



Enhancing Energy Efficiency in New Construction

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Report prepared for



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1.0 INTRODUCTION

Currently, buildings in Canada are responsible for 38 per cent of energy use and 30 per cent of greenhouse gas (GHG) emissions¹. Emissions from commercial and institutional buildings are projected to increase by 16 per cent over their 1990 levels by 2010 under a business-as-usual scenario.² For local governments, where municipal buildings account for a substantial portion of total energy use, pursuing energy-efficient building design is an effective way to combat climate change and substantially reduce operating costs in times of rising energy prices.

As part of the *Toronto and Region Inter-governmental Declaration on Clean Air* adopted at the 2004 Smog Summit in Toronto, the GTA Clean Air Council has identified a series of actions to reduce air pollutants and greenhouse gases. Article 3.3 of the Declaration states that members of the GTA Clean Air Council will:

“Explore and promote the benefits of developing a consistent approach to exceeding building performance for new construction projects by GTA-CAC members by a minimum of 25 per cent better than the current Model National Energy Code for Buildings.”

This report is intended to provide members of the GTA Clean Air Council with the rationale, and information required to pursue energy efficient design in their own construction and encouraging others within their community to do the same. The report outlines the benefits of energy efficient buildings, barriers to their establishment, and approaches to overcoming these barriers. The report concludes by providing of a set of recommendations for GTA Clean Air Council members, which are as follows:

1. Take advantage of Commercial Buildings Incentive Program (CBIP) and commit to designing new municipal buildings to achieve a minimum 25 per cent energy reduction target over the Model National Energy Code for Buildings (MNECB).
2. Municipalities should review their permitting and approvals process to identify areas where incentives for energy efficient new construction could be incorporated.
3. Disseminate information on the benefits of energy efficient design and related programs through their communication networks.
4. Encourage the Province of Ontario to allow municipalities to require stricter energy efficiency requirements than is currently stipulated in the *Ontario Building Code*.
5. Encourage the Province of Ontario to consider stricter energy efficiency guidelines in the *Ontario Building Code*, such as adoption of the R-2000 standard for homes and a minimum 25 per cent increase in energy efficiency over the MNECB.
6. Encourage the federal government to update the MNECB energy efficiency standards by a minimum of 25 per cent.
7. Encourage the federal government to establish a financial incentive program to encourage the construction of R-2000 homes.

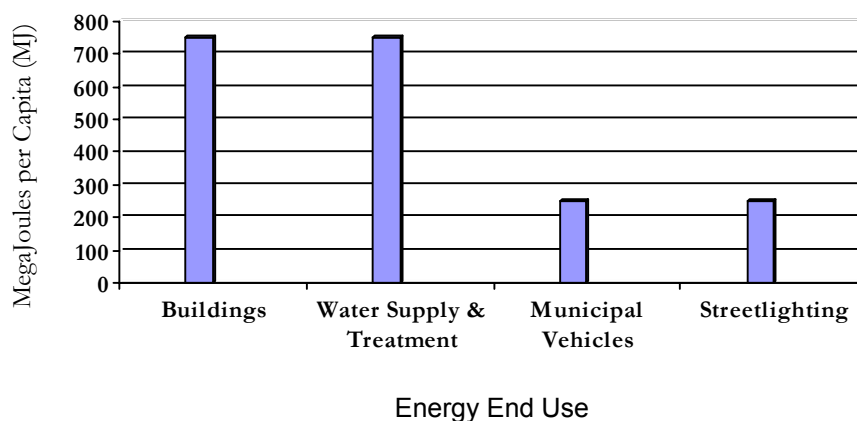
2.0 BACKGROUND

Addressing the energy efficiency of buildings at the municipal level has the potential to greatly reduce energy use and greenhouse gas (GHG) emissions nation-wide. Municipalities can influence more than 50 per cent of Canada's total GHG emissions

through direct control (energy use in their own buildings) or through indirect control and influence³ (energy use in residential and commercial buildings).⁴

Municipal governments own and operate a diverse range of buildings including city halls, community centres, libraries, social housing, community multi-purpose facilities, rinks, pools and arenas to name a few. These facilities account for approximately 40 per cent of the total energy used in municipal operations and roughly 40 per cent of its GHG emissions.⁵ This is depicted graphically below. It should be noted that these figures are an approximation as the level and mix of services varies among local governments⁶, however, it does suffice to show that buildings are a key area for reducing energy use and GHG emissions in municipal operations.

Annual Average Distribution of Municipal Energy Use in Canada



Data Source: *National Climate Change Process (1998) Municipalities Issue Table: Foundation Paper*

On a regional level, Ontario contains the highest amount of commercial/institutional floorspace in Canada (36 per cent) followed by Quebec (20 per cent), which highlights the need for central Canada to address energy efficiency in its buildings.⁷ And with the population in the GTA projected to grow from 5.1 million in 1999 to 7.5 million in 2028 (the fastest growing region in Ontario) the GTA represents an ideal region to address energy efficiency in new construction.⁸

Buildings consume energy for a variety of uses such as space heating and cooling, lighting, and service water heating. Energy consumption can be reduced in a number of ways including ensuring that a building's shell has a high level of heat retention, installing efficient HVAC systems, heat recovery systems, using energy efficient lighting and employing passive solar techniques to reduce the need for artificial heating and light.⁹

The initial design and construction stage of a building is the ideal time to incorporate energy efficient measures, especially since an efficient building envelope will allow for smaller and more cost effective mechanical systems. Moreover, once this opportunity

has passed, many components, especially those that are part of the building shell, will not be replaced for 20 to 25 years.¹⁰

3.0 MODEL NATIONAL ENERGY CODE FOR BUILDINGS

The *Model National Energy Code for Buildings* (MNECB) is a model energy efficiency code published by the National Research Council Canada (NRCC) in September 1997.¹¹ The code sets minimum standards of construction for building components and features that affect a building's energy efficiency.

In Ontario, the MNECB is referenced in the *Ontario Building Code* along with ASHRAE/IES 90.1-1989¹², providing designers with a choice on how to address energy efficiency in non-residential buildings. The MNECB applies to all new buildings (other than houses of three storeys or less and farm buildings) and to additions of more than 10 square metres (m²) to such buildings. A separate code, the *Model National Energy Code for Houses*, applies to residential dwellings.

