

12

CANADA

Energy efficiency retrofits: policy solutions for sustainable social housing

Sasha Tsenkova and Karim Youssef

Overview of national energy policy and climate conditions

In Canada support for comprehensive energy retrofits in the built environment is in the initial stages of implementation (Fuller, 2009). Recently the federal government launched policy initiatives supporting energy efficiency retrofits in social housing in an effort to create green jobs and provide efficient responses to climate change.¹

Canada is a federal state, governed by ten provinces and three territories. Because Canadian provinces have jurisdiction over energy matters within their borders, the federal government needs to work with provincial governments to build consensus on the goals and means of energy policies as well as the provincial fair share towards advancing national energy goals (Canadian Energy Efficiency Alliance, 2010). This is further complicated due to the vast size of the country where large distances between production and consumption as well as diverse climatic regions further influence specific provincial energy efficiency targets and policies.² As for the social housing providers – public, private non-profit and community (cooperative) we focus on two provinces – namely, Ontario and British Columbia.

Climate conditions

Canada is the world's second largest country by total area including eleven distinct climatic regions (see Figure 12.1). The differences between Canada's climatic zones are significant. Winters can be harsh in many regions of the country, particularly in the interior and Prairie Provinces with continental climate, where daily average temperatures are near -15 °C but can drop below -40 °C. Coastal British Columbia enjoys a temperate climate, with a mild and rainy winter. On the east and west coasts, average high temperatures are generally in the low 20s °C, while between the coasts, the average summer high temperature ranges from 25–30 °C. Cities on the Atlantic coast receive as little as 1,500 hours of sunshine each year, while cities on the Prairies

T&F Proofs: Not for distribution

210 Sasha Tsenkova and Karim Youssef

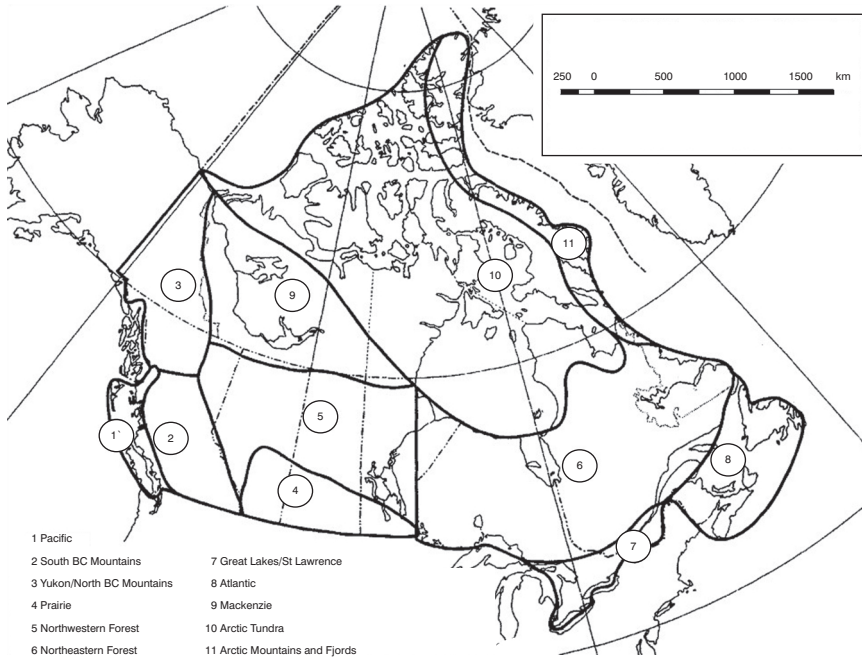


FIGURE 12.1 Climate regions in Canada
Source: Environment Canada, 1994: 19

receive as much as 2,400 hours (Environment Canada, 1994: 18). Canada's coastal regions receive an average of 1,500–3,200 mm of precipitation annually, while areas in the north average only 100 mm to 200 mm. Overall, Canada's climate is characterised by short intensive summers and long winters leading to significant heating requirements.

National energy policy regarding housing

Energy savings in the built environment have a high priority on the political and scientific agenda in Canada due to their potential to improve the security of energy supply, reduce greenhouse gas (GHG) emissions and respond to climate change imperatives (Engelund Thomsen and Wittchen, 2008; Itard and Klunder, 2007). In 2008, the provinces and territories collectively committed to achieving a 20 per cent increase in energy efficiency by 2020. This was followed by Canada's announcement of its 2020 emissions reduction target (a 17 per cent reduction from 2005 levels) under the Copenhagen Accord (IEA, 2010). The housing sector accounts for 17 per cent of secondary energy use and for 16 per cent of GHG emissions with over 80 per cent of the residential energy use related to space and hot water heating (Natural Resources Canada, 2006). While experimental technologies in new housing and Leadership in Energy Efficient Design (LEED) certified buildings have demonstrated the potential of 40 per cent reduction in energy consumption, the

impact remains limited due to the pilot nature of these projects (CMHC, 2008). More recent national and provincial commitments to energy savings have directed policy attention to measures affecting the built environment and in particular the housing sector.

Canada is committed to energy efficiency and alternative energy initiatives as part of its national Green Plan. National energy programmes incorporate energy security, economic development and environmental protection. Canada's energy efficiency has improved between 1990 and 2007 by 16 per cent as reflected by a decrease in energy intensity (energy use per unit of GDP) by 19 per cent. These improvements reduced energy use by approximately 1,089.7 PJ, decreased GHG emissions by 63 Mt and saved Canadians C\$22.8 billion (approximately €15 billion) in 2007. However, this increase in energy efficiency has not been coupled by a parallel decrease in per capita energy use. In fact, energy use per capita increased by 7 per cent due to the increase in use of electronic appliances (Office of Energy Efficiency, 2009: 8).

Government institutions at all levels have substantial roles in energy efficiency policy and implementation (Energy Efficiency Working Group, 2008). Natural Resources Canada (NRCan), created in 1994, is the lead federal agency with its Office for Energy Efficiency (OEE) that administers the Energy Efficiency Act and manages the ecoEnergy for Efficiency Initiative. NRCan spends C\$220 million on energy efficiency programmes of various types.³ Federal efforts centre on regulatory and fiscal instruments. An example is the current redevelopment of the National Energy Building Code by 2012 to improve energy efficiency standards and requirements. The federal government also plays a role in the integration of efforts into existing federal programmes, such as Infrastructure Canada's Integrated Community Sustainable Plans, in order to increase the market penetration of energy efficiency and renewable energy technologies in Canadian communities. Currently, the main federal-provincial forum for energy efficiency discussions is the Council of Energy Ministers and the associated Steering Committee on Energy Efficiency. Provinces collaborate through the Council of the Federation. The diversity and the autonomy at the provincial level are both a challenge and an opportunity. The International Energy Agency in its review points out that Canada still lacks national efficiency targets and a national strategy to attain them as well as systematic harmonisation of policies across provinces and territories (IEA, 2010).

The federal government has built a foundation for investment in energy efficiency through initiatives like the EnerGuide home rating system and regulations under the Energy Efficiency Act. However, provincial governments are left to their own initiative in the housing sector, which has resulted in a wide variety of financial programmes and standards/targets for energy efficiency. Energy efficiency in housing is promoted at several levels:

- the level of appliances used within the building;
- the level of site planning and building envelope;
- the level of land uses to deliver more compact and complete communities.

T&F Proofs: Not for distribution

212 Sasha Tsenkova and Karim Youssef

First, policies targeted appliances and heating and cooling systems in housing through the EnerGuide rating system (mandatory since 1995) and Energy Star rated appliances (introduced in 2001), then shifted to regulations for new home construction (R-2000) and LEED certification. More recently, federal and provincial programmes targeted energy efficiency upgrades and retrofits in existing housing combining regulatory and financial instruments. Given the fact that 58 per cent of the residential buildings across Canada are single detached dwellings, some small-scale programmes attempted to provide incentives to home owners to replace heating and ventilation systems with energy efficient furnaces as well as carry out window replacement and weatherisation measures. Green mortgage programmes, administered by CMHC, are one of the ways of overcoming the initial cost of energy retrofits by taking into consideration resulting energy savings on the long term. Overall, the implementation of energy efficiency measures in housing within a decentralised framework of policy-making has been limited. Studies indicate that only 8 per cent of the homes have had a retrofit, many buildings operate at 50 per cent below their efficiency potential and that due to fragmented support policies many Canadian homes and businesses are not enjoying the benefits of efficient energy use (Canadian Energy Efficiency Alliance, 2010).

NRCan uses financial incentives to encourage end-users of energy to adopt energy efficiency and renewable energy technologies and practices. The C\$60 million ecoENERGY for Buildings and Houses, introduced in 2007, encourages the construction and retrofit of more energy-efficient buildings and houses. The programme has three additional activities: developing a more stringent National Energy Code for Buildings and Houses; support for EnerGuide for Houses rating system; and provision of information and training on energy efficient practices and technologies. The Energy Efficiency Act of 1992, amended in 2009, gives the Government of Canada the authority to enforce regulations regarding performance and labelling requirements for energy-using products including doors and windows that are imported or shipped across provincial borders. NRCan disseminates information to consumers, increases awareness of the environmental impact of energy use and encourages consumers to become more energy efficient and make greater use of alternative energy sources.

Provincial and municipal initiatives

The province of Ontario was the first jurisdiction in Canada to mandate EnerGuide 80 levels. This means that homes built after 2011 will have a 35 per cent increase in energy efficiency compared to homes built before 2006. Ontario's 2006 Building Code requires energy-efficient standards to be implemented for residential and institutional buildings. The extra cost to build a home to the new higher energy-efficiency standards is expected to be recovered in three years through reduced energy bills. This will result in substantial long-term energy savings as well as reduced GHG. In British Columbia (BC), a 'green' Building Code that specifies requirements for energy and water efficiency for all buildings came into effect in

2008. Insulation standards have been increased for houses, multi-family residential buildings under five stories, and commercial buildings. Builders may choose to meet these new standards or achieve an EnerGuide rating of 77 by other means. The latest amendments of BC's Energy Efficiency Act, effective January 2009, raised the energy performance of residential low-rise and high-rise windows, skylights and doors (which will be marked by a temporary label for the heat loss coefficient).

Municipalities also play an important role in energy efficiency through the Federation of Canadian Municipalities (FCM), which manages the C\$550 million Green Municipal Fund and the Partners for Climate Protection network. Municipalities design and implement a variety of energy efficiency programmes. Examples of municipal programmes include the Energy Efficiency Office (EEO) of the City of Toronto which has undertaken a variety of energy retrofit social housing programmes under the umbrella of the Better Buildings Partnership and the Better Buildings New Construction Program. A Community Action on Energy Efficiency initiative is a pilot programme that provides financial and research support to select BC municipalities to advance energy efficiency through local government policy instruments and building upgrade incentives since 2005.

In addition to governments, utilities play a significant role in the implementation of programmes to promote energy efficiency. Most electricity and natural gas distributors/retailers have established demand management and energy efficiency programmes (e.g. thermostats, furnace and water heater replacement programmes, PowerSmart, PowerWise, PowerSense, etc.). Demand side management programmes typically include information and education initiatives, low-interest loans or subsidies for the installation of energy-efficient technologies, direct or free installation of energy-efficient technologies, performance contracting, and market transformation initiatives.

Energy efficiency in the non-profit housing sector

Sector characteristics

Social housing in Canada is less than 6 per cent of the housing stock (630,000 units). The sector operates in a market-driven environment for the provision, allocation and maintenance of housing, with limited government support. About one-third of the social housing is publicly owned, 12 per cent is cooperative housing and the rest is owned and managed by a wide range of non-profit housing organisations as the data presented in Table 12.1 indicate. CMHC, the federal housing agency, administers 15 per cent of the housing stock, while the majority (486,300 dwellings) is administered by the provinces.

Social housing is a provincial responsibility. However, the federal government historically has supported the sector through a variety of financial instruments and programs that were largely discontinued in 1993. Most of the social housing units were developed under federal programs since 1949. The

TABLE 12.1 Social housing in Canada, 2008

Programme	Administered by CMHC									
	Administered by Province / Territory	Rent Assistance	Co-operative	Non-Profit/ Urban Native/ Public Housing	RNH	Limited Dividend	On Reserve	Sub-Total CMHC	Rental RRAP	Total
Newfoundland	12,200	0	0	0	0	0	100	100	400	12,700
Prince Edward Island	900	150	200	1,550	150	0	50	2,100	100	3,100
Nova Scotia	19,300	0	0	0	0	250	1,150	1,400	700	21,400
New Brunswick	15,650	0	0	0	0	0	1,000	1,000	1,750	18,400
Quebec	89,450	200	16,900	16,900	0	850	5,000	39,850	6,300	135,600
Ontario	201,100	3,700	19,350	500	0	0	3,700	27,250	9,000	237,350
Manitoba	35,500	0	0	450	0	0	5,100	5,550	1,500	42,550
Saskatchewan	28,300	0	0	1,000	50	0	4,150	5,200	850	34,350
Alberta	25,650	550	2,800	5,050	0	0	3,100	11,500	1,900	39,050
British Columbia	52,050	0	12,400	150	0	0	4,800	17,350	2,850	72,250
Yukon	500	0	0	100	0	0	500	600	200	1,300
Northwest Territories	2,650	0	0	0	0	0	0	0	0	2,650
Nunavut	3,050	0	0	0	0	0	0	0	0	3,050
Canada	486,300	4,600	51,650	25,700	200	1,100	28,650	111,900	25,550	623,750

