



GREEN BUILDING
I N N O R T H A M E R I C A

Paper 4c: Green Residential Building in North America:

The Benefits of a North American Strategy:
A Perspective from Canada

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Summary

Context

Homes and buildings are among the defining elements of the urban environment. They give a community its character and offer landmarks that create a sense of place and identity. Homes and buildings can make communities attractive places where people wish to live, work and play. The quality of the built environment has a strong influence on the quality of the urban experience, but this influence is much deeper than purely social or aesthetic.

The environmental impacts of homes and buildings is profound, as the building sector in Canada is responsible for:

- 33 percent of all energy consumed;
- 50 percent of natural resources used;
- 12 percent of non-industrial water usage;
- 25 percent of landfill waste;
- 10 percent of airborne particulates; and
- 35 percent of greenhouse gases.¹

In North America, people spend almost 90 percent of their time inside buildings. Poor design and construction practices can have a significant effect on the health of the building's occupants and can produce buildings that are expensive to operate and maintain, and costly to renovate to accommodate the occupants' changing needs or life stages. These impacts disproportionately affect the elderly and less affluent social groups.

Over 80 percent of Canada's citizens live in cities. Therefore, developing strategies to support sustainable residential buildings also requires consideration of residential building form in the context of urban planning. Increasingly, citizens are turning their backs on city centers, preferring to live on the periphery. They rightly feel that their well-being is affected adversely by pollution and the state of housing in urban centers. This sprawl into peripheral areas is resource intensive, depletes agricultural land resources, generates higher levels of traffic, and weakens the heart of the city. In summary, it is not sustainable.

The housing industry is international. Therefore, developing strategies to reduce the environmental impact of housing will be of benefit from an international perspective. For example:

- Building components designed in the United States may be manufactured in Mexico, and assembled on-site in Canada.
- Product standards are increasingly international, with ongoing efforts to harmonize performance metrics across national boundaries.
- Costs and environmental impacts of construction materials and practices are increasing globally and transcend boundaries.

A premise of this work is that enhanced integration and harmonization among Canadian, Mexican, and US construction industries will support improved environmental performance in the industry.

¹(CaGBC 1, pg. 2)

It is within this context that the current research seeks to offer a common vision to support enhanced environmental performance of the residential building sector, as well as providing a set of strategies to move the industry towards sustainability.

Objectives:

The objective of this report is to propose a vision and identify strategies and recommendations aimed at promoting more sustainable residential construction in a North American context.

Scope

While the issues associated with green buildings transcend traditional sectoral boundaries, the scope of the current analysis is the residential construction industry. Although social, economic and environmental aspects of sustainability are intimately interwoven, this study focuses on the environmental imperative, while acknowledging the other aspects of sustainability. The primary environmental impacts associated with housing include:

- Depletion of arable land resources and associated loss of habitat;
- Non-renewable energy use and associated emissions of greenhouse gas emissions;
- Water consumption;
- Consumption of non-renewable resources; and
- Emissions of waste into the atmosphere, aquatic bodies and ground.

Potential Benefits

Improving the ways that buildings and the built environment are designed, constructed, renovated and demolished has the potential to make significant improvements in the social, environmental and economic performance of communities and enhance the quality of life of citizens. When compared to conventional housing, green housing can significantly lessen these impacts by:

- *increasing energy efficiency and reducing greenhouse gas emissions*—climate change contributions associated with a conventional inefficient building can be reduced by more than 70 percent when both material and energy use effects are minimized;²
- *reducing water usage*—green buildings can reduce potable water needs from 10 to 50 percent and the generation of sewage waste from 50 to 75 percent;³
- *improving indoor air quality*—The use of non-toxic materials and natural ventilation is less harmful to the environment and to the health of occupants;
- *consuming fewer resources for*

A recent report by the Canadian Green Building Council describes the purpose of green buildings as follows:

Green buildings strive to balance environmental, economic, and social considerations in design, construction and operation. Energy, water and resource efficiency; occupant comfort and well-being; site development and community context; and the economics of building construction and operation are key considerations. In comparison to conventional buildings, green buildings take advantage of natural processes to generate less waste, less pollution, and reduce their overall environmental footprint.

² (CGBC p. 8)

³ (GBC 1.1 p.3)

construction and operation—The use of local and reused materials can reduce construction and demolition waste by up to 90 percent and reduce operational waste by 60 percent.

In addition to the environmental benefits identified above, promoting the use of innovative green technologies can:

- enhance the quality of life and offer customer satisfaction,
- offer flexibility and the potential to cater for user changes in the future,
- provide and support desirable natural and social environments,
- increase investment in people and equipment for a competitive economy,
- achieve higher growth while reducing pollution and maximising the efficient use of resources,
- share the benefits of growth more widely and more fairly,
- improve our towns and protect the quality of the countryside, and
- contribute to sustainable development throughout North America.

The Challenge

Supporting the development of a green and sustainable residential construction industry requires an understanding of the challenges to innovation facing the industry. As shown in Figure 1, challenges facing the industry include:

1. Industry fragmentation;
2. An industry focus on price and first cost instead of value;
3. Lack of performance targets beyond the minimum code requirements.