Both of the above-mentioned codes are divided into five technical sections:

- Building envelope
- Lighting
- Heating, ventilation and air conditioning systems
- Service water heating systems
- Electric power

The MNECB does not apply uniformly across Canada. As the code was being developed, one of the guiding principles was that the individual requirements should not cost more to implement than they would save in energy costs. With this in mind, life-cycle cost analyses were conducted for most of the building envelope requirements, with the level that offered the lowest life-cycle cost being selected.

A number of factors affect the life-cycle cost of a building component including total construction costs, energy costs, and climate. Since these factors vary from one region of Canada to another, the country was divided into different regions based on climate, which took into account the various factors. The life-cycle costing process was repeated for each administrative region as well as for different energy types. The end result is that the MNECB is more stringent in colder areas of Canada and for buildings that will be heated with more expensive fuels or energy.¹³

Given the continuing emergence of new technologies, the MNECB (developed six years ago) stands to become dated in the near future. Updating the code to account for current changes in technology would ensure greater energy efficiency in new buildings.

EXCEEDING THE MNECB BY 25 PER CENT

In November 2002, the Government of Canada released the *Climate Change Action Plan for Canada*, a three-step approach for achieving Canada's climate change objective to reduce greenhouse gas emissions by 240 megatonnes (MT) by 2010. The plan applies to seven different sectors, including housing and commercial/institutional buildings. As a measure to achieve Canada's emission reduction goal, the plan calls for all new commercial/institutional buildings to exceed the MNECB by 25 per cent.¹⁴

To encourage adoption of this strategy, Natural Resources Canada developed the Commercial Buildings Incentive Program (CBIP). The program provides a financial incentive to encourage the design and construction of buildings that meet the 25 per cent energy reduction target. (See Section 7.0 for more detail on the CBIP).

Achieving a 25 per cent reduction in energy usually requires the services of an energy and sustainable building consultant to identify and evaluate potential energy efficiency measures. Demonstrating a building's ability to reduce energy consumption by 25 per cent is conducted using energy model software (most commonly EE4 software) to show that the building design will improve energy efficiency by at least 25 per cent when compared to a similar building designed according to MNECB standards.

This 25 per cent is an important and achievable energy reduction target to work towards despite the fact that a national code is in place. Buildings codes are designed first and foremost to meet health and safety requirements. The MNECB, like all other codes, are minimum standards that do not necessarily represent optimized energy efficiency levels that account for societal benefits of GHG reduction. They are based on cost-effective levels of energy efficiency based on regional energy costs. Secondly, the technology required to achieve greater energy savings is readily available, and holds immense, yet unmet potential to reduce energy use and GHG emissions across Canada.

4.0 BENEFITS OF ENERGY EFFICIENT BUILDING DESIGN

There are a multitude of economic, environmental, and social benefits associated with increasing the energy efficiency of new construction. An overview of these benefits is provided below.

ENVIRONMENTAL

Buildings that are more energy-efficient generate fewer emissions through the combustion of fossil fuels, including emissions of sulphur compounds that result in acid deposition, emissions of nitrogen oxides and volatile organic compounds that produce smog, and emissions of a number of air toxins.

PUBLIC HEALTH

The air quality improvements resulting from fewer emissions of pollutants can lead to a decrease in respiratory ailments such as asthma. The 2004 Toronto Public Health report, *Air Pollution Burden of Illness in Toronto: 2004 Summary*, states that air pollution contributes to about 1,700 early deaths and 6,000 hospitalizations in Toronto each year.¹⁵

DIRECT ECONOMIC SAVINGS

Energy efficient buildings use less energy, which means operating costs for heating, cooling, ventilating, and lighting buildings will be reduced. For instance the Mountain Equipment Co-op building in Ottawa, built to C-2000 standards, saves an estimated \$30,000 per year in energy costs (a savings of two thirds the energy cost of a conventional building), which was achieved at no additional capital cost¹⁶. The energy

savings could be used to pay contractors hired for the project, or be set aside for other energy-saving projects thus eliminating the need for up-front capital.

INCREASED COMMUNITY INVESTMENT

The energy savings obtained through more efficient buildings could also be used to improve community services, such as increasing the number of bike lanes, improved public transit, or the provision of more green space.¹⁷

WORKER PRODUCTIVITY AND HEALTH

Energy efficient buildings are more likely to make use of natural light, provide improved thermal comfort and better ventilation, and allow greater occupancy control over light and temperature levels. Many studies¹⁸ have shown that improvements to these elements can increase labour productivity and improve worker health, thereby reducing illness symptoms and absenteeism.¹⁹

SUPPORT FOR LOCAL ECONOMY

Investing in energy-efficient technology stimulates market demand for these products, and when sought locally, will stimulate the local economy. While each municipality will have its own economic multiplier for energy, typical multipliers have shown that each dollar spent on energy conservation generates \$0.84 more municipal economic activity than petroleum products purchases, and \$0.57 more than a dollar spent on electricity. This difference is attributable to the fact that the production of petroleum products and the generation of electricity tend to occur outside of the community, while most expenditures relating to energy efficiency (hiring contractors or purchasing energy-efficiency products) occur within the community.²⁰

5.0 APPROACHES TO PROMOTING ENERGY EFFICIENT BUILDING DESIGN

The role municipalities can play in promoting energy efficient building design in their communities can take on three forms. Firstly, they can design their own new construction projects to higher standards, secondly, they can regulate this through bylaws, and lastly they can promote voluntary action through incentives and/or a targeted education and awareness program.

LEADING BY EXAMPLE

By choosing to design their own buildings to more stringent energy standards, municipalities can play a key role in affecting change and raising awareness. By “leading by example”, local governments will demonstrate leadership to the community, enhance credibility, and build capacity and experience that can be shared. In addition, better building performance will reduce municipal operating costs thereby benefiting the community at large through reduced costs, improved services, better air quality and increased economic activity.

ADOPTING MORE STRINGENT REGULATIONS

Another means to achieve energy efficient buildings design is to adopt more stringent energy efficiency requirements. Because provincial regulations limit a municipality’s ability to require higher energy efficiency standards, and due to the resistance exhibited

by some sectors of industry to this approach, this report will not explore this option in great detail, however, recommendations addressing this issue will be made.

ENCOURAGING VOLUNTARY ACTION

Municipalities have existing communication and information networks, which can be used to promote energy efficient new construction. Whether it is profiling local efforts (internal or external), highlighting funding sources, or simply promoting the idea (through Web site or flyers), municipalities have significant public outreach influence to affect change.

6.0 BARRIERS TO ENERGY EFFICIENT BUILDING DESIGN

There are a number of barriers that have prevented energy efficient building design from becoming commonplace. An overview of the barriers is presented below.

LACK OF INFORMATION

Familiar technologies require minimal investments of time. New approaches or technology, however, often require significant investment in time to identify the best approach or practice.²¹

CONSTRUCTION INDUSTRY RESISTANCE

Builders are commonly opposed to stricter energy efficiency codes and standards because they perceive that the changes will decrease sales due to the increased price.²²

ORGANIZATIONAL PRACTICES OR CUSTOM

Organizations budget and operate buildings according to an established practice that typically changes only incrementally. This commonly leads to owners sustaining high operating costs rather than investing in energy efficient practices to reduce these costs.²³

PERFORMANCE UNCERTAINTIES

Familiar products have withstood the test of time, and have well-known performance characteristics. New approaches or new technology, however, introduces uncertainties and may lead to problems. Fear of failure is often a critical factor in the decision-making process.²⁴

HIGHER UP-FRONT COSTS

The up-front capital required to finance the construction of a more energy efficient building is the single largest obstacle to a more widespread implementation of this approach. Lack of access to capital, borrowing constraints, or high debt loads often mean that building or homeowners cannot borrow the additional capital needed to finance energy-efficient construction.

MISPLACED OR SPLIT INCENTIVES

Institutional relationships may separate the benefits of energy efficiency from an energy efficiency purchasing decision. For instance, building owners who pass on energy costs in the lease do not capture a return on investment. Therefore, owners often tend towards options that incur the least capital or initial cost.²⁵

LONG PAYBACKS

It is often the case that the more efficient a building is to become, the longer the payback period will be. Developers/owners have little incentive to make the investment if they own the building for only a few years.²⁶

ADMINISTRATIVE AND MANAGERIAL COSTS

There are often additional administrative and managerial costs associated with the construction of an energy efficient building, especially when coupled with an incentive program. Building owners/developers often do not possess the knowledge or managerial capacity to take advantage of energy efficiency funding and opportunities.²⁷

7.0 APPROACHES TO OVERCOMING BARRIERS

While barriers exist to implementing energy efficient building design, there are many benefits to doing so and the options to overcome these barriers are increasing. As previously mentioned, there are three ways in which municipalities can promote energy efficient design – they can construct their own buildings to higher energy standards, enforce these standards through regulations, and/or encourage voluntary action through incentives and education and awareness programs. Outlined below are various tools, programs and resources municipalities can use to pursue these avenues.

LEADING BY EXAMPLE

For most municipalities, the biggest hurdle when considering energy efficient building design is financing the upfront capital (this is particularly true for small, rural communities). The size of the investment will vary depending on the size of the municipality, the type of building, and the desired technology and energy reduction target. To help offset the upfront costs, Natural Resources Canada has launched the Commercial Buildings Incentive Program.

Commercial Building Incentive Program (CBIP)

The CBIP is a Natural Resources Canada (NRCan) program that encourages the design and construction of energy efficient buildings. To qualify, buildings must be designed to use 25 per cent less energy than a similar building designed to the standards outlined in the MNECB. A detailed energy simulation must be performed to show that the 25 per cent energy reduction target is being met. The incentive is available for new buildings, major additions, and extensive renovations of existing buildings.

CBIP provides a financial incentive of two times the predicted annual energy savings to a maximum of \$60,000. Buildings over 60,000 square feet would likely receive the full incentive. Smaller buildings can achieve the full incentive by careful selection of energy efficient features.

The application for the incentive is made when the design drawings and energy simulation are complete. The file is reviewed for accuracy and 80 per cent of the incentive is paid to the building owner, commonly within three months of receipt of the application. The final 20 per cent is paid when the energy efficiency measures are installed and construction is complete.

To date, this program has provided the incentive to approximately 450 buildings, with 100 of these being in Ontario. The CBIP incentive is being offered until March 31, 2007. NRCan also provides a technical guide, which provides details on how to take advantage of the CBIP.²⁸

Examples of two municipalities that have participated in the CBIP program are provided in Appendix A. One is the City of Richmond's city hall in Vancouver B.C., which achieved a 26.4 per cent reduction target and the other is the Alice Turner Branch Library, in Saskatoon, Saskatchewan, which achieved a 65 energy reduction target.

Experience with CBIP

Participation in the CBIP involves technical aspects (energy modeling which requires specialized qualifications) and administrative aspects (filling out applications/forms) both of which can be confusing, time consuming, and costly. Accordingly, it is suggested that the services of an energy and sustainable building consultant be used, one that is well-versed with the CBIP process and can therefore perform the energy simulation and also manage the administrative process.²⁹

Furthermore, to achieve the most cost-effective energy measures, it is suggested that an "integrated design process" be employed. An integrated design process involves a multi-disciplinary design team (including a design facilitator and an energy simulator), which can discuss various design options to establish performance goals for the building at the concept stage. One of the key reasons for this is to take advantage of mechanical system cost reductions as a result of a more efficient building envelope and lighting design. A successful integrated design process should be able to keep the incremental cost of achieving the 25 per cent reduction between zero and two per cent of the construction budget and deliver a payback within two years.³⁰

The CBIP incentive typically covers the fees associated with the services of an energy and sustainable building consultant. Further assistance can also be obtained from Enbridge Gas Distribution through their Design Advisory Program (DAP). The program will pay an incentive of up to \$7,800 per design towards the energy simulation and design facilitation costs as required by the CBIP. The fees for the services are paid directly to the consultant by Enbridge. To take advantage of this offer, interested parties need to contact one of the approved advisors directly.³¹

An excerpt from the RFP used by the City of Toronto to retain the services of an energy and sustainable building consultant is provided for reference purposes in Appendix B.

Revolving Funds

Municipalities might also consider setting up "revolving funds" or "internal banks". The City of Regina, for instance, sets aside \$250,000 each year to fund its own energy management initiatives. City departments may borrow against the fund at the current interest rate and repay the loan through reduced operating costs. Such a fund could be set up specifically for energy efficient new construction, or include this measure under an umbrella of energy efficiency measures.³²

Triple Bottom Line Accounting

One of the challenges of overcoming the cost barriers is that traditional economic concepts and accounting methods do not accurately depict the true costs and benefits of reducing energy use.

A new approach to developing a business case for sustainable community initiatives is “triple bottom line accounting” (TBL), a framework that determines a return on capital investment when evaluated and measured along environmental, economic, and social dimensions. In the case of energy efficient buildings, a TBL business case could be made on the fact that reduced energy use will save money, reduce air pollution, create new jobs, and free up municipal funds for other investments.³³ This approach is successfully being used by governments in New Zealand, Australia and the United States to move the sustainable community agenda forward.