CMHC: Canadian Mortgage Housing Corporation; RNH: Rural and Native Housing; RRAP: Residential Rehabilitation Assistance Program
Source: Data derived from CMHC, 2008: 58.

devolution of responsibilities for social housing provision started in the mid-1980s with provinces gradually moving away from the sector eventually 'passing the buck' to municipalities and community partnerships. By the end of 1990s a housing crisis emerged due to growing need for affordable rental housing and increasing homelessness, particularly in Canadian cities, and a supply shortage due to limited new output and long waiting lists.⁴

This prompted a reengagement of the federal government in social housing in 2001 through the Affordable Housing Initiative (AHI) – a multilateral agreement between federal, provincial and municipal governments. This initiative consisted of two phases: the first, with a budget of C\$680 million, was to create new rental housing and to renovate existing social housing, while the second phase, with a budget of C\$320 million, was to create housing for low-income households, aboriginals, people with disabilities, recent immigrants and seniors, resulting in 27,000 new units across Canada (Leone and Carroll, 2010).

Public housing (about 2 per cent of Canada's housing stock) is owned by local and provincial government authorities. It is managed by public non-profit organisations and housing companies established by local government. The Board of Directors is appointed by a municipal council and is composed of council members and tenants. Some of the largest landlords of public housing are in Toronto and Vancouver. For example, Toronto Community Housing Corporation (TCHC), with a portfolio of 2,240 apartment buildings comprising 58,500 households, is the largest social housing provider in Canada. Rents are geared to income, and tenants are expected to pay 25 per cent of their gross income in rent.

Private non-profit organisations range from ethnic or religious groups to special purpose organisation that accommodate seniors, people with disabilities and in more general terms low-income households. Some of the non-profit providers build one project for the group, but there are cases in larger cities where community-based organisations build several projects (Dreier and Hulchanski, 1993). The sector is very diverse and dependent on government funding and philanthropy both in terms of supply and demand-side support.

The cooperative sector consists of 2,200 housing cooperatives, each usually contains 50 to 80 households, housing in total 250,000 people. More than 40 per cent of the households receive federal or provincial housing allowance, while the rest pay market rents. Direct involvement of resident members who volunteer in committees and participate as board members in the elected Board of Directors is a key feature of cooperative governance. Seventy per cent of Canada's housing cooperatives are managed directly by the residents while 30 per cent of the cooperatives, usually the larger ones, have full- and part-time paid staff (Dreier and Hulchanski, 1993: 56) The Co-operative Housing Federation of Canada provides support and a platform for exchange of ideas between co-ops.

Federal spending on social housing in Canada was over 1.4 per cent of the federal budget (less than 0.15 per cent of GDP) in the mid-1990s and has remained relatively stable till 2007, when it peaked to 0.3 per cent of GDP (see Wellesley

T&F Proofs: Not for distribution

216 Sasha Tsenkova and Karim Youssef

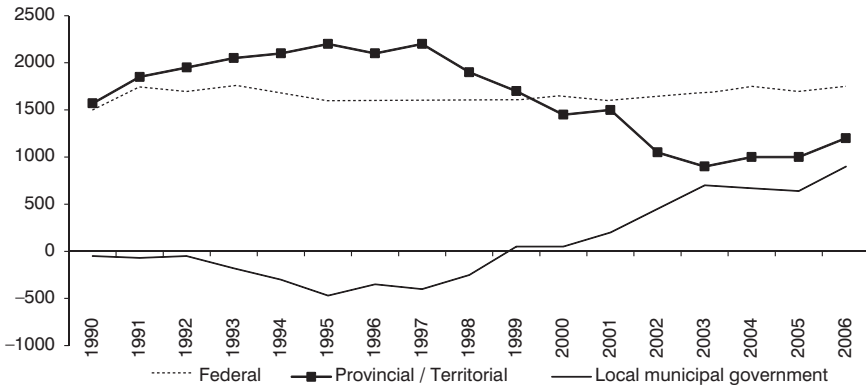


FIGURE 12.2 Net housing expenditure for social housing by level of government, in millions of dollars

Source: Data derived from FCM, 2008: 7

Institute, 2008, for additional information). Figure 12.2 presents time series data on net housing expenditure in social housing by all three levels of government. The municipal share has grown substantially as a result of the devolution process in the last decade. According to Hulchanski (2002), capital subsidies, rent supplements, supportive housing, rehabilitation of ageing housing and assistance for homeless people would require another 1 per cent of the annual federal budget in order to make a significant dent in addressing Canada's housing problems. Eligibility criteria for social housing vary according to the funding regime under which it was developed. Social housing stock developed between 1974 and 1986 (15 per cent of units) needs to be allocated predominantly to households with low incomes. Social housing stock developed since 1986 is targeted to households that meet 'core housing need' requirements – defined by a measure of suitability (overcrowding), adequateness (need of repairs) and affordability (over 30 per cent of gross income) in addition to an income threshold test (Ditch *et al.*, 2001).

Social rents are set as fixed proportions of tenants' income rather than being property-based. Rents for social housing range between 25 to 30 per cent of household income and increase to 'net cost' or 'low end of the market' for higher income households. There is no national rent allowance scheme. Only four provinces in Canada (Quebec, Manitoba, Saskatchewan and British Columbia) have housing allowance schemes. Low-income tenants in the social and private rental sector are eligible, but out of the 3.5 million renter households in Canada only 6 per cent receive a housing allowance or rent supplement. The elimination of supply side support has not been matched by an increase in demand-side subsidies, as overall spending on housing allowances is 0.02 per cent of GDP (Steele, 2007: 61). In general, eligibility for social assistance is a pre-condition to eligibility for housing allowance. A fundamental issue is the 'unemployment trap' where tenants, upon accepting low paid employment, would have to pay full housing costs (Ditch *et al.*, 2001).

Portfolio and asset management

Since the federal downloading of responsibilities of social housing, provinces are completely autonomous in managing and administering all of their social housing stock. All federal controls have been removed and provinces are free to allocate funding for developing their social housing stock as they see fit. Provinces are also free to reduce the size of their portfolio by disposing of their aging stock which includes the stock previously under provincial–federal partnership. Recent years have seen a number of sales and conversions of social housing into condominiums, but there is no systematic assessment on the extent of these sales and/or their impact in local housing markets. In such cases the federal government, through CMHC receives a share of any capital gain. The autonomy gained by the provinces includes their ability to modify and rationalise the housing programmes inherited from the federal government. Such modifications could result in reducing operating and administrative costs with increased savings totally retained by the province.

The downside of expanded provincial government social housing responsibilities is constrained investment in the maintenance and rehabilitation of the aging stock owned by public and non-profit housing providers. Although co-ops and other non-profit housing providers are responsible for meeting their upgrading and maintenance costs, provinces are indirectly involved by subsidising the cost of those projects and paying the rent-geared-to-income (RGI) assistance. Moreover, in the case that housing providers fail to fulfil their mortgage obligations, provinces get financially penalised from CMHC.

The majority of social housing stock is between 20 and 50 years old and in need of repairs and modernisation. Operating costs in public and non-profit housing on average are higher than the operating costs of co-ops – in the order of 60 per cent and 15 per cent respectively. Public housing tends to be older with higher turnover, which contributes to higher operation costs. The allocation predominantly to low-income households also places additional requirements for on-going social service support and capital to bridge the revenue/expenditure gap. Co-ops and non-profit community groups are also limited in their potential to intensify renovation efforts due to shortage of financing and commitment from senior government. Furthermore, management support to empower non-profit community groups in making sound decisions for their overall portfolio is lacking.

Energy-efficient enhancements/retrofits could be well integrated with renovating the condition of the social housing stock. However, large-scale renovations and retrofits needed to effectively and economically address the housing stock condition require systematic support through well integrated regulatory, fiscal and financial measures. Federally funded housing projects as well as most co-ops and non-profit projects have inadequate capital reserves and are not in a financial position to fulfil upkeep, major maintenance costs or essential capital replacements. The financial situation due to insufficient reserves is even worse for the older non-profit projects. It is estimated that 60 per cent of social housing providers have already depleted their capital reserve funds. Some may argue that use be made of the 'latent equity' of the

T&F Proofs: Not for distribution

218 Sasha Tsenkova and Karim Youssef

existing housing stock. However, that is not the case with social housing as rents are not at market value nor are assets freely traded between investors (Pearson, 2010: 4).

There is a lack of a long-term financing strategy for social housing in Canada. Recent federal initiatives since 2009 are limited to providing a few years of funding and merely act as an economic stimulus with no promise of gaining momentum. Some estimates suggest that at least 18,000–20,000 new social housing units need to be built every year, plus 7,000 repaired and renovated, to adequately address a growing need for affordable rental housing across Canada (see Wellesley Institute, 2010). Many social housing providers are currently maintaining their properties through the federal Infrastructure Stimulus Fund for renovation and retrofit of the existing social housing stock. One billion dollars is allocated for public social housing projects while C\$150 million is allocated for co-ops and private non-profit projects. This fund comes at a time when capital reserves of social housing providers are insufficient to undertake major upgrades. However, because the programme sets tight deadlines (it mandates, e.g., that projects that received funding in 2010 had to be completed by March 2011 and caps expenditure at C\$28,000 per unit), money is spent hastily and not necessarily wisely. The result is more of a superficial maintenance job for the existing housing stock intended for a quick payback rather than structural efficiency changes since the renovation and retrofits are not compelled to be energy-efficient related.

Energy efficiency in housing management in the sector

Canada introduced The Renewable Energy Initiative in 2009 through funding of C\$70 million for energy efficiency upgrades of existing social and new affordable housing projects. The federal and provincial governments are contributing equally to this investment as part of Canada's Economic Action Plan. It provides over two years C\$850 million for the renovation and retrofit of existing social housing, plus a further C\$475 million to build new rental housing for low-income seniors and persons with disabilities. These new housing investments also address Canada's goals with respect to climate change and the environment. Overall, the Economic Action Plan includes C\$2 billion for new and existing social housing, plus up to C\$2 billion in loans to municipalities for housing-related infrastructure. It builds on the Government of Canada's commitment in 2008 of more than C\$1.9 billion, over the next five years, to improve and build new affordable housing and help the homeless.

This new joint federal and provincial policy is expected to lead to improved energy efficiency and support the purchase and installation of renewable energy systems in existing and new affordable housing that are capable of generating energy and selling surplus energy back into the electrical grid. The federal funding is complemented by provincial investment. For example, in the province of Ontario C\$704 million is channelled into repair and energy efficiency retrofits of social housing. In British Columbia, the commitment to developing, managing and operating environmentally sustainable affordable housing is supported in the new sustainable action plan. The implementation of Livegreen: A Housing Sustainability

Action Plan includes the retrofitting of more than 7,500 directly managed social housing facilities to be more energy efficient and environmentally friendly. Another initiative – Solar BC – is funded by the Ministry of Energy, Mines and Petroleum Resources and delivered in cooperation with Natural Resources Canada’s federal ecoENERGY for Renewable Heat programme. It provides support to affordable housing owners and operators in the province, including not-for-profit social housing societies, for the installation of a solar water system. Provincial utilities offer additional opportunities for investing in energy efficiency and reducing energy costs. Some utility programmes partially fund projects to improve building energy performance while others cover the entire cost.

The above federal and provincial energy retrofit initiatives should be interpreted in the context of no national housing policy and the reduction of supply side support for social housing. Since the 1990s this minimalist federal housing policy has translated into growing regional disparities between the larger provinces and the rest of the country (Hulchanski, 2006). Given the limited financial support on the supply side, it is understandable that some of the innovation so far has centred on technologies and standards that improve the energy performance of new housing (such as R2000, LEED, EQUilibrium), but the new supply adds less than 1.5 per cent to the housing stock on an annual basis. In this context, sustainable transformation of the existing housing constitutes an extensive societal challenge and is of great importance for the elimination of environmental impacts caused by the use of non-renewable energy sources (Hamilton *et al.*, 2010). Notwithstanding the limited results of government programmes targeting energy efficiency retrofits, studies have pointed out a few critical issues;

- 1 projects are focused on a fairly narrow range of opportunities, defined by current technology and often fail to factor in behaviour changes;
- 2 the real cost-reduction effectiveness of energy efficiency policies might be lower than their proponents claim due to difficulties in accurate monitoring of energy savings;
- 3 taxpayer-funded energy efficiency programmes are an unfair subsidy that hurts non-participants and low-income households (Energy Efficiency Working Group, 2008; International Energy Agency, 2010).

In 2010, almost 700 existing social housing projects have benefited from the first year’s allocation of C\$75 million for the Renovation and Retrofit of Existing Social Housing administered by CMHC Initiative under Canada’s Economic Action Plan. It was expected that another C\$75 million would be allotted for projects in 2011. Some of the large and more professional social housing providers, such as BC Housing in British Columbia and Housing York Inc. in York Region (Ontario) have used Infrastructure Stimulus Fund to support major structural efficiency changes alongside low-cost initiatives. For example, BC Housing invested in balcony and elevator retrofits alongside lighting and boiler replacements whereas Housing York Inc. is providing renewable energy solutions in social housing using wind, solar and

T&F Proofs: Not for distribution

220 Sasha Tsenkova and Karim Youssef

geothermal resources. Rents are expected to increase as a result of renovations and energy retrofits in order to pay off for capital investments. Most of the low-income households will find themselves living in a unit that they cannot afford while provinces will face higher spending on housing allowances.

A number of social housing providers view energy efficiency upgrades as costly and in some cases not feasible. The difficulty to cover upfront costs for advanced technologies such as electric thermal storage, or the difficulty of implementing geothermal heating in existing social housing stock exemplify the challenges. Moreover, aspiring to achieve LEED compliant standards typically increases capital costs by at least 5–10 per cent, making it even more difficult to recover costs through rents. In addition to grants, providers need to access new capital through loan underwriting, renegotiation of loan insurance or its replacement by another form of rated guarantee. This is a significant challenge for the small non-profit and co-op organisations. Other measures – organisational and fiscal – need to be implemented to generate a more robust response, remove barriers and target providers and projects most in need of financial help. One possible scenario is a bundled turnkey service where audits and retrofits are integrated thus achieving time efficiency in meeting programmatic deadlines and facilitating the funding process for participants.

Obtaining a high performance energy rating for their social housing building may be sought after for both ‘energy-conscious’ tenants and social landlords even though energy performance certificates are voluntary. Certification helps landlords and tenants become more aware of the impact of their building’s energy performance on operating costs. However, it is increasingly apparent that grants and long-term funding to defray the capital intensive nature of these improvements rather than a rating is what mobilises social landlords towards achieving reductions in energy consumption of their stock. Enhancing the energy performance of a building is definitely welcomed by social landlords especially with availability of necessary funding. Having a well-performing building will facilitate management and monitoring of the stock as well as enhance tenants’ well-being. In the majority of cases, social landlords may not see, or realise, the benefits of making their housing stock energy efficient due to split incentives and lack of clear market signals. Direct incentives should be felt by social landlords in order for them to totally ‘buy into’ energy retrofits. Moreover, there is a need to facilitate monitoring of the energy performance of social housing units as well as a need to improve access to information for social landlords about available housing programmes and community-based support for social tenants.

Integration of energy efficiency in social housing management is needed in order to control/lower costs of utilities for the social housing sector. For example, utility costs of the social housing sector in the province of Ontario amount to approximately C\$500 million a year. Energy Service Companies have identified high-rise and medium-rise social housing as the market segment with greatest potential because they offer larger investment return and easier day-to-day control (see Box 1). Nevertheless, institutional intervention is needed in order to facilitate their access to social housing as well as area-based intervention in groups of residential buildings to achieve economies of scale (CMHC, 1997).

BOX 1: ENERGY MANAGEMENT PROGRAMMES IN ONTARIO'S SOCIAL HOUSING SECTOR

The first coordinated energy management initiative for social housing in Canada was the Social Housing Services Corporation (SHSC) Energy Management Program. It brings together social housing projects with utility companies, government agencies, and energy management experts to take advantage of all possible energy conservation opportunities. The programme also provides tools and education to help both landlords and tenants reduce their energy use. Major electricity distribution companies are helping pay for energy audits of 1,000 units in six social housing buildings from Hamilton, Mississauga, York Region, and Ottawa in order to decide upon possible ways for reducing energy consumption.

The nation's largest public landlord, the Toronto Community Housing Corporation (TCHC), has also incorporated an energy management programme in their existing portfolio since 2003. Greater savings may be obtained when energy management is part of an on-going process that includes auditing, tracking and monitoring of energy use. Funding in this programme is maintained through an 'Energy Retrofit Revolving Fund'.

Funding

As a result of the federal-provincial funding initiatives since 2009, the construction of 285 projects for low-income seniors and persons with disabilities, and the renovation of 6,533 existing social housing projects nationwide have been realised. The largest scale of renovations and retrofits has taken place in the provinces of Ontario and British Columbia (see Box 2). Other provinces have a more modest cost-shared funding for social housing retrofit projects such as Alberta with C\$90 million. Implementation measures for energy efficiency in social housing projects include insulation, draft-proofing, roof design and materials, air circulation, boiler replacement, upgrades such as lighting retrofits, installation of new energy-efficient appliances and water-efficient toilets, and roof and siding replacement. The most common practices implemented for fast payback for investment are:

- replacing appliances with those carrying Energy Star ratings;
- putting in weather-stripping;
- switching to compact fluorescent lights and installing new hot water tanks.

Case Studies

The case studies highlight diversity in the implementation process by different social housing providers — non-profit and cooperative. The analysis focuses on types of

T&F Proofs: Not for distribution

222 Sasha Tsenkova and Karim Youssef

BOX 2: FEDERAL PROVINCIAL PARTNERSHIPS FOR ENERGY RETROFITS IN ONTARIO AND BRITISH COLUMBIA

In 2009, Ontario allocated a combined federal and provincial investment of C\$704 million for the renovation of social housing, and C\$540 million for the creation of new affordable housing. Ontario's investment will result in the repair of more than 150,000 social housing units, while creating more than 4,500 new affordable housing units for low-income families, senior citizens, and persons with disabilities. The province has made available C\$70 million for the use of renewable energy technologies to improve energy efficiency in social housing as part of its Green Energy Strategy. In York Region, one of the major regional municipalities of the Greater Toronto Area, Housing York has submitted applications under an Ontario-specific programme for the provision of renewable energy generation in social housing in the form of solar photovoltaic (PV) systems, solar thermal heating for air and/or water, geothermal projects or micro wind turbines.

In 2009, British Columbia announced 101 renovation and retrofit projects totalling approximately C\$177 million, which is cost-shared with the federal government under the Housing Renovation Partnership, a jointly funded programme to renovate and retrofit social housing. The majority of the Housing Renovation Partnership funding, approximately C\$164 million, will be directed toward repairs at 81 social housing developments.

retrofits implemented and savings achieved. Both cases evidence efforts to combine energy efficiency upgrades with sustainable energy conservation measures.

Wilmar Court Non-profit Seniors Residence, Scarborough, Ontario⁵

Built in 1974, envisioned by the Wilmar Heights United Church Board in 1988 and commissioned in 1993, Wilmar Court is a joint venture between Wilmar Heights United Church Non-Profit Homes Inc. and the City of Toronto Shelter, Support & Housing. Wilmar Court is a Rent Geared-to-Income and Market Mix, multi-cultural, Independent Living, 72-unit, 4-storey non-profit seniors' residence. Only 19 of the 72 units are market price and the remainder is subsidised social housing. All units are self-contained with resident controlled heating and air conditioning. There are 52 bedrooms and 67 one-bedroom units. The one-bedroom units are 550 sq ft and the two bedroom units are 750 sq ft. There are approximately 80–85 residents (of average age 84 years).