These challenges result in increased environmental impacts of housing, a cyclical boom/bust cycle in the industry and unmet user needs.

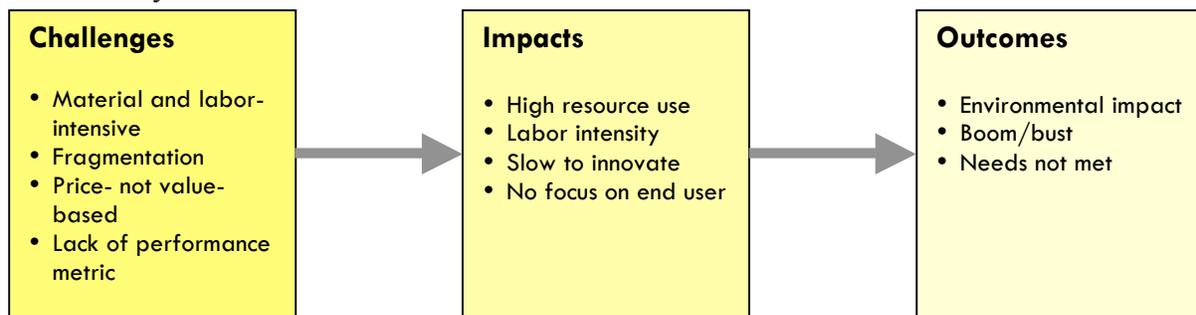


Figure 1: Industry Challenges, Impacts and Outcomes

Creating a North American Vision for Green Residential Buildings

The Vision

A North American vision for green residential building could result in the creation of a common set of sustainability principles and planning or design tools for green construction, with each country having region/context-appropriate policies and programs to address differences in building codes, regulatory environments, and climate. These tools would be used to enhance quality of life and balance environmental, economic, and social considerations and would reduce environmental

impacts through construction, operation and retrofit activities which focus on minimizing on a broader, life-cycle basis rather than short-term costs.

Residential Sector Vision:

Residential Buildings are designed, constructed, operated and decommissioned in a manner that supports a healthy, vibrant, inclusive and environmentally efficient economy, to support the well-being of Canada’s citizens and meet their needs in a sustainable manner, being sensitive to natural systems and working in harmony with them.

Achieving this vision will require more than just mitigating the environmental aspects of the construction industry. Rather, it will require a new way of thinking about the industry—one that fosters a long-term perspective, broad capacity building, and evolution to a service-based industry. This is reflected in the objectives proposed below for a green residential construction industry.

Objectives of a Green Residential Construction Sector	
<p>Environmental Stewardship</p> <ul style="list-style-type: none"> Reduce consumption Renewable use of resources Internalization of costs by occupants 	<p>Value, Not Price</p> <ul style="list-style-type: none"> Life-cycle thinking Define and monitor performance Communicate performance
<p>Innovative and Learning</p> <ul style="list-style-type: none"> Create environmental tools New materials and products Continual improvement 	<p>Knowledge-based, Service-oriented</p> <ul style="list-style-type: none"> Information-based processes Enhance quality Provide service, not product

The Strategies

To support green residential buildings, a market transformation strategy is proposed to achieve the objectives noted above. Rather than prescribing the construction of buildings with specific ‘green’ building characteristics, the goal is to transform the market so that ‘green’ buildings are demanded and supplied, and so that the marketplace innovates continuously toward increasingly improved performance. Strategies proposed to enhance the performance of residential buildings include:

Strategy #1 – Shared Directions

- 1.1 Develop/adopt high–performance-enabling strategies / building policies to influence green buildings and to phase them into the regulatory environment for residential sector.
- 1.2 Explore opportunities for partnerships (federal government, Canada Green Building Council, utilities, municipalities)
- 1.3 Develop / adopt enabling strategies for the private sector

Strategy #2 – Guidelines And Standards

2.1 Establish an integration team to help coordinate independent green guidelines and standards initiatives occurring across the country
2.2 Adopt a set number of standard building evaluation tools best suited to region/climate/density. Promote adoption in regions, provinces and municipalities, and facilitate their translation to other building types and market segments.
2.3 Develop an inter-jurisdictional ‘green’ building technical guideline (a multi-faceted toolkit) for residential construction (new/renovation, detached/townhouse/multi-unit, low-/med-/hi-rise).

Strategy #3 – Analytical Models

3.1 Develop a common, simple and user-friendly assessment tool for infrastructure and environmental impacts of capital development.
3.2 Develop a life-cycle costing tool that incorporates risk assessment.
3.3 Develop/adopt a user-friendly energy consumption-modeling tool (coordinate / package available tools: e.g., CBIP-EE4, DOE-2, HomeRun).
3.4 Develop valuation procedures to account for the benefit of owning and operating a green building

Strategy #4a – Financial Incentives: Supply Side

4a.1 Establish a team, including financial authorities within governments, to complete a benefit/cost analysis on all supply- and demand-side financial incentives listed.
4a.2 Revise development cost charges (DCC) to account for ‘green’ building features.
4a.3 Provide zoning/development bonuses for certified ‘green’ buildings.
4a.4 Develop and promote a national and international marketing program for Canadian ‘green’ building products and services.
4a.5 Leverage existing programs to provide financing incentives for private sector ‘green’ building upgrades.
4a.6 Provide a one-stop service center for access to all ‘green’ building financial incentives (supply- and demand-side audiences).
4a.7 Support government and industry partnerships to develop the capacity for supporting targeted R&D in green building design, technologies and products.

Strategy #4b – Financial Incentives: Demand Side

4b.1 Establish and/or enhance sustainable mortgage programs to decrease interest rates, increase approved property value, decrease down payment to favor ‘green’ buildings.
4b.2 Work with assessment offices to investigate a property appraisal method that recognizes the value of ‘green’ built space.
4b.3 Provide grants and low-cost loans as a coordinated and integrated suite of opportunities for green materials, components, systems and buildings (new or retrofit).
4b.4 Encourage uptake of graduated utility rates to encourage conservation and penalize excessive consumption (electricity, gas, water, sewer, storm water, etc.).
4b.5 Provide a one-stop service center for access to all ‘green’ building financial incentives (supply- and demand-side audiences).

Strategy #5 – Awards Programs

5.1 Showcase ‘green’ buildings built in Canada. Take an exhibition of these projects on a cross-Canada tour.
5.2 Develop an Awards Program for finished projects, recognizing all categories of stakeholders in collaboration with industry and other building industry award programs.

Strategy #6a – Industry Education

6a.1 Establish a ‘virtual’ green building technical resource and outreach center with targeted materials for all stakeholders in the building industry.
6a.2 Develop partnerships with the development industry, trade and professional associations, public agencies, universities and non-profit organizations to cooperate on curriculum development and training, research and development, networking and continuous learning.
6a.3 Develop/implement a targeted awareness campaign to illustrate benefits of: a) improved bottom line (including life-cycle cost analysis), b) increased market value and return on investment, c) better learning environments, d) improved productivity, e) increased retail sales, f) increased comfort, g) intangible values.

Strategy #6b – Public Education

6b.1 Conduct a general outreach campaign to key decision-makers within the community.
6b.2 Support point-of-purchase outreach for homebuyers as well as consumers (and realtors) of home construction and renovation materials and services.
6b.3 Enhance school curricula with a unit on green buildings in addition to cross-disciplinary curricula on sustainable development and sustainable business.

Strategy #7 – Process Alignment

7.1 Implement an integrated permitting process within municipal approval processes, including expedited processing for green building submissions.
7.2 Consolidate government capital and operational budgets and integrate interdepartmental government infrastructure development teams.
7.3 Disseminate information on alternative forms of relationship contracting (3P, Design-build, Build-Own-Operate, etc.)

Strategy #8 – Empower Green Bylaws

8.1 Allow municipalities to enforce green development commitments.
8.2 Amend the Local Government Act to allow financial support for cleaning up brownfield sites.

Strategy #9 – ENHANCED REGULATION

9.1 Amend building codes to include clear processes for obtaining equivalencies.
9.2 Amend building codes to promote best practices.

Strategy #10 – PRICING

10.1 Account for externalities in pricing natural resources.
10.2 Remove price subsidies for infrastructure and energy.

Targets

Targets are an essential component to enhancing performance, as they provide a means to measure progress towards a stated vision. Each of the strategies identified above will have associated with it a set of impacts and expected outcome. In aggregate, high-level environmental indicators and targets for the residential sector are summarized in Table 1.

Table 1: Environmental Targets for Residential Construction in 2030

Indicator	Target for 2030
Depletion of arable land resources and associated loss of habitat	All new residential development occurs within a defined Urban Containment Boundary
Non-renewable energy use and associated emissions of greenhouse gas emissions	Eliminate non-renewable energy consumption associated with construction and operation of residence
Water consumption	Water needs are provided within the capacity of the local watershed
Consumption of non-renewable materials	Non-renewable materials are 100 percent recycled
Emissions of waste into the atmosphere, aquatic bodies and ground	Eliminate emissions of toxic waste into the atmosphere, aquatic bodies and ground associated with the construction, operation and demolition of residential buildings

Realizing the Vision

Following the European example, the three North American countries will require, first and foremost, a common vision for green residential building. It must be recognized that the barriers to the proliferation of green residential construction within Canada will be magnified by working across international borders. Both the diversity of the actors involved as well as the regulatory and non-regulatory barriers will need to be addressed and overcome.

Coordination, particularly at the strategic level, will require trilateral agreement on the objectives of a sustainable residential construction sector, including:

- A consistent and comprehensive protocol to promote environmental stewardship
- Tools to support innovation and learning
- Performance metrics and tools to support value over price, and
- Capacity building within the industry to support a knowledge-based, service-oriented industry.

Just as the European Commission drove the process in Europe, the creation of a common vision or framework for green residential building across North America will require the leadership of an organization representing the interests of all three countries. The CEC may provide an instrumental role in driving the process of establishing a North American vision.

It must be stressed that this is not a job only for governments. Other key players such as the building industry and the financial sector must recognize the value in green homes and have a desire to promote their construction. In the end, consumer demand will be the main driving force for green residential. If green is seen as desirable, the market will respond.

Chapter 1: – Introduction

1.1 The Benefits of a North American Green Residential Building Vision

A North American vision for green residential building can lead to common approach to green construction across the three North American countries, whether through the promotion of green building practices at the national or local levels, harmonization of green building standards, and/or facilitation of trade in green building products and technologies. These actions can have significant environmental, social, and economic benefits for Canada, Mexico, and the United States, individually and collectively. The three countries are facing many of the same social, environmental, and economic issues, particularly with regard to urban areas, including air quality, affordable housing, urban sprawl, aging infrastructure, and rising energy costs. However, local and national governments share the common objectives of resource conservation, increased health and wellbeing for citizens, and general economic prosperity. A North American vision for green residential building can assist governments in addressing these issues and meeting these objectives.

A recent report by the Canadian Green Building Council describes the purpose of green buildings:

Green buildings strive to balance environmental, economic, and social considerations in design, construction and operation. Energy, water and resource efficiency; occupant comfort and well-being; site development and community context; and the economics of building construction and operation are key considerations. In comparison to conventional buildings, green buildings take advantage of natural processes to generate less waste, less pollution, and reduce their overall environmental footprint.⁴

As appealing as green buildings may sound, they currently make up only a fraction of all new building construction in North America. This is due, in part, to the existence of numerous barriers that inhibit the wide-scale adoption of green building as well as to the large number of actors, levels of government, and regulations involved in the building industry. A North American vision for green residential building, supported by national and local strategies, could assist in overcoming these barriers. For example, a common vision would see resource-efficient, low impact, energy-efficient, healthy housing as the norm instead of the exception. This could be achieved through the creation of a common set of sustainability principles, accepted green standards, and planning tools for green construction, with each country having region/context-appropriate policies and programs to address differences in building codes, regulatory environments, and climate. These planning tools would be used to enhance quality of life and balance environmental, economic, and social considerations.

However, the creation of a vision, principles, standards, and tools will be required a unified effort given that there are currently no green building practices, technologies, building codes, or building performance standards common to Canada, Mexico, and the United States. Indeed,

⁴ Canadian Green Building Council, *CaGBC Municipal Green Building Toolkit* (Ottawa: 2007), Chapter 1, p.3.

practices, technologies, regulatory requirements, and performance standards often vary within each country. For example, in Canada and the United States, building codes differ from province to province and from state to state. Generally desirable green building practices such as airtight construction may be effective in arid climates, but are problematic in rain forests due to humidity problems in building enclosures. As well, the same green building performance standard may have different requirements in different jurisdictions or be applicable only in certain locations. The Built Green Standard, for example, is valid only in Alberta and British Columbia and in certain US states. In Canada, the R2000 national standard for energy-efficient homes, is ideal for prairie environments, but can be problematic in humid areas. The Leadership in Energy and Environmental Design (LEED) performance standard, although widely recognized in both the US and Canada, currently applies only to multi-family residential buildings and is therefore relevant only in urban centers. In addition, performance metrics and certification requirements differ for all green building standards, and desirable green attributes and technologies vary from region to region. A North American vision could promote the use of recognized, quality green building standards that are appropriate to a variety of North American regulatory environments and climates.

One of the goals of NAFTA is to promote trade and harmonization of environmental regulations across North America. Trade in green building technologies, however, is currently limited. This may be because requisite testing and evaluation services for product acceptance in different jurisdictions can be difficult and costly. Moreover, test standards are not uniform across borders, as technology objectives differ from place to place. For example, the ASTM International and the Canadian Standards Association have different performance targets for certain green technologies. As well, these standards are performance-based and provisions for environmental targets are absent. Incorporating region-specific environmental performance targets would promote the use of climate-appropriate products and technologies minimize the use of eco-inefficient products. Further, enhanced standards across North America could keep harmful or inefficient building products manufactured in one country from being dumped, and therefore used, in the market of another. The harmonization of product certification standards and the inclusion of environmental targets would facilitate and promote better quality and more environmentally friendly construction materials and methods within each country and trade of better products across borders.

A North American vision for green residential construction could also improve the competitiveness of the building construction industry by inspiring research and development activities and promoting knowledge sharing. Coordination of R&D and activities and networking between governments and key industry actors could speed product and technological innovations and transform the construction industry. A unified vision could also contribute to trade in new technologies and construction methods as well as to the harmonization of policies promoting green buildings. Increased trade would create markets for green building products and services and reduce costs and barriers to adopting new green housing components and technologies.

At the building level, green residential homes have potential to generate such economic, environmental, and social benefits as: lower fuel/energy and water costs; lower environmental impact; improved indoor air quality; increased occupant comfort; lower maintenance costs; and increased market and resale value. These benefits, however, can be significantly magnified at the

community scale when green residential construction is integrated into sustainable community planning objectives. In developing a sustainable approach to land use, the challenge is to move from a separate use, automobile-oriented, low density planning paradigm to one that is integrated, mixed use, compact and pedestrian, cyclist and transit-oriented. This type of development is often called “smart growth.”⁵ Smart growth planning also advocates the use of green infrastructure, urban revitalization and a healthy working land base, and the creation of inclusive neighbourhoods and complete communities.⁶ A North American residential green building vision promoting green construction practices combined with smart growth principles and planning tools could change urbanization patterns, thereby reducing environmental impacts and resource needs, and contributing to the creation of more liveable and sustainable communities.

1.2 Creating a North American Vision for Green Residential Building

Developing a vision promoting green residential buildings across North America will require a concerted effort across multiple levels of government and involve numerous key actors within each country. Such issues as sustainability principles and planning tools, green building objectives, green building standards and rating systems, common green product testing methods/codes; and accepted green building technologies will have to be considered and addressed. Although this may sound daunting, there is a best practice example of a continent-wide approach to addressing pressing environmental concerns.

1.2.1 Case Study: The European Union

The Commission of the European Communities’ *Thematic Strategy on the Urban Environment*⁷ is one of seven European-scale thematic strategies intended to provide a holistic approach to key environmental issues that are characterized by their complexity, the diversity of actors concerned, and the need for innovative and multiple solutions. It was created in recognition of common problems facing Europe’s cities and towns and the opportunity, at the European Union level, to develop and facilitate the implementation of appropriate solutions. The goal was to develop a conceptual framework and implementation plan, which would be implemented at a local scale to achieve specific measurable benefits in European cities. The Thematic Strategy focuses on four cross-cutting themes, including sustainable urban management, sustainable urban transport, sustainable construction and sustainable urban design.

The Commission’s vision with regards to sustainable construction was developed to support the strategy and provide guidance for its implementation at the local level. This vision states:

Sustainable construction is a process where all the actors involved (e.g., owner, financier, engineer, architect, builder, material supplier, permitting authority) integrate functional, economic,

⁵ The 10 Smart Growth Principles can be found at: http://www.smartgrowth.bc.ca/index.cfm?Group_ID=3524

⁶ For a more detailed explanation of how green buildings contribute to the broader sustainability agenda see: West Coast Environmental Law, *The Green Building Guide: Tools for Local Governments to Promote Site Sustainability* (Vancouver, 2006), p. 9.

⁷ Commission of the European Communities, *Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: Towards a Thematic Strategy on the Urban Environment* (Brussels, 2004).

environmental and quality considerations to produce and renovate buildings and a built environment that is:

- *Attractive, durable, functional, accessible, comfortable and healthy to live in and use, promoting the well-being of all that come into contact with it.*
- *Resource-efficient, in particular with respect to energy, materials and water, favoring the use of renewable energy sources and needing little external energy to function, making appropriate use of rain and ground water and correctly handling waste water, and using materials that are environmentally friendly, that can be readily recycled or reused, that contain no hazardous compounds and can be safely disposed of.*
- *Respects the neighborhood and local culture and heritage.*
- *Is competitively priced, especially when taking into account longer-term considerations, such as maintenance costs, durability and re-sale prices.*⁸

To move towards implementation, the Commission proposed that member states adopt international standards (e.g., setting high performance requirements using European harmonized standards and codes) and strengthen national programs (e.g., implementing a national sustainable construction program). Local authorities were encouraged to promote sustainable construction.

In addition to Europe's vision for sustainable construction and its strategy for a sustainable urban environment, the European Commission has recently created the European Construction Technology Platform (ECTP).⁹ Comprising stakeholders from every facet of the industry, including consumers, financiers, and academics, the ECTP's objective is to raise the level of performance and competitiveness within the construction industry by analysing the major challenges faced by the sector in terms of society, sustainability, and technological development as well as to engage with and mobilise the wide range of leading skills, expertise, and talent available within the industry in order to meet the societal needs. These major challenges include:

- Creation of safe and healthy working and living environments for European citizens;
- Participation in the work to streamline national and European legislation to create a truly common market for construction products and services;
- Action to reduce the use of energy, materials, and other resources in construction and in the built environment;
- Contribution to the improvement of the quality of the built environment that will be accessible for all;
- Enhancement of the competitiveness of the European construction sector with respect to the USA and the low cost economies; and
- Creation of an understanding that the construction sector is innovative and research-driven.

The ECTP has also developed its own vision for the European construction industry in 2030 that recognizes the transformation of the industry to a knowledge- and demand-driven sector with an emphasis on serving client and societal needs, contributing to quality of life and environmental health, meeting accessibility needs, and enhancing the attractiveness and competitiveness of the industry.¹⁰ Supporting this vision is the objective of becoming sustainable:

⁸ *Towards a Thematic Strategy on the Urban Environment*, p. 45.

⁹ See: <http://www.ectp.org/default.asp>

¹⁰ See: <http://www.ectp.org/documentation/ECTP-Vision2030-25Feb2005.pdf>

Europe combines ‘high tech’ with ‘high culture’, and is a natural leader in creating a sustainable built environment. The built environment links nature and citizens in a sustainable way. The built indoor environment enables health and comfort in living, moving and working. The negative impacts of construction’s whole life-cycle and of the built world on the environment are radically reduced, thereby substantially improving the sustainability of the construction sector in Europe, with policies such as zero-waste construction and an efficient use of all resources. Environmental life-cycle approaches are adopted for design, construction works, maintenance and operation, as well as in product development.¹¹

Supported by and linked to the ECTP, numerous European countries have developed their own National Technology Platforms (NTPs). NTPs, led primarily by industry, share many common elements with the ECTP, such as involvement of all industry stakeholders and the aim of identifying technological, regulatory and financial challenges to improving the performance of the industry in terms of productivity and environmental impact.

These European examples show us that green building can be promoted and mainstreamed at government and industry levels. Although this paper deals primarily with government actors, it is important to recognize that the construction industry has a key role to play in addressing economic and trade issues and in responding to societal expectations around the quality of the built environmental.

Drawing from the European undertaking of creating a cross-border vision for sustainable construction, it becomes apparent that coordinated local, national, and international government efforts are essential, as well as the involvement of key industry actors. If North America were to follow the European example, national and local governments would work to build and strengthen residential building programs and set implementation targets. Consequently, it will be important for each country to understand the current state of green residential housing within its borders. Particular attention should be paid the benefits of and barriers to the proliferation of green residential construction at the local and national levels, for it will be through the development and implementation of strategies to remove these barriers that the full benefits of green residential will be realized. These issues, as they pertain to Canada, are examined in the following chapters.

¹¹ European Construction Technology Platform, *Challenging and Changing Europe’s Built Environment: A vision for a sustainable and competitive construction by 2030* (Brussels: February 2005).

Chapter 2: Background

2.1 Baseline Information

2.1.1 History of Green Housing Activities in Canada

Green building has its roots in the solar and earthen homes constructed during the 1970s and 1980s. The type and number of green homes grew as builders and developers began to incorporate other forms of energy efficiency and strategies for resource efficiency and healthy building materials. Over the last two decades, a variety of standards for green residential construction have been developed and are recognized across Canada. The best known of these standards include the following:

*EnerGuide*¹²

Run by the Office of Energy Efficiency (OEE) of Natural Resources Canada (NRCan), EnerGuide is a national, voluntary program. Its purpose is to promote and improve energy efficiency for both new and existing homes. For new homes built to this standard, an EnerGuide advisor becomes involved prior to construction, reviewing building blueprints and recommending energy-saving upgrades concerning:

- air leaks and sealing;
- the proposed structure's resistance to heat loss;
- the energy efficiency of building components such as windows and doors;
- passive solar heat gain and the house's orientation;
- heating system efficiency and heat distribution; and
- air exchange systems, including exhaust fans in kitchens and bathrooms.

Based on the blower door testing and the upgrades implemented, homes are given an EnerGuide rating of 0-100. A typical new house has an Energuide rating of 68 to 70. An energy-efficient new house has an Energuide rating of 80.

*R2000*¹³

Introduced in the 1980s, R-2000 is another initiative of the OEE. Also a national, voluntary standard, the R-2000 program is designed to promote the use of cost-effective, energy-efficient building practices and technologies. R-2000 homes must be constructed by R-2000 certified builders and meet rigorous energy consumption targets. They must also meet other technical requirements, including water efficiency, indoor environmental quality and recycled materials content. R-2000 homes are about 30 percent more energy efficient than conventional new homes and achieve a minimum energy efficiency rating of at least 80 on the EnerGuide rating scale

¹² See: <http://oee.nrcan.gc.ca/residential/personal/new-homes.cfm?attr=4>

¹³ See: <http://oee.nrcan.gc.ca/residential/personal/new-homes/r-2000/About-r-2000.cfm?attr=4>

*Built Green*¹⁴

Built Green is a certification program for new single-family homes and row houses. Managed by the Built Green Society of Canada, the program currently operates in Alberta and British Columbia. Its purpose is to encourage homebuilders to use resource-efficient and environmentally friendly technologies, practices and products. Certification (at the bronze, silver, or gold level) requires meeting minimum energy efficiency performance standards as well as achieving a set number of points from a prescriptive checklist addressing a range of "green" items. During different phases of construction, Built Green conducts random audits to verify conformance with the Built Green checklist. This standard makes use of EnerGuide, with a gold rating requiring a score of 77 or higher.

*Leadership in Energy and Environmental Design (LEED)*¹⁵

Launched by the US Green Building Council and adopted by the Canadian Green Building Council (CaGBC), the LEED rating system certifies buildings as silver, gold or platinum based on a point system. The LEED rating system uses a whole-building perspective and takes into consideration the specific goals and constraints of each project. The rigorous performance standards evaluate the design, construction and operation of a building and require specific documentation for all credits. At present, the LEED system applies only to multi-family residential buildings, but a LEED for Homes standard is currently in the pilot phase.

2.1.2 Canada's Housing Characteristics

*Housing Stock*¹⁶

In 2001, according to that year's national census, Canada had approximately 1.6 million occupied dwellings in its residential stock. Single detached homes constituted over half of that housing stock, maintaining a trend that has existed for the last 25 years. Detached homes are more prevalent in small centers and in rural areas, where they comprise over 80 percent of the housing stock. In large urban centers, higher land costs and density patterns result in a greater mix of housing types.

Canada's housing stock can be broken down as follows¹⁷:

- Single detached: 57 percent
- Semi-detached: 4.9 percent
- Row house: 5.3 percent
- Single attached: 0.4 percent
- Duplex: 3.6 percent
- High-rise apartment: 9.1 percent
- Low-rise apartment: 18 percent

Housing Size

While household size has been decreasing, the size of homes has been steadily increasing. In 2001, the average number of occupants per private household was 2.6, compared to 3.6 in

¹⁴ See: <http://www.builtgreencanada.ca/>

¹⁵ See: <http://www.usgbc.org>

¹⁶ Figures in this section are derived from Canada's 2001 Census. The 2006 Census results pertaining to dwelling characteristics will be released in September 2007.

¹⁷ Canada Mortgage and Housing Corporation. *Canadian Housing Observer 2004* (Ottawa, 2004), p. 10.

1971.¹⁸ Still, new single-family homes built in the 1990s were, on average, up to twice the size of homes built in the 1940s.¹⁹ Since 1993, the average heated area of a detached single-family home has increased from 1378 sq. ft. to 1425 sq. ft.²⁰ By comparison, row houses and low-rise apartments, with their significantly smaller footprints, average 861 sq. ft. and 1266 sq. ft., respectively.²¹

Occupancy and Land Development Patterns

Despite the trend to urbanization and a recent rise in the construction of multi-family dwellings, Canadians continue to own and inhabit single detached homes. In 2001, two-thirds of dwelling units were owner-occupied. Approximately 90 percent of single detached homes were owned, whereas 81 percent of low- and high-rise apartments were rented.

In 2001, 79.4 percent of Canadians lived in urban centers, more than double the figure of 100 years ago. According to a UN Report on World Urbanization Prospects (March 2002), Canada is projected to have 85.1 percent of its population residing in urban areas by 2030. Yet low density, dispersed development is still the norm in many Canadian municipalities. Even in locations with aggressive growth management policies, such as the Greater Vancouver Regional District (GVRD), the size of the urban environment (as measured by area of serviced land) is increasing faster than the population growth rate. This is known as urban sprawl.²²

One of the more pressing issues related to type and amount of land is the relative inefficiency of land use associated with single detached housing development. This is a significant issue for a number of major metropolitan areas in Canada, notably Toronto, the Lower Mainland of British Columbia, and the Calgary to Edmonton corridor. In the City of Vancouver in 2001, for example, single-family dwellings accounted for 28 percent of housing stock. Forty percent of the population lived in single-family dwellings that consumed 86 percent of the residential land area. Stated differently, 60 percent of Vancouver's population is accommodated in non-single-family dwellings on only 15 percent of the residential land base.²³

Current Demand and Consumer Preferences

Demand for housing has been strong since the late 1990s, due primarily to increasing rates of employment and income and low mortgage rates. In 2004, housing starts were at their highest level since 1987. The decline in housing starts in 2005 indicates demand has been absorbed and is beginning to match Canadian demographics. A 16-year peak in single detached home starts was also marked in 2004, while 2005 saw 19-year high in multi-family housing starts (semi-detached, row, and apartment units). Demand for multi-family housing is expected to be sustained as the population continues to age and looks for ways to manage issues of health and independence (e.g., closer proximity to services, smaller homes).²⁴

¹⁸ Canadian Mortgage and Housing Corporation. *Canadian Housing Observer 2006* (Ottawa, 2006). See table Households by Age of Maintainer and Tenure, Canada 1971-2001, p. a-18.

¹⁹ *Canadian Housing Observer 2006*, p. 51

²⁰ Natural Resources Canada. *2003 Survey of Household Energy Use (SHEU)* (Ottawa, 2005), p.4.

²¹ *2003 Survey of Household Energy Use (SHEU)*, p.9

²² The Sheltair Group. *Land Use and the Built Environment* (Vancouver: May 2005), p. 25.

²³ *Land Use and the Built Environment*, p. 9.

²⁴ *Canadian Housing Observer 2006*, p.5.

A recent survey by the Canada Mortgage and Housing Corporation (CMHC) on Home Buying Intentions confirms Canadian consumers' strong preference for ground oriented detached dwellings. Across the six centers in the study, nearly 60 percent of respondents expressed a preference to purchase a single detached home. Consumer demand for singles is particularly high in Halifax (76 percent) and Calgary (72 percent). A further 25 percent of potential buyers across the six centers expressed a preference to buy a semi-detached, row or town house. This preference is strongest in Montreal and Ottawa.²⁵

Environmental Impacts

In Canada, despite increases in energy efficiency and more environmentally friendly construction technologies, buildings are still huge consumers of resources, responsible for:

- 33 percent of all energy produced;
- 50 percent of natural resources;
- 12 percent of non-industrial water usage;
- 25 percent of landfill waste;
- 10 percent of airborne particulates; and
- 35 percent of greenhouse gases²⁶

Although the residential sector has a lower impact on the environment than the industrial/commercial sector, it is still a major consumer of energy and resources. In 2003, the residential sector accounted for 17 percent of Canada's secondary energy use and 16 percent of the country's greenhouse gas (GHG) emissions. Over 81 percent of this energy was associated primarily with space and water heating, while 13 percent was attributable to appliances.²⁷

2.1.3 Best Practices in Green Building

Canada has many examples of state-of-the-art green housing initiatives. The Dockside Green project in Victoria, British Columbia, is one of these.

Green Development: Dockside Green²⁸

Dockside Green is an 11.5-acre housing, industry, and retail project located on a former brownfield site along Victoria's harborfront. The development uses a "triple bottom line" approach, which encompasses social, economic and environmental considerations in its development. The aim is for all buildings in the project to obtain LEED Platinum ratings and for the development to be carbon neutral. Among the highlights:

- Potable water savings are projected at 66.5 percent, or 70 million gallons of water per year.
- Sewage treatment is proceeding, with 100 percent of all sewage to be treated on site.
- Building energy modeling projects energy savings of 50 to 52 percent.
- Meters will be installed in each residential unit to measure hot and cold water, heat and electricity, ensuring that building occupants pay for what they use and eliminating free riders.

²⁵ Canadian Mortgage and Housing Corporation, *Consumer Intentions to Buy or Renovate a Home* (Ottawa, 2005).

²⁶ CaGBC *Municipal Green Building Toolkit*, Chapter 1, p. 2.

²⁷ Office of Energy Efficiency. *The State of Energy Efficiency in Canada, Report 2006* (Ottawa, 2006), p. 13. See: <http://oee.nrcan.gc.ca/Publications/statistics/see06/pdf/see06.pdf>

²⁸ <http://www.docksidegreen.ca/index.php>

2.1.4 Driving Forces for Green Housing

Growth Projections

It is estimated that Canada's population will be approximately 36 million by 2020, with 85 to 90 percent of the population and the vast majority of jobs located in the major urban centers. Most people will be living in the 25 largest urban regions, with six of these regions home to more than half of Canada's residents. The following Statistics Canada's projections for population growth in the eight largest Census Metropolitan Areas (*CMAs*) are based on continuing trends in fertility, mortality and migration:

- Toronto CMA – to 6.6 million;
- Montreal CMA – to 3.8 million;
- Vancouver CMA – to 3 million;
- Ottawa-Gatineau CMA – to 1.3 million;
- Calgary CMA – to 1.2 million;
- Edmonton CMA – to 1.1 million;
- Winnipeg CMA – to more than 700,000; and
- Halifax CMA – to almost half a million.²⁹

Faced with the challenge of accommodating growth, an increasing number of communities are looking at intensifying and renewing existing neighborhoods through infill development, adaptive reuse and conversion, redevelopment of brownfields, and secondary suites.

Consumer Demand

Consumer demand for green housing is growing, albeit slowly. One factor is increased and awareness of the adverse impacts of poorly designed houses and communities on the environment and on personal and public health. A recent CMHC poll surveyed 150 British Columbians to assess demand for green housing. Respondents ranked quality of construction as the key factor influencing home buying decisions. Environmental sustainability ranked ninth out of a list of 12, scoring 7.2 out of 10.³⁰

Urban development over the last 50 years has been driven by the availability of energy and land resources. As scarcity for these goods increases, the cost will increase, resulting in increased efficiency of use as well as substitution. Rising energy prices will may prove the strongest driving force for consumer demand in green housing, as homeowners and builders look to cost- and energy-efficient homes. In the above CHMC study, energy efficiency was ranked highest for features influencing green housing purchase decisions.

Growing consumer interest may be also be attributable to the work of NGOs such as Smart Growth, The Net-Zero Energy Home Coalition, and the Urban Development Institute Canada, all of which cite within their mandate healthy housing and communities. Municipalities and regional districts are also working to mainstream green construction. Toronto's Living City Campus, an initiative of the Toronto and Region Conservation Authority, is working to move the city towards widespread implementation of green buildings by involving individuals, businesses and governments in education and training programs (the Sustainable Schools program), through

²⁹ *Land Use and the Built Environment*, p. 25.

³⁰ Canadian Mortgage and Housing Corporation. *UniverCity: Assessing Consumer Demand for Sustainable Development* (Ottawa, 2004).

showcasing sustainable technologies (the Renewable Energy Project), and by inspiring leadership (the Mayors' Megawatt Challenge).³¹

Energy and Land Availability and Price

Urban development over the last 50 years has been driven by the availability of energy and land resources. As scarcity for these goods increase, the cost will rise resulting in increased efficiency of use as well as substitution. This will drive the market for green building as increasing land prices limit sprawl and energy sprawl becomes more expensive. However, as free goods, both energy and land tend to be under-priced and thