed in the North to respond to the challenges of building on permafrost. Although permafrost provides a stable foundation as long as it remains frozen, the loss of heat from the house can cause melting and serious settlement problems. Approaches to address this in Arctic communities include:

Building on piles: Steel or wooden piles, protruding up to 1.5 m (5 ft.) above the ground can provide sufficient cold air circulation under the house to keep the permafrost frozen. The piles can be driven in with a pile driver, after a channel in the permafrost has been created with a steam jet. Ideally, piles are left undisturbed for up to a year until firmly wedged in the permafrost.

Thermal piles: A *thermal pile* is a unique foundation pile in which a refrigeration system draws warmth from the earth, thereby helping to stabilize the permafrost, and keep it frozen during warmer weather.

Wood cribbing on a gravel pad: A gravel pad, 0.9 m (3 ft.) or more deep, is used to level the site, insulate the ground and provide drainage. The house is supported above the pad on small piles of wood timbers organized horizontally on top of each other (see Figure 7-19). One advantage of this method is its low cost. Ground heaving can be addressed by adjusting the height of the cribbing through the use of wood wedges or screw-jacks (annually if necessary).

FIGURE 7-19

WOOD CRIBBING ON A GRAVEL PAD,
DAWSON CITY, YUKON



Credit: CMHC

The low elevation of a crib foundation reduces the number of steps or the length of a wheelchair ramp required to enter the house (potentially a significant cost saving) and better addresses cultural preferences to be close to the ground.

Screw-jack footings on a gravel pad: The Northwest Territories Housing Corporation uses screw-jack type footings on gravel pads instead of wooden cribbing. This type of foundation allows for easy adjustment if there is some seasonal movement in the gravel pad. As they are less bulky than wooden cribbing, screw-jack footings minimize the obstruction underneath the house, allowing more air movement and reducing the potential for snow build-up on the leeward side of the house. Screw-jack footings are manufactured in the Northwest Territories.

Space frame foundations: These foundations consist of a network of interconnected structural steel (or alloy) members, which form a frame supporting the house (see Figure 7-20). The load and stresses on the foundation are distributed evenly through the framework, increasing the structural integrity of the building. However, space frame foundations are much more costly and result in higher elevation of the house above ground level. They are used more commonly in areas with problem soils or in multiple unit dwellings. In the latter, space frame foundations reduce the possibility of breaches in the fire separation (a construction assembly that acts as a barrier against the spread of fire), that could occur with differential movement.

FIGURE 7-20

AWARD WINNING NUNAVUT
HOUSING CORPORATION FIVE-PLEX
ON A SPACE FRAME FOUNDATION



Credit: CMHC

Nunavut Charrette

Examples of priorities and concerns:

- Allow for the lifestyles of two seasons.
- A place within the house for large groups to get together to eat country food.
- Accommodate differing needs of young and old in an extended family.
- A partially heated area to sew skins and make small crafts.
- Different storage and living areas (cold, cool and warm).
- Mechanical rooms are too tiny, noisy, and difficult to clean.
- Require wind studies before issuing permits to avoid snowdrift problems, which could block home access and interfere with combustion venting systems (furnace flues).

Some of the design features selected to respond to these and other priorities:

- Two entrances (summer and winter) oriented for local conditions.
- A large central open space (living room, dining room and kitchen) with room for groups to eat country food.
- A cold storage area to accommodate skin clothing.
- A “cool room” for sewing and preparing skins.
- A large laundry tub for soaking skins.
- An isolated mechanical room with easy access off the main entrance for maintenance.
- Allowances for easily constructing additional rooms.

The search for culturally appropriate housing continues

Aboriginal people in the North who still follow traditional lifestyles have different housing needs than people in southern Canada and they relate to their domestic space differently. Southern homes are not designed for a hunting culture, for skinning animals at home, or for the traditional large gatherings to eat country food.²⁸ To address these traditional needs, Northern house design must take into account cultural considerations as well as the other northern challenges discussed above.

Over the years, territorial housing corporations have held design consultations with Aboriginal residents to determine their specific housing needs. Recently, two design charrettes were organized by Canada Mortgage and Housing Corporation to provide cultural input into the design for demonstration houses in two Northern communities. They were held with the Inuit in Arviat, Nunavut (*see Nunavut Charrette text box*) and with the Tr'ondëk Hwëch'in First Nation in Dawson City, Yukon.

The goal of the demonstration projects is to incorporate the cultural and lifestyle needs of the community in the design of the house.

FIGURE 7-21
TR'ONDËK HWËCH'IN HOUSING
IN DAWSON, YUKON



Credit: CMHC

28 Country food is food obtained from hunting or fishing.

The charrettes involved the participants in identifying their cultural goals, what they liked about their housing, what they wanted to change, what the critical community housing issues were, and what could be done to improve their housing conditions. On the basis of this, they identified building performance and design needs that matched their lifestyles. The designs for two versions of the Northern Sustainable House were carried out. The designs are transferable to other parts of the North with similar cultural needs. Construction of the Tr'ondëk Hwëch'in/CMHC Northern Sustainable House has been completed.

The Northern Sustainable House

The Northern Sustainable House near Dawson is a one-storey, 141 m² (1,519 sq. ft.) residential structure completed in early 2008 (see Figures 7-22 and 7-23).

FIGURE 7-22

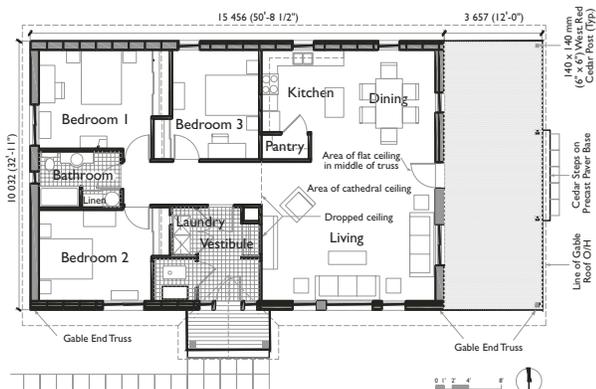
TR'ONDËK HWËCH'IN/
CMHC NORTHERN SUSTAINABLE HOUSE



Credit: CMHC

FIGURE 7-23

FLOOR PLAN OF TR'ONDËK HWËCH'IN
NORTHERN SUSTAINABLE HOUSE



Credit: CMHC

FAST Facts

- The North, comprising Yukon, the Northwest Territories, Nunavut, Nunavik, and Nunatsiavut, represents over 40 per cent of Canada's land mass and is home to about 115,000 people.
- In Nunavut, construction of housing is a two-year process—the building materials are shipped in one year and stored over the winter, ready for construction to begin the following year.
- Although permafrost provides a very stable foundation as long as it remains frozen, any melting of the permafrost can cause serious settlement problems and structural damage to the building.
- In the Northwest Territories, the average annual utility costs in most communities in 2005 were more than double the Canadian average (\$4,328 compared to \$2,140).
- Many communities in the North are remote and inaccessible by road. Building materials are shipped in once a year from southern Canada by barge, ship or winter roads.
- Housing built in the North today has improved technology based on years of research and includes innovative foundation designs enhanced ventilation systems, high-performance building envelopes and culturally-appropriate designs for First Nations and Inuit communities.

The house was designed in a partnership between Canada Mortgage and Housing Corporation and the Tr'ondëk Hwëch'in First Nation, with the participation of the Yukon Housing Corporation (YHC). It was erected by the local construction company of the Tr'ondëk Hwëch'in First Nation. The intent of the design and construction of the home was to create a prototype for, and to promote the construction of, northern housing that is both highly energy-efficient and culturally acceptable to the occupants and the community.