Since its inception, the facility has been managed utilising an integrated approach to conservation and sustainable development. All initiatives are examined with consideration for the senior tenants, the costs, current facility design and equipment, education and language programme requirements, and the ability of both the facility and the tenants to sustain the programme given the obvious tenant turnover.



FIGURE 12.3 View of Wilmar Court Senior Residence and Wilmar Heights United Church

Photo: authors

Wilmar Court Management offers a unique approach to conservation initiatives, which should be adapted by other similar facilities. All initiative/conservation programmes are reviewed as a three-step process. Step one introduces specific education programmes to the client base that will alter behaviours to assist in the reduction and/or conservation initiatives. The conservation initiatives are included in the tenant marketing brochures, information packages and tenant orientation training. For example, appropriate instructions on the temperature/thermostat settings and controls for the suites and tenant programmes that included: the opening and closing of corridor windows on all four floors at appropriate times to enhance corridor temperatures and fresh air, instructions on the use of in-suite blinds and window opening to better control suite temperatures and minimise energy use. Step two examines the existing equipment and facility and ensures that maintenance programmes and repairs have the systems running at Manufacturer's specifications. For example, the existing conservation measures by Management have permitted the shutdown of two of the four domestic hot water tanks and the utilisation of only one domestic hot water boiler. Step three (the most costly) is to introduce enhanced technologies to work in conjunction with existing or retrofitted equipment or as a replacement for the equipment. In 2008, the management has examined the technical feasibility and financial viability of applying solar thermal technology for supplying supplemental DHW (Domestic Hot Water) in order to reduce the natural gas consumption of the facility. They are currently integrating

T&F Proofs: Not for distribution

224 Sasha Tsenkova and Karim Youssef

TABLE 12.2 Energy Consumption at Wilmar Court

<i>Energy consumption per year</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>
Cubic meter of natural gas	74522	76470	68560	32865
Total gas bill (C\$)	28336	28652	27408	14947
Cubic meter of water	9566	9233	9579	6254
Total water bill (C\$)	12581	12987	14786	10917
Electricity (kW/h)	592400	534400	545600	322800
Total hydro bill (C\$)	52441	58141.	49137	31417

Source: Canada-China Environmental Cooperation Council, 2008.

a condensing boiler system with DHW solar technology – a first in Canada for retrofits.

Gas consumption reduction (see Table 12.2) was evident with the changes to the air handling unit operation (2001), the installation of timers on the re-circulating pumps for the domestic hot water heating system (August 2006). However, further reductions are envisioned by the introduction of solar thermal heating.

Based on the historical data of natural gas consumption of this seniors' residence, it is estimated that 26,600 m³ of gas will be used for heating water each year. Suppliers of solar thermal hot water systems claimed savings of natural gas used for hot water from 30 per cent to 70 per cent on a yearly basis. Assuming a 40 per cent reduction in gas consumed for water heating (26,600 m³), this will lead to an annual reduction of 10,640 m³ of natural gas, and C\$5,320 in savings (assuming C\$0.50/m³ of gas). This corresponds to a 15.2 per cent reduction in both the total gas consumption (70,000 m³) and gas billing per year. It will also lead to a reduction of 20.4 tons of CO₂ emission per year, based on an emission factor of CO₂ at 1.92 kg/m³ of natural gas. If the actual savings is only 30 per cent, the above saving/reduction figures will decrease by 25 per cent. For example, the gas bill saving will be C\$3,990 per year and the CO₂ emission reduction will be 15.3 tons per year.

There are two major types of solar thermal collectors that are currently being used: the flat plate and evacuated tube. The flat plate type has been used for a longer time in Canada, while the evacuated tube technology is getting its momentum likely due to its relatively higher heat conversion efficiency. There are at least a few hundreds of installations in Canada, demonstrating the technical feasibility of applying solar thermal DHW technologies under the Canadian weather conditions.

Funding from both Federal and Provincial Renewable Heat (solar thermal and geothermal) Subsidy Programmes will reduce the project cost by 50 per cent. 25 per cent funding of the total cost of a solar thermal heating project will be provided by the Federal Government subsidies programme called 'ecoENERGY for Renewable Heat'. Another 25 per cent subsidy (up to a maximum of C\$80,000) will be provided by the Ontario government that is making C\$14.4 million available over four years to encourage the industrial/commercial/institutional sector to convert to solar thermal heating. Without any government subsidies, the simple ROI (return-on-investment)



FIGURE 12.4 Solar Thermal Evacuated Tube Technology installed on the rooftop of Wilmar Court

Photo: Wilmar Court Non-profit Housing

for such a project is not so attractive (ranging from 3.3 to 8.8 per cent), with the payback period longer than 10 years. With 50 per cent subsidies from the government and factoring in an annual energy cost increase of 5 per cent, the annualised ROIs improve to an acceptable average of 11.5 per cent over an average payback period of 9.7 years. It is apparent that the evacuated tube products offer the highest ROIs and shortest payback periods. The flat plate technology has been used longer in Canada but its ROI appears to be less attractive compared to other technologies. This is probably why solar thermal products had not been popular in Canada.

In 2010, Wilmar Court was among the 27 finalists for the Green Toronto Award in Energy Conservation as well as recipient of the Ontario Non-Profit Going Green Award.

Greenbrook sustainability project, Surrey, British Columbia⁶

Built in 1974, Greenbrook is a public housing development owned and operated by BC Housing, the provincial agency that develops, manages, and administers a wide range of subsidised housing options across the province. The complex has an amenity building and 127 units in 28 separate low-rise, wood-frame townhouse blocks clustered in 3 or 5 buildings, housing 380 people (including 130 adults and 250 children).

The Greenbrook sustainability project combined both building envelope-replacement and energy upgrades to achieve significant energy reductions and physical improvements on an existing building complex. The building envelope replacement will extend the life of the complex by an estimated 30 years or more. The use of high efficiency heating and electrical systems will reduce the complex's

T&F Proofs: Not for distribution

226 Sasha Tsenkova and Karim Youssef

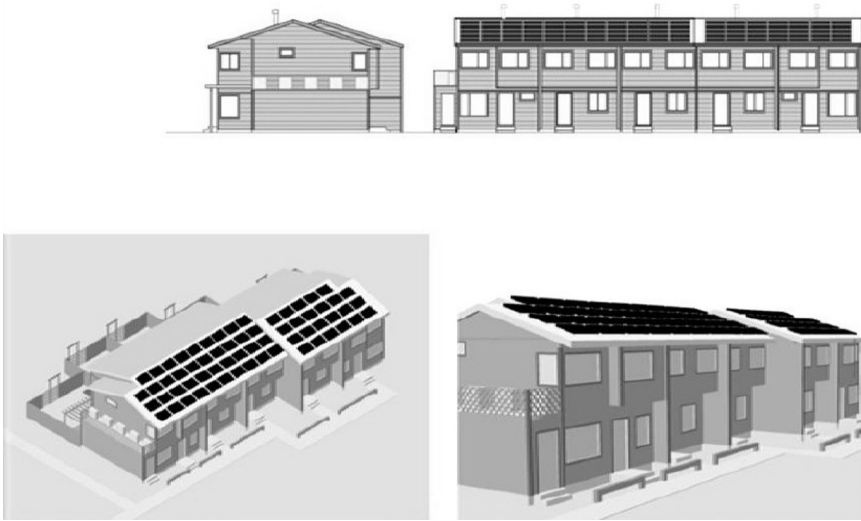


FIGURE 12.5 Typical townhouse building of Greenbrook
Source: BC Housing

greenhouse gas (GHG) emissions by 86 per cent in 2010 compared to the 2005 baseline. The project boasts the largest residential solar panel installation in Western Canada. Solar voltaic panels have been installed on 11 south-facing roofs of the 28 buildings. The solar technology will offset about 10 per cent of the site-used electricity and a large portion of remaining energy consumption and further reduce GHG emissions, resulting in a housing complex that is very close to being carbon neutral.

The project was carried out in two phases and was completed mid-2010. The first phase began in 2008 with a site-wide drainage replacement. The second phase began in 2009 with a complete building envelope replacement including interior renovations to units as well as extensive exterior landscaping.

The four major areas of work that were the focus of energy retrofits/upgrades were:

- replacement of perimeter drainage that included a new drain mat and weeping tile drainage system;
- building envelope replacement (new roofing system, attic insulation, exterior spray foam insulation to wall system, double-glazed argon-filled windows, and rigid insulation to foundation walls);
- new mechanical and electrical system (high efficiency hot water heaters, air source heat pump and electric furnace);
- replacement of major landscaping elements including fencing, turf, patio pavers, as well as new trees and shrubs (30 trees of the 80 on site were affected). These main upgrades were complemented by new energy efficient light fixtures and water efficient showerheads and toilets.

T&F Proofs: Not for distribution



FIGURE 12.6 Townhouses before and after renovations

Photos: BC Housing

In addition to technical challenges faced during renovations such as the extensive wall area of the complex to be insulated (over 8,700 m²), tenants lived in the complex throughout the two and half years of the project. During work replacing the furnaces and hot waters in a building cluster, several tenant families would be relocated for a period of about two weeks as work progressed on their units. Tenant on-site relocation was made possible by the keeping up to a dozen furnished units in the complex vacant for this purpose to help minimise the disruption to families. Tenants received a 25 per cent reduction in rent for the month of their relocation and a C\$100 food gift certificate. Tenants were further supported by a tenant support worker to help with the logistics of moving to and from temporary accommodation. In addition, their mail

T&F Proofs: Not for distribution

228 Sasha Tsenkova and Karim Youssef

was relocated and they were provided with temporary telephone service during their relocation.

The total cost of the project was C\$21.8 million.

The cost of the perimeter drainage component was C\$4 million; of building envelope replacement – C\$10.2 million; improvements in energy efficiency retrofits, including solar, did cost C\$5 million; and landscaping – C\$1.3 million. Although interior renovations were not originally in the budget, BC Housing was able to upgrade one-third of the townhouse interiors due to substantial cost-savings on the project.

Comments by one of the tenants, who formerly had to pay expensive heating bills and cope with a draughty and mouldy unit with an occasional flooded basement, gives an indication of the improved quality of life after the renovations: ‘The difference is night and day; the units are beautiful and it’s a nicer place to live in’, says a single mother of three boys who had moved to the complex four years before the start of renovations and adds: ‘We feel good where we live now.’

Conclusions

Recognising the high impact of energy savings in housing, this chapter reviewed the effect of new federal and provincial initiatives on energy efficiency retrofits in the social housing sector. The social housing sector is targeted as a field of policy intervention, where socially responsible and very professional housing providers have the potential to capitalise on government funding to leverage further investment in energy efficiency retrofits as well as to showcase the results of transformative change. The research points to several interrelated opportunities. First, an energy-efficient social housing stock will contribute to the larger objective of mitigating climate changes resulting from GHG emissions. Second, in regard to the low-income families and social tenants, an energy-efficient social dwelling will reduce utility costs and thus shield them from energy poverty. In addition, saving on utility costs will render those tenants more economically competitive. Third, because energy efficiency activities have the potential for creating ‘green collar’ jobs in the new economy, training low-income people to acquire the skills needed for such jobs will be a beneficial. It is estimated that 8 to 11 person-years of work are created for every million dollars invested in energy efficiency (Foshay, 2008). Finally, energy retrofits and better housing conditions in social housing will have a positive impact on the well-being of tenants and thus reduce their dependence on other social services and support.

The research documents challenges in the implementation process as well as profiles innovative responses that tend to be efficient in economic and environmental terms. Similar approaches have been used in the European Union and the United States to pilot test the mix of regulatory, fiscal and financial measures designed to promote energy efficiency implementation (Mlecnik *et al.*, 2010). Such policy reforms recognise the growing importance of energy efficiency retrofits in environmental terms, but also the economic and social benefits of green job

creation, lower housing costs, improved housing quality, health and community wellbeing (Schüle, 2009). While the emphasis in this review is on the social housing sector, this first systematic assessment has the potential to offer important insights into policy responses that might benefit the residential sector as a whole. As the number of successful projects grows, green and affordable housing could be seen as a proven, cost-effective approach to creating healthy, vibrant communities. These significant advances in implementation, due in large part to public sector leadership, could signal an emerging transformation in housing and energy policy. Together, these trends signal an emerging transformation in affordable housing policy through federal and provincial commitment. The engagement of government agencies and social housing institutions is critical for the continued success in the implementation process.

Notes

- 1 The Renewable Energy Initiative of 2009 provides C\$70 million for energy efficiency upgrades of existing and new social housing. 'Canada's Economic Action Plan provides C\$850 million for the renovation and retrofit of existing social housing over two years with another C\$2 billion for new and existing social housing.
- 2 For some provinces, efforts should be directed towards reducing energy use to prevent different forms of pollution, particularly greenhouse gas and smog emissions, whereas, for other provinces, conserving electricity and other energy supplies should be high on the agenda.
- 3 Other federal agencies include the Canada Mortgage and Housing Corporation (CMHC), the National Research Council, Transport Canada, Environment Canada, the National Round Table on the Environment and the Economy, Sustainable Development Technology Canada, and the Energy Efficiency Working Group.
- 4 The annual supply of new social housing declined by over 65 per cent reaching levels of output lower than 5,000 per year. Meanwhile estimates indicate that there are 1.7 million Canadians with core housing needs, unable to afford adequate housing in the marketplace.
- 5 Information for this case study was provided by James Ramesbottom, Environmental Consultant and Executive Director at Wilmar Court.
- 6 Information for this case study was provided by BC Housing.

References

- Brandson, T., van de Donk, W. and Putters, K. (2005) 'Griffins or chameleons? hybridity as a permanent and inevitable characteristic of the third sector', *International Journal of Public Administration* 28 (9/10): 749–65.
- Canada-China Environmental Cooperation Council CCECC (2008) *A Solar Thermal Domestic Hot Water (DHW) Project at a Non-profit Seniors' Residence with Measurable Results in Energy Saving and GHG Reduction. A Feasibility Study*.
- Canadian Energy Efficiency Alliance (2010) *A National Energy Efficiency Strategy for Canada: Results of a Multi-stakeholder Dialogue*, Mississauga: Canadian Energy Efficiency Alliance.
- CMHC (1997) *Energy Performance Contracting and the Residential Sector*, Ottawa: Canada Mortgage and Housing Corporation.
- CMHC (2008) *Analysis of Renewable Energy Potential in the Residential Sector*, Ottawa: Canada Mortgage and Housing Corporation.

T&F Proofs: Not for distribution

230 Sasha Tsenkova and Karim Youssef

- CMHC (2010) *CHS – Public Funds and National Housing Act (Social Housing) 2009*, Ottawa: Canada Mortgage and Housing Corporation.
- Ditch, J., Lewis, A. and Wilcox, S. (2001) *Social Housing, Tenure and Housing Allowance: An International Review*, York: University of York.
- Dreier, P. and Hulchanski, J.D. (1993) The role of nonprofit housing in Canada and the United States: some comparisons, *Housing Policy Debate* 4 (1): 43–80.
- Energy Efficiency Working Group (2008) *Energy Efficiency in Canada; Final Report: Energy Sector Sustainability Table*, Ottawa: Government of Canada.
- Engelund Thomsen, K. and Wittchen, K. (2008) *European National Strategies to Move Towards Very Low Energy Buildings*, Hørsholm (Denmark): Aalborg Universitet, Statens Byggeforskningsinstitut [Aalborg University, Danish Building Research Institute].
- Environment Canada (1994) *Canada's National Report on Climate Change*, Ottawa: Environment Canada.
- FCM (2008) *Sustaining the Momentum; Recommendations for a National Action Plan on Housing and Homelessness*, Ottawa: Federation of Canadian Municipalities.
- Fuller, M. (2009) *Enabling Investments in Energy Efficiency: A Study of Energy Efficiency Programs that Reduce First-cost Barriers in the Residential Sector*, Berkeley, CA: University of California, California Institute for Energy and Environment/Burlington, VT: Vermont Energy Investment Corporation.
- Foshay, E. (2008) Economic outcomes of The Apollo Economic Recovery Act, <<http://apolloalliance.org/data-points-nap/data-points-economic-outcomes-of-the-apollo-economic-recovery-act/>> (accessed 22 September 2011).
- Gruis, V., Tsenkova, S. and Nieboer, N. (eds) (2009), *Management of Privatised Housing: International Perspectives*, Chichester: Wiley-Blackwell.
- Hamilton, B. et al. (2010) *A Comparison of Energy Efficiency Programmes for Existing Homes in Eleven Countries*, Burlington, VT: Vermont Energy Investment Corporation, <http://www.raponline.org/docs/RAP_Hamilton_ComparisonOfEEProgrammesForExistingHomesInElevenCountries_2010_02_19.pdf> (accessed 31 August 2011).
- Hulchanski, J.D. (2002) *Housing Policy for Tomorrow's Cities*. Discussion Paper F27 Family Network. December. Canadian Policy Research Networks Inc.: 1–31.
- Hulchanski, J.D. (2006) 'What factors shape Canadian housing policy? the intergovernmental role in Canada's housing system', in Young, R. and Leuprecht, C. (eds) *Canada: The State of the Federation 2004: Municipal-Federal-Provincial Relations in Canada*. Montreal/Kingston (Canada): McGill-Queen's University Press: 221–47.
- IEA (2008) *Worldwide Trends in Energy Use and Efficiency: Key Insights from IEA Indicator Analysis*, Paris: International Energy Agency.
- IEA. (2010) *Energy Policies of IEA Countries – Canada 2009 Review*, Paris: International Energy Agency.
- Itard, L. and Klunder, G. (2007) Comparing environmental impacts of renovated housing stock with new construction, *Building Research & Information* 35 (3): 252–67.
- Kickert, W., Klijn, E. and Koppenjan, J. (eds) (1997) *Managing Complex Networks: Strategies for the Public Sector*, London: Sage Publications.
- Leone, R., and Carroll, B.W. (2010) Decentralisation and devolution in Canadian social housing policy, *Environment and Planning C: Government and Policy* 28 (3): 389–404.
- Mlecnik, E., Visscher, H., and van Hal, A. (2010) Barriers and opportunities for labels for highly energy-efficient houses, *Energy Policy* 38 (8): 4592–603.
- Natural Resources Canada (2006) *The State of Energy Efficiency in Canada*. Ottawa: Natural Resources Canada.

- Office of Energy Efficiency (2009) *Energy Efficiency Trends in Canada 1990–2007*, Ottawa: Natural Resources Canada.
- Pearson, S.N. (2010) *Financing Capital Improvements and Renovation of Social Housing in Ontario*, Ontario: Social Housing Services Corporation.
- Pitt, M. (2007) *Linking Social Housing and Energy Efficiency*, Ottawa: Social Housing Services Corporation.
- Schüle, R. *et al.* (2009) *Energy Efficiency Watch: Final Report on the Evaluation of National Energy Efficiency Action Plans*, Wuppertal/Berlin: Wuppertal Institute, Cologne/Berlin: Ecofys Germany, <http://www.energy-efficiency-watch.org/fileadmin/eew_documents/Documents/Results/EEW_-_Final_Report_July_2009.pdf> (accessed on 31 August 2011).
- Steele, M. (2007) 'Canadian housing allowances' in Kemp, P.A. (ed.) *Housing Allowances in Comparative Perspective*, Bristol: The Policy Press: 61–85.
- Thibert, J. (2007) *Inclusion and Social Housing Practice in Canadian Cities: Following the Path from Good Intentions to Sustainable Projects*, Ottawa: Social Housing Services Corporation.
- Wellesley Institute (2008) *Universal Periodic Review (Canada) – Statistical Annex*, Toronto: Wellesley Institute.
- Wellesley Institute (2010) *Precarious Housing in Canada*, Toronto: Wellesley Institute.