Maintenance and Operations

While the design of a building will greatly reduce its energy use, it is also imperative to consider the maintenance and operations of a building. Measures such as turning off water systems when not required and reducing power requirements when less power is needed can have a major impact on energy use, particularly in a large building. Training of building operators is recommended to ensure that the savings achieved through an efficient building are not lost through a building’s operational practices.

According to a study conducted for ASHRAE³⁴ the cost of training is a small component of overall operations and maintenance costs, ranging from 0.4 per cent downward. Furthermore, the study found that an increase in training investment of 100 per cent would provide a return on investment of 400 per cent.³⁵

Training for building operators/managers can be obtained through the Office of Energy Efficiency, Natural Resources Canada³⁶, at Seneca College in Toronto³⁷, and through energy management firms³⁸.

ADOPTING MORE STRINGENT REGULATIONS

Municipal Energy Code

One regulatory option is to adopt a municipal energy code for buildings that requires all new construction to exceed the MNECB by 25 per cent. Currently, the *Building Code Act* does not allow municipalities to enforce energy efficiency standards beyond what is stipulated in the Ontario Building Code.³⁹ A historical precedent does exist for this though. The Province allowed the former City of Toronto to implement ASHRAE 90.1 commercial energy standards through its permitting process.⁴⁰

Local Improvement Charges (LICs)

A study recently released by the Pembina Institute suggests that municipalities can use local improvements charges (LICs) to finance energy efficiency measures. This approach associates the additional cost of the measure with the building property, rather than with the current building owner. In other words, the additional costs are shared by all owners, rather than solely by the current owner.

Currently, LICs are used help cover the costs of infrastructure improvements on public property, such as roads and sidewalks, deemed to benefit a specific neighbourhood. The municipality pays for the improvements (usually from annual capital budgets), and subsequently the benefiting landowners are assessed the LIC on their property taxes until their share of the improvements have been paid for. An approval process must be conducted (which includes obtaining agreement from a certain percentage of property owners who are to benefit from the project), before a project can be subject to LICs.

In the case of new construction, the additional cost of energy efficiency improvements would be included in the LIC. This eliminates the capital cost of the efficiency measures from the sale price of a new home, for instance, which has long been the basis of opposition by the home construction industry. The LIC would allow a new homeowner to pay off the outstanding investment in annual installments. Because these payments would be less than that of the actual energy savings achieved by the improvements, the new owner would receive immediate benefits.

In a similar fashion, LICs would provide an incentive for landlords to improve the energy efficiency of their buildings. Since they would benefit from a net reduction in total energy costs during the year of installation, the cost savings reaped would allow landlords to either lower rents to attract tenants, or leave rents unchanged to earn a greater profit on their property.

A major benefit of LICs is that they specifically address some of the barriers mentioned earlier, namely long payback periods, higher up-front costs, and construction industry resistance, by allowing the additional cost of the building to be shared by all owners over time. The report does not specifically mention drawbacks to this approach, but does state that this type of program is best suited to municipalities that already have internal program and staff dedicated to energy management, strong council support, success in GHG reduction and other environmental initiatives as well as a low debt level, which will allow for the provision of the necessary financing. According to the report, both the Regional Municipality of Waterloo and the City of Oshawa have LIC bylaws in their jurisdiction.⁴¹ More information on setting up and operating an energy efficiency LIC program can be found in the Pembina report.⁴²

ENCOURAGING VOLUNTARY ACTION

Municipalities can encourage builders/developers to voluntarily opt for energy-efficient new construction through mechanisms such as financial incentives, funding programs, and targeted education and awareness programs.

Financial Incentives

Developers/builders willing to build energy-efficient buildings on vacant land (in dense areas, such as downtown cores) could be offered “tax increment financing”. This provides the property owner with grants that compensate for the property tax increase that would result from the establishment of a building. The tax increment is the difference between the pre-construction and post-construction taxes. The tax grant would be made available for a period of time set out in an agreement between the municipality and the owner, commonly about 10 years.⁴³

Builders/developers could also be provided with a “development charges credit”. This would exempt an applicant from paying all or part of the development charges on a property if the building is designed to specified energy efficiency standards.⁴⁴

Builders/developers could also be offered “planning and building fee/rebates/exemptions” related to planning and development applications. Fees could be waived for applications for Official Plan amendments, zoning by-law amendments, consents, development agreements, minor variances, and building permits if the proposed building is designed to specific energy efficiency standards.⁴⁵

Another incentive to encourage energy efficient new construction is to offer “density bonusing”. Buildings can be granted increased floorspace or increased building height beyond regulations set in the zoning by-law if there are to be a resultant community benefits. Energy efficient buildings could be argued to provide community benefits as they decrease environmental impact and risks to public health.

Funding Programs

Municipalities can also establish funding programs, which help builders and developers offset the upfront costs, to encourage energy efficient building design. An example of such a program is the Better Buildings New Construction Pilot Program (BBNCP), which was launched by the City of Toronto in September 2004.

Better Buildings New Construction Pilot Program (BBNCP)

The BBNCP is a pilot project of the City of Toronto in co-operation with NRCan and Enbridge Gas Distribution to encourage the design of more energy efficient buildings in the City of Toronto. The BBNCP, which is complimentary to the CBIP, will supply the services of an energy consultant to provide design and energy modelling assistance to meet the requirements of the CBIP incentive.

To qualify, the building must be built within the City of Toronto, should be in the concept or schematic stage to allow for incorporation of energy-efficient measures, and be industrial or commercial (including hospitality, retail, office, educational, institutional and high-rise multi-unit residential). The program is limited to 17 projects and designs must be finalized by March 30, 2005.⁴⁶

Targeted Education and Awareness Programs

As with all education and awareness efforts, the most effective program is one that identifies its target audience and has been designed accordingly. In terms of new construction projects, there are a variety of ways to structure a program. Targets may include:

- Building type: office, shopping center, school, high-rise, strip mall
- Building size: large or small
- Influencers: trade associations, contractors, building associations
- Stakeholders: building owners, homeowners, designers (i.e. architects, engineers)

Furthermore, once a target has been identified, the outreach program should aim to identify the barriers specific to the targeted group as each of these groups will require different services to aid in the shift from conventional design practices to more energy

efficient ones. Given the breadth of this topic, this report will elaborate on education and awareness for building owner/developers and homeowners.

Building Owners/Developers

In the commercial/institutional sector, retail and office space combined consume almost 50 per cent of total energy end use in Canada followed by schools (14 per cent) and health (11 per cent).⁴⁷ Accordingly, municipalities might want to target these building owners/developers in their outreach programs.

The major barriers for building owners/developers are cost related, such as the upfront capital costs, long-payback periods, and the perception that energy-efficient design will lead to decreased sales. In order to overcome these barriers, this audience typically needs more information, financial help, and demonstration projects.⁴⁸ For instance, developers should be made aware that it is feasible to design an energy-efficient building at no cost premium. This is the case for the Mountain Equipment Co-op building in Ottawa⁴⁹, and for the IBM Canada Software Headquarters in Markham, Ontario (See Appendix C.).

The BBNCP, mentioned above, is one way of providing financial help to this target group, although this will not be feasible in all municipalities. Outlined below are funding and information sources that may be useful in encouraging building owners/developers to consider more energy efficient design.

The CBIP also applies to retail food stores and arenas. Because these building types make intensive use of refrigeration equipment, the CBIP evaluation will assess the impact of this equipment on the building's performance.

Similar to the CBIP, the Industrial Building Incentive Program (IBIP) was established by NRCAN to encourage energy-efficient design in industrial buildings. The incentive program offers up to \$80,000 to help offset the upfront costs, and runs until March 31, 2006.⁵⁰

The C-2000 program focuses on office buildings and sets four criteria for building design: energy efficiency, minimal environmental impact, occupant health and comfort, and functional performance. Though still in a pilot phase, this standard is to result in energy reductions of 35 to 50 per cent.⁵¹ The first Canadian building to achieve this standard is Green on the Grand⁵², a low-rise office building in Kitchener, Ontario.

Building owners/developers can also be encouraged to build according to green building rating systems. One such approach is the Leadership in Energy and Environmental Design (LEED) SystemTM, which was launched by the U.S. Green Building Council in 2000 to provide a guideline and rating system for green buildings. The program, which is voluntary and consensus-based, uses a points-based rating system in six project design areas. Accordingly, four levels of building certification can be achieved: certified, silver, gold, or platinum. A Canadian version of LEED is now available through the Canada Green Building Council⁵³, which focuses on Canadian building standards, programs, and references. What is remarkable about LEED is the considerable momentum it has gained throughout the U.S., and the impact it has had on the real estate market. LEED is currently standard practice for the U.S. federal government (and for many state and local agencies) and is rapidly spreading to private sector applications.⁵⁴ Four per cent of all

new commercial construction in the U.S. is now being completed according to LEED guidelines⁵⁵.

Another green building rating system is the BRE Environmental Assessment Method (BREEAM).⁵⁶ Similar to LEED, this system is a tool that allows owners and designers to review and improve the environmental performance throughout the life of a building.

Homeowners

Home energy use accounts for 17 per cent of energy used in Canada⁵⁷, and the number of households is predicted to increase by 2.5 million households from 1996 to 2001. With 57 per cent of Canadian dwellings being single-detached homes, this sector presents an ideal opportunity to reduce energy use in new construction.⁵⁸

Homeowners can be encouraged to have their home built according to R-2000 standards. This standard was launched in 1981 to provide design options for comfortable, healthy, energy-efficient homes. R-2000 standards are updated continuously, and can provide a 30 to 40 per cent energy reduction over conventional homes.⁵⁹ On average, the cost premium for an R-2000 home is between four and seven per cent, which is recovered through energy savings over approximately seven years. To date, 10,000 homes have been built to this standard.⁶⁰

Despite the many benefits of R-2000 homes, the single largest barrier to building this type of home is the incremental cost (2 to 4 per cent). Additionally, Canadians are extremely mobile, and have a general sense of job security, making any additional costs highly unattractive, even if they generate savings in the long term.⁶¹ To help overcome these costs, Canada Mortgage and Housing Corporation (CMHC) is offering a 10 per cent refund on its mortgage loan insurance premium when a new home is built to R-2000 standards or has an Energuide for Houses rating of 80 or above.⁶²

9.0 ESSENTIAL ROLE OF INTER-GOVERNMENTAL CO-OPERATION

As the government closest to the public and as a major influencer over Canadian GHG emissions, it is clear why municipal governments need to take action on increased energy efficiency for new construction.

For local government to be able to effectively lead by example, adopt more stringent regulations, and/or encourage voluntary action, federal and provincial governments will need to be supportive of municipal action. Canadian municipal governments are governed by provincial/territorial legislation, portions of which can act as barriers to effective municipal action.

Examples of local governments working with their provincial/territorial counterparts to receive resources and specific enabling legislation do exist. For instance, both Vancouver and Montreal have the authority to implement their own building codes.⁶³ By allowing municipalities to adopt their own codes, or by adopting stricter energy efficiency guidelines into the *Ontario Building Code*, the construction of energy efficient buildings can be greatly accelerated.

On the federal level, there are already programs in place (such as CBIP) that provide incentives to encourage more efficient building design. These programs have been well received and have been successful in moving the agenda forward. The federal government should consider continuing these programs until further legislation which makes these standards mandatory, are put in place.

In addition, given the proven track record of R-2000 homes, the federal government should also consider establishing a financial incentive program to encourage the construction of these homes. Such a program could be delivered through municipal governments and would help homeowners offset the higher upfront capital costs.

10.0 RECOMMENDATIONS

Based on the findings of this report, GTA Clean Air Council members are encouraged to pursue the following:

1. Municipalities should take advantage of CBIP and commit to designing new municipal buildings to achieve a minimum 25 per cent energy reduction target over the MNECB.
2. Municipalities should review their permitting and approvals process to identify areas where incentives for energy efficient new construction could be incorporated.
3. Disseminate information on the benefits of energy efficient design and related programs through their communication networks.
4. Encourage the Province to allow municipalities to require stricter energy efficiency requirements than is currently stipulated in the *Ontario Building Code*.
5. Encourage the Province to consider stricter energy efficiency guidelines in the *Ontario Building Code*, such as adoption of the R-2000 standard for homes and a 25 per cent increase in energy efficiency over the MNECB.
6. Encourage the federal government to update the MNECB energy efficiency standards by a minimum of 25 per cent.
7. Encourage the federal government to establish a financial incentive program to encourage the construction of R-2000 homes.

APPENDIX A. – MUNICIPAL CASE STUDIES

CITY HALL, RICHMOND, BRITISH COLUMBIA⁶⁴

Energy reduction achieved:	26.4 %
Annual energy cost savings:	\$32,700
Owner:	City of Richmond
Building type:	Large office building
Budget:	\$39 million or \$4,429/m ²
Cost premium:	not specified
CBIP incentive:	\$65,348

The City of Richmond wanted to demonstrate its commitment to sustainable design practices, durability, energy efficiency, and provide a healthy and effective working environment.

The building makes use of daylight through the use of continuous dimming daylight sensors that adjust the lighting level in response to the amount of available natural light. Daylight use is enhanced through the use of exterior and interior light shelves, which reflect the daylight further into the building.

The building employs two highly efficient condensing boilers that operate at seasonal efficiencies of about 90 per cent. Building ventilation is provided by make-up air units (MAUs), which have variable speed drives for demand ventilation when meeting rooms are occupied and in need of increased ventilation.

Ambient lighting is provided by a direct/indirect lighting system with T-8 fluorescent lamps and high-efficiency hybrid ballasts. Meeting and exercise rooms are controlled by occupancy sensors that automatically turn the lights off when the room is unoccupied.

A reduction in fans and pumps shows the highest energy savings (55 percent), which is due to the difference in static pressure between the proposed design and the MNECB model. Lower lighting loads, daylighting and occupancy controls reduce annual energy consumption by 38 per cent.

ALICE TURNER BRANCH LIBRARY, SASKATOON, SASKATCHEWAN⁶⁵

Energy reduction achieved:	65 %
Annual energy cost savings:	\$13,038
Owner:	City of Saskatoon
Building type:	Municipal library
Budget:	\$2.2 million or \$1,648/m ²
Cost premium:	3% to 5%
CBIP incentive:	\$26,076

The Alice Turner Library was designed to improve life-cycle optimization and minimize environmental impact. The building maximizes the use of daylight with extensive south-facing glazing, exterior louver shades, interior light shelves and high ceilings. The windows are highly efficient (spectrally selective, double-pane, argon-filled with low-e glazing) and are set in wooden frames to minimize thermal bridging. The walls and ceilings are insulated to R-20 and R-30 values respectively.

Heating is provided by a hot water radiant floor system. A ceiling air distribution system with low-energy fans for cooling and back-up heating are also used. The lighting system consists of high-pressure sodium exterior lights combined with deep-cell interior parabolic fixtures, T-8 lamps and electronic ballasts for interior lighting. This results in a 60 per cent reduction in energy use.

The building's high level of energy efficiency tops the CBIP's project list and also qualifies for NRCan's C-2000 program.

APPENDIX B. – SAMPLE RFP FOR CONSULTANT SERVICES

Excerpt from: Request for Proposal for a Technical Consultant to Supply Program Support Services for the Better Buildings New Construction Pilot Program⁶⁶

PROPOSERS QUALIFICATIONS

Mandatory Requirement

Must be qualified under Natural Resources Canada Commercial Building Incentive Program (CBIP) Design Assistance Network and/or Submission Review Network.

Non-Mandatory Requirement

The respondent is to have experience in projects of this nature and must also have technical experience relevant to this project. Communication skills are also a key requirement of this project since this project includes communicating and consulting with various other City Departments and external agencies and recipients of services provided by the Better Buildings New Construction Pilot Program.

SCOPE OF WORK

The proponent will provide professional services for the design and implementation of the Better Buildings New Construction Pilot Program which will include necessary materials required to facilitate and enhance the implementation of the Better Buildings New Construction Pilot Program in the areas of program development, program delivery, program execution, technical assistance, and program monitoring & verification protocols.

The Proponent will provide a well thought-out Proposal regarding the design and supply of Program Support Services respecting the elements of program support noted in Section 3.

The Better Buildings New Construction Pilot Program will incorporate higher energy efficiency standards at least 25% better than currently required in the Model National Energy Code of Canada for Buildings 1997 (MNECB) in the construction of new buildings. The Better Buildings New Construction Pilot Program will also build on the features of the federal Commercial Building Incentive Program (CBIP) and Industrial Building Incentive Program (IBIP) which encourage higher energy efficiency standards in new construction and which are provided through Natural Resources Canada's Office of Energy Efficiency. The successful proponent will be required to work cooperative in a multi-disciplinary team that include staff from Natural Resources Canada, City of Toronto, Enbridge Gas Distribution, planners, architects, engineers, designers, developers and owners in carrying out the essential tasks involved in the Better Buildings New Construction Pilot Program. The City's Energy Efficiency Office in cooperation with Natural Resources Canada's Office of Energy Efficiency will provide oversight and coordinate the Better Buildings New Construction Pilot Program.

A requirement of this initiative is for the successful proponent to develop a Program Participation Guideline, which includes the following details:

- ♦ Detailed description of steps to be followed for pilot program participation and compliance
- ♦ Suggested Measures sets for the Prescriptive Path option

- ♦ Suggested Software requirements for the Performance path
- ♦ Instructions regarding the method of comparison of energy
- ♦ Suggested forms for applicants to use in their submissions to demonstrate compliance with the program.

This guideline may draw on the resources and materials available for the Commercial Building Incentive Program and Industrial Building Incentive Program and should illustrate in a compelling manner the cumulative benefits available to participants from the NRCan-CBIP program, Enbridge Consumers Gas Design Assistance Program (DAP) and the City's Better Buildings New Construction Pilot Program.

The Better Buildings New Construction Pilot Program will provide design-modeling assistance up to December 31, 2004. Design Modeling Assistance consulting services shall be provided by the proponent and/or qualified sub-consultants. The proponent must provide evidence that the Design Modeling Assistance consultant(s) and sub-consultant(s) are qualified to provide these services as required and defined by the Natural Resources Canada's Commercial Building Incentive Program.

Recognizing that a key barrier to broader participation in the Commercial Building Incentive Program is based in the complex and detailed undertakings of EE4 simulations and Commercial Building Incentive Program proposal submissions, design modeling assistance and proposal submission assistance maybe provided on a one-to-one building specific basis and/or on a expert-to-group basis where supplemental design assistance is provided to a target group where the target group represents a specific building sector or archetype or the target group may consist of design & construction professionals engaged by one specific owner/developer.

The proponent shall detail the most feasible and effective package of design and submission assistance services which would be implemented to encourage and increase successful Commercial Building Incentive Program new construction projects in Toronto.

The initial phase of the Better Buildings New Construction Pilot Program proposes to provide design modeling assistance for up to seventeen projects based on Toronto building and environmental conditions and based on input from a consultation process to be under taken by the proponent. This consultation process shall also provide input into the development (by the proponent) of the eligibility and selection criteria to be used for selecting up to seventeen participating buildings in the pilot program. A proposed representative "mix" of new construction projects is illustrated below:

BUILDING TYPE	BUILDING SIZE	NUMBER
Commercial & Institutional	Small/Medium	4
	Large	3
Multi-residential	Small/Medium	5
	Large	2
Industrial	Small/Medium	1
	Large	2
Total External Modeling Incentives		Up to 17

Environmentally Responsible Procurement Statement

The City of Toronto Environmentally Responsible Procurement Policy encourages bidders to also offer products/services that are environmentally preferred. Environmentally preferred.

Environmentally preferred products/services offered must be competitive in cost, conform to specifications, performance requirements and, be suitable for the intended application as determined by the using department(s)

Environmentally preferred products/services are those such as durable products, reusable products, energy efficient products, low pollution products/services, products (including those used in services) containing maximum levels of post-consumer waste and/or recyclable content, and products which provide minimal impact to the environment.

An environmentally preferred product is one that is less harmful to the environment than the next best alternative having characteristics including, but not limited to the following:

1. Reduce waste and make efficient use of resources: An Environmentally Preferred Product would be a product that is more energy, fuel, or water efficient, or that uses less paper, ink, or other resources. For example, energy-efficient lighting, and photocopiers capable of double-sided photocopying.
2. A re reusable or contain reusable parts: These products such as rechargeable batteries, reusable building partitions, and laser printers with refillable toner cartridges.
3. Are recyclable: A product will be considered to be an Environmentally Preferred Product if local facilities exist capable of recycling the product at the end of its useful life.
4. Contain recycled materials: An Environmentally Preferred Product contains post-consumer recycled content. An example is paper products made from recycled post-consumer fibre.
5. Produce fewer polluting by-products and/or safety hazards during manufacture, use or disposal: An EPP product would be a non-hazardous product that replaces a hazardous product.
6. Have a long service-life and/or can be economically and effectively repaired to upgraded.

Bidders shall if requested, provide written verification of any environmental claims made in their bid/Proposal satisfactory to the City of Toronto within five (5) working days of request at no cost to the City. Verification may include, but not be limited to, certification to recognized environmental program (e.g., Environmental Choice Program [ECP]), independent laboratory tests or manufacturer's certified tests, Only proven environmentally preferred products/services shall be offered. Experimental or prototype products/services will not be considered.

For a copy of *the* City of Toronto Environmentally Responsible Procurement Policy, contact the Finance Department Purchasing and Materials Management Division at (416) 392-7303 or (416) 392-1302.

State if environmentally preferred products/service is being offered: YES _____ NO _____

State briefly the environmental benefit of the product/service offered:

APPENDIX C. – PRIVATE SECTOR CASE STUDY

IBM CANADA SOFTWARE HEADQUARTERS, MARKHAM, ONTARIO⁶⁷

Energy reduction achieved:	32 %
Annual energy cost savings:	\$300,000
Owner:	IBM Canada
Building type:	Office complex
Budget:	not specified
Cost premium:	none
CBIP incentive:	\$320,000 (largest CBIP incentive ever awarded)

The facility consists of four, four-storey buildings joined by corridor links in a campus setting. The building has high electrical demands due to the high computer density. Through the use of occupancy sensors, electrical loads were reduced.

Efficient lighting design consisting of ambient and task lighting was used, resulting in a power requirement reduction of 50 per cent. Windows are double glazed with low-e and argon gas fill. The roof and opaque sections of the curtainwall contain high levels of insulation. Energy efficient lighting and HVAC systems led to a reduction in natural gas and electricity demand by 41 per cent and 15 per cent respectively.

ENDNOTES

¹ Canada Green Building Council. (2003) Estimate based on Natural Resources Canada's *Energy Use Data Handbook, 1990 and 1995 to 2001*.

² National Climate Change Process (1999) *Buildings Issue Table: Commercial Institutional Sector Options Report*. Prepared by Bay Consulting Group <www.nccp.ca>

³ Municipalities have indirect control or influence over where buildings are located (zoning), under what terms they are built (compliance with building codes) and on their operations (permitting requirements).

⁴ National Climate Change Process (1998) *Municipalities Issue Table: Foundation Paper*. <www.nccp.ca>

⁵ National Climate Change Process (1999) *Municipalities Issue Table: Options Paper*. <www.nccp.ca>

⁶ For information on determining which municipal services produce the highest amount of emissions, see *Modelling Municipal Smog and Greenhouse Gas Reduction Practices in the GTA*. (2004) Clean Air Partnership.

⁷ National Climate Change Secretariat (1999) *Buildings Issue Table: Foundation Paper on the Commercial/Institutional Sector in Canada*. <www.nccp.ca>

⁸ Ontario Ministry of Finance (2000) *Ontario Population Projections*. <www.gov.on.ca/FIN/english/enghome.htm>

⁹ Climate Change Solutions <www.climatechangesolutions.ca> Accessed on November 1, 2004.

¹⁰ Ibid.

¹¹ The Model National Energy Code for Building can be purchased from the National Research Council Canada (NRCC) for \$79 by visiting <http://irc.nrc-cnrc.gc.ca/publications/order.html>

¹² ASHRAE/IES 90.1-1989 is a set of minimum energy efficient requirements for buildings, adopted as the U.S. federal standard in 1993. In contrast to this standard, the MNECB references Canadian standards and regulations, uses metric (SI) units and includes only enforceable requirements.

- ¹³ National Research Council <www.nationalcodes.ca/mnecb/index_e.shtml> Accessed on November 14, 2004.
- ¹⁴ Government of Canada <www.climatechange.gc.ca/plan_for_canada/plan/index.html> Accessed on November 14, 2004.
- ¹⁵ Toronto Public Health <www.toronto.ca/health> Accessed on November 3, 2004.
- ¹⁶ Natural Resources Canada <http://oee.nrcan.gc.ca/awards/build_mountain.cfm?PrintView=N&Text=N> Accessed on January 7, 2005.
- ¹⁷ ICLEI Energy Services (2003) *The Business Case for Cutting Greenhouse Gas Emissions from Municipal Operations*. Prepared for the Federation of Canadian Municipalities. <www.fcm.ca>
- ¹⁸ See *Green Development: Integrating Ecology and Real Estate*. (1998) Rocky Mountain Institute. John Wiley & Sons, Inc. New York, NY. pp. 17-18.
- ¹⁹ Kats, G.H. (2003) *Green Building Costs and Financial Benefits*. Massachusetts Technology Collaborative, Massachusetts.
- ²⁰ ICLEI (no date) *Fact Sheet: The Economic Power of Energy Efficiency*. ICLEI, Berkeley. <www.iclei.org/co2/Fact/Fact.htm>
- ²¹ National Climate Change Secretariat (1999) *Buildings Issues Table: Foundation Paper on the Commercial/Institutional Sector in Canada*. <www.nccp.ca>
- ²² Ibid.
- ²³ Ibid.
- ²⁴ Ibid.
- ²⁵ Ibid.
- ²⁶ Pembina Institute (2004) *Using Local Improvement Charges to Finance Building Energy Efficiency Improvements: A Concept Report*. Prepared for Climate Change Control and BC Hydro. <www.pembina.org>
- ²⁷ National Climate Change Secretariat (1999) *Municipalities Issue Table: Options Paper*. <www.nccp.ca>
- ²⁸ Natural Resources Canada <<http://oee.nrcan.gc.ca/newbuildings/cbip.cfm?PrintView=N&Text=N>> Accessed on November 14, 2004.
- ²⁹ A list of consultants can be found on the Natural Resources Canada Web site at <http://oee.nrcan.gc.ca/newbuildings/qualified_assessors.cfm?PrintView=N&Text=N>
- ³⁰ Enermodal Engineering (2004) *Commercial Building Incentive Program – Explained* <www.enermodal.com> Accessed on November 12, 2004.
- ³¹ Enbridge Gas Distribution <www.cgc.enbridge.com/B/B05-11_building_design.asp#dap> Accessed on December 6, 2004.
- ³² For more energy efficiency financing options, municipalities can refer to *Profiting from Energy Efficiency: A Financing Handbook for Municipalities* (1994) available from the ICLEI Web Store at <<http://krushinator.iclei.org/merchant/index.htm> or by emailing publications@iclei.org>. Cost is \$17.00.
- ³³ ICLEI Energy Services (2003) *The Business Case for Cutting Greenhouse Gas Emissions from Municipal Operations*. Prepared for the Federation of Canadian Municipalities.
- ³⁴ Bach, H.R. (1996) *Impact of Staff Training on Maintenance and Energy Costs in Commercial and Institutional Buildings*. ASHRAE.
- ³⁵ National Climate Change Secretariat (1999) *Foundation Paper on the Commercial/Institutional Sector in Canada: Buildings Table*. <www.nccp.ca>
- ³⁶ Dollars to \$ense Workshops <<http://oee.nrcan.gc.ca/workshops/index.cfm?PrintView=N&Text=N>>
- ³⁷ The Seneca College building operator training program is a continuing education certificate course, with a course on “Energy Efficiency in Large Buildings”. See it at <http://senecac.on.ca/parttime/pip-bes_certificate.html>
- ³⁸ A list of firms is provided on the City of Toronto Web site at <www.city.toronto.on.ca/wes/techservices/bbp/firms>
- ³⁹ The Planning and Transportation Committee of the City of Toronto have made a number of recommendations in response to the proposed amendments to the Ontario Building Code, which include that Council request that the Ministry of Affairs and Housing work towards requiring that new commercial/institutional construction meet exceed the MNECB standards by 25 per cent.
- ⁴⁰ Clean Air Partnership (2004) *Model Clean Air Plan – Draft Report*.
- ⁴¹ Peters, R. et al. (2004) *Using Local Improvement Charges to Finance Building Energy Efficiency Improvements: A Concept Report*. Prepared for Climate Change Control and BC Hydro. <www.pembina.org>

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- ⁴² Pembina Institute for Appropriate Development <www.pembina.org/publications_item.asp?id=170>
- ⁴³ City of Toronto (2004) Community Improvement and Plans. Information Bulletin Vol. 1, No. 4.
- ⁴⁴ Ibid.
- ⁴⁵ Ibid.
- ⁴⁶ Office of Energy Efficiency (2004) *Fact Sheet: The Better Buildings New Construction Pilot Program*. City of Toronto.
- ⁴⁷ Ibid.
- ⁴⁸ Ibid.
- ⁴⁹ Natural Resources Canada <http://oee.nrcan.gc.ca/awards/build_mountain.cfm?PrintView+N&Text=N> Accessed on January 7, 2005.
- ⁵⁰ Natural Resources Canada <<http://oee.nrcan.gc.ca>> Accessed on November 14, 2004.
- ⁵¹ Natural Resources Canada <www.buildingsgroup.nrcan.gc.ca/projects/c2000_e.html> Accessed on November 26, 2004
- ⁵² For more information on this building, visit <www.advancedbuildings.org/main_cs_gog.htm>.
- ⁵³ Canada Green Building Council <www.cagbc.ca>
- ⁵⁴ Lewis, P. (2003) "The Future of LEED" *Environmental Design + Construction*. Michigan
- ⁵⁵ Washington Post (2004) "Big Savings From 'Smart' Buildings" Washington
- ⁵⁶ Environmental Assessment Consortium <www.breeam.com> Accessed on December 6, 2004.
- ⁵⁷ Canada Mortgage and Housing Corporation <www.cmhc-schl.gc.ca> Accessed on December 3, 2004.
- ⁵⁸ National Climate Change Secretariat (1999) *Buildings Issue Table: Options Report on the Residential Sector*. <www.nccp.ca>
- ⁵⁹ R-2000 <<http://r2000.chba.ca>> Accessed on November 26, 2004.
- ⁶⁰ Natural Resources Canada <<http://oee.nrcan.gc.ca/r-2000/english/public/index.cfm?PrintView=N&Text=N>> Accessed on December 2, 2004.
- ⁶¹ National Climate Change Secretariat (1999) *Buildings Issue Table: Foundation Paper on the Residential Sector*. <www.nccp.ca>
- ⁶² Canada Mortgage and Housing Corporation <www.cmhc-schl.gc.ca> Access on December 3, 2004.
- ⁶³ Ibid.
- ⁶⁴ Natural Resources Canada <<http://oee.nrcan.gc.ca>> Accessed on November 12, 2004.
- ⁶⁵ Natural Resources Canada <<http://oee.nrcan.gc.ca>> Accessed on November 12, 2004 and Climate Change Solutions <www.climatechangesolutions.com> Accessed on November 12, 2004.
- ⁶⁶ City of Toronto (2004) Request for Proposal No. 9163-04-7210 for a Technical Consultant to Supply Program Support Services for the Better Buildings New Construction Pilot Program.
- ⁶⁷ Enermodal Engineering <www.enermodal.com> Accessed on November 12, 2004.