The design addresses concerns raised at the charrette:

- sun shading in summer;
- protection from winds and heavy snow in winter;
- proper ventilation for good indoor air quality and to prevent moisture buildup;
- household size;
- privacy needs;
- space for items such as computers;
- lot size and building siting, to provide a southern orientation to maximize the passive solar heating in winter;
- the possibility of using innovative construction methods, such as structural insulated panels (SIPs) which are a composite building material in which a thick layer of polystyrene or polyurethane foam is sandwiched between two layers of structural board;
- the need to provide more storage space inside and outside the house;
- affordability and energy efficiency; and
- design and construction techniques transferable throughout the Yukon and other parts of the North.

FlexHousing™²⁹ design features that have been incorporated into the Northern Sustainable House are:

- the design and construction of porches that can be easily converted into additional bedrooms or other living space;
- the installation of 90 mm (36 in.) interior doors and the incorporation of adequate turning area for wheelchair accessibility throughout the home;
- the installation of electrical outlets and switches at a height easily reached from a wheelchair; and,
- grading of the lots to provide ground level access to the houses at the front entrance.

In addition to these features, the Northern Sustainable House includes a larger, more open concept living room/dining room/ kitchen area to provide space for family gatherings, an important cultural feature identified by the design charrette participants.

Energy modelling

Energy modelling of the building envelope and mechanical and electrical systems was carried out with Natural Resources Canada's (NRCan's) HOT2000 building energy simulation program. For further information on NRCan's HOT2000 Program, go to www.nrcan.gc.ca and search under HOT2000. Successive iterations of the house design were evaluated to ensure that the overall energy performance goals of the house (to exceed the Model National Energy Code of Canada for Houses (MNECH) by 50 per cent) would be achieved. For further information on this Code, go to www.nationalcodes.ca or www.nrc.gc.ca and search under MNECH.

The modelling predicted a reduction of 54 per cent in energy consumption of the Northern Sustainable House near Dawson in comparison to the same house designed to meet the requirements of the MNECH. Overall, the total annual energy consumption of the house is 168 KWH/m² of floor area. The estimated annual energy cost savings were estimated to be approximately \$3,000 in comparison with the estimated costs associated with the base case house designed to meet the MNECH.

Performance monitoring and occupant survey

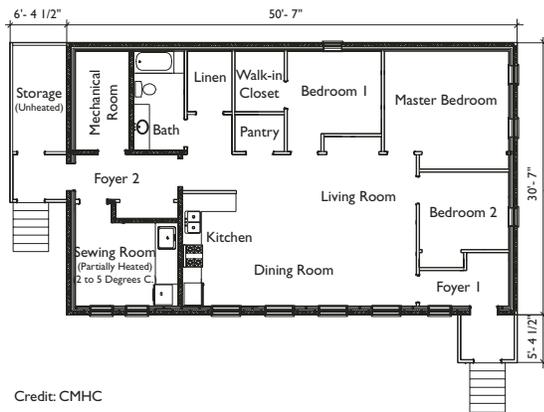
When the Northern Sustainable House near Dawson was completed early in 2008, CMHC began monitoring the energy use during occupancy for a period of one year. The information gathered will be assessed to determine the extent to which the energy consumption meets the 50 per cent reduction compared with the MNECH baseline. The monitored energy consumption will also be compared with the energy consumption of similar Tr'ondëk Hwëch'in houses that use conventional construction techniques. It is anticipated that this will demonstrate the cost/benefit relationships between reduced energy consumption and increased construction costs.

29 For more information on FlexHousing™ go to www.cmhc.ca, keyword "FlexHousing".

Several key indoor air quality parameters will also be monitored. In addition, CMHC will interview residents to determine their perceptions of the house, its energy efficiency, indoor air quality and comfort, ease of maintenance, and the overall functionality of the house.

Construction of the Nunavut Housing Corporation/CMHC Northern Sustainable House is now being planned (See Figures 7-24 and 7-25).

FIGURE 7-24
FLOOR PLAN
NUNAVUT HOUSING CORPORATION/
CMHC NORTHERN SUSTAINABLE HOUSE



Credit: CMHC

Nunavut Housing Corporation receives CMHC's Best Practices in Affordable Housing Award

In 2006, an innovative five-plex housing design created by the Nunavut Housing Corporation was awarded CMHC's Best Practices in Affordable Housing Award (See Figure 7-20).

FIGURE 7-25
COMPUTER GENERATED INTERIOR VIEW
OF THE NUNAVUT HOUSING CORPORATION/
CMHC NORTHERN SUSTAINABLE HOUSE



The house features a large central combined living and kitchen area for the family and large groups to get together.

Credit: Nunavut Housing Corporation

The design, based on extensive community consultations, addresses the unique cold-weather challenges of building in the North. Construction innovations include higher insulation values, heating from a centralized boiler with individual Heat Recovery Ventilators (HRVs) in each unit, and the use of lighter steel studs that save on shipping costs. Design innovations include heated porches, large open living spaces, larger kitchen cupboards, and a room with separate outdoor access for preparing country food. Many of the 725 units being constructed by the Nunavut Housing Corporation under the Nunavut Housing Trust Initiative will be built with this design.

FIGURE 7-26
HOUSING IN ARVIAT, NUNAVUT



Credit: Nunavut Housing Corporation

Housing in the World's Other Northern Regions

The circumpolar countries

There are seven other countries whose land mass extends far North into the Arctic: United States (Alaska), Denmark (Greenland), Iceland, Norway, Finland, Sweden, and the Russian Federation. The inhabitants of these regions face similar challenges in building housing adapted to the harsh climate and in coping with climate change.

The indigenous peoples

Indigenous peoples are found in the arctic portion of all of these regions except Iceland. About 155,000¹ Inuit persons live in Canada, Greenland, Alaska and the Russian Federation. The indigenous people of the far north of Norway, Finland and Sweden and the contiguous area of the Russian Federation are the Sámi, whose traditional lifestyle is reindeer herding (an estimated 10 per cent still depend on it). They number between 50,000 and 100,000.²

Housing conditions

Relatively poor housing conditions are common for Inuit across all of their regions. In the U.S., as is the case in Canada, the 2005 *Alaska Housing Needs Assessment Survey* found that the high cost of construction and the lack of skilled tradespeople act as barriers to developing adequate housing. The populations most in need of housing there are identified as Alaska Native households, rural households and low-income households. Affordability is a serious problem.

Sámi areas in Europe were heavily bombed during World War II causing wholesale destruction of homes. There is currently no wide disparity between their housing (or those of others in the North) and those of residents in the southern parts of their respective countries.

Comparative studies

The *Survey of Living Conditions in the Arctic* (SLiCA) is an international cooperative effort funded by the circumpolar countries, including Canada. Data are available for a number of indicators comparing conditions in Canada's North (regions of Inuit Nunaat), Greenland, Chukotka in the Russian Federation, and Alaska; however, comparability is difficult to achieve, and the authors caution about the dangers of misinterpretation.

The data suggest that Canada's Inuit may be somewhat less likely to be in housing in need of major repair than those in the other arctic regions studied, and may also have more rooms in their dwellings. However, waiting periods for housing appear to be considerably longer in Canada. Attachment to local community is stronger for Canada's Inuit, who are less likely to have considered moving away from the community in the last 5 years than those in Alaska or Greenland.³

Testing and certification for building products for the circumpolar world

The Cold Climate Housing Research Center (CCHRC) in Alaska (an industry-based research facility) plans to implement a "Certified Alaska Tough" certification for building products suitable for circumpolar regions around the world.⁴ In Canada, the Government of Yukon has been working on the development of a cold climate research centre coupled with an innovation cluster (including training, and research and development), a major focus of which will be the technology of building.⁵

1 Estimate from Inuit Circumpolar Council (Canada) Annual Report.

2 Estimate from Norway Cultural Profile, http://www.culturalprofiles.net/norway/directories/norway_cultural_profile/-2067.html [July, 2008].

3 Birger Poppel, Jack Kruse, Gérard Duhaime, Larissa Abryutina. 2007. SLiCA Results. Anchorage: Institute of Social and Economic Research, University of Alaska Anchorage <http://www.arcticlivingconditions.org/> [July, 2008].

4 See <http://www.cchrc.org/> [July, 2008].

5 For further information see <http://www.yukoncoltech.com/> [July, 2008].

Housing in the World's Other Northern Regions (continued)

Sharing building knowledge

The common challenges of building in the North have fostered an interest in sharing knowledge, experience and practice among circumpolar nations. In November 2007, CCHRC and the University of Alaska Fairbanks hosted an international conference on circumpolar housing and infrastructure issues, with CMHC as a partner. The various presentations are documented on the CCHRC website.⁶

Expanding use of geothermal energy

The use of geothermal heating approaches is expanding in circumpolar countries. In Iceland, close to 90 per cent of the housing is now heated with geothermal energy. The geothermal heat is used to warm up fresh water which is then used directly for central heating.⁷ While Iceland's circumstances are unique, given its high level of naturally occurring and accessible geothermal resources, the potential in Canada's North has recently been demonstrated through a feasibility study completed for the city of Yellowknife. The study found that there is enough geothermal energy in a local abandoned gold mine to heat 1,600 to 2,000 homes and reduce greenhouse gas emissions by 24,000 tons per year.⁸

An example of a low energy house from Greenland

The low-energy house in Sisimiut (*see Figure 7-27*) is an example of sustainable building practices in Greenland. Energy-saving features of the house include:

- more insulation than usual in the wall, floor and roof constructions,
- low-energy windows, developed especially for Arctic conditions,
- a ventilation system that features heat recovery—developed especially for Arctic conditions,
- solar energy for heating rooms and water.

The house was completed in 2005 and currently functions as a research laboratory. Work is underway to examine how the low-energy materials chosen affect the interior climate and humidity levels.

FIGURE 7-27
LOW-ENERGY HOUSE IN SISIMIUT



Credit: Arctic Technology Centre, Technical University of Denmark

6 See <http://www.cchrc.org/> [July, 2008].

7 Ministry of Industry, Energy and Tourism, Reykjavik, 2005 [online] <http://eng.idnadarraduneyti.is/minister/speeches/nr/1680> [July, 2008].

8 Con Mine geothermal heat could heat 2,000 Yellowknife homes: study, 2008 [online] For more information, go to <http://www.cbc.ca/canada/north/story/2008/05/16/con-geo.html> [July, 2008].

Yukon leads the way with green housing in the North

The Yukon Housing Corporation (YHC) is leading the way in promoting green building standards in the North with its *GreenHome* Program, in operation since 1999. Certified *GreenHome* provide healthy living environments for the occupants, produce less greenhouse gas emissions and have lower energy costs than traditionally constructed houses. *GreenHome* benefits the Yukon housing industry by requiring a minimum of 75 per cent of the building materials to be purchased in Yukon and requiring the house to be constructed by a Yukon builder. An owner of a certified *GreenHome* can apply for a Green Mortgage at a preferred interest rate with no mortgage insurance fee as the homes are self-insured by YHC.³⁰

YHC has also been progressive in setting design standards for persons with limited mobility through its “Accommodating Homes Standard” developed in the 1990s. YHC incorporates this standard into many of its housing units. Initiatives such as these are increasingly important in Yukon, as anecdotal evidence suggests more and more people are choosing to remain in the North when they retire, rather than relocating to southern Canada, as was common practice in the past.

Conclusions

Governments at all levels are cooperating to provide resources to address Northern housing needs. Technological innovations have overcome some of the challenges and resulted in improved foundation designs, enhanced ventilation systems, high performance building envelopes and building materials more suited to the harsh Northern winters. Design charrettes and consultations with Aboriginal communities have resulted in culturally-appropriate house designs that are transferable to other communities in the North. Through cooperation among governments, northern residents and our circumpolar neighbours, Canada is making progress in addressing the challenges of building better housing in the North.

³⁰ See http://www.housing.yk.ca/green_home_programs.html [July, 2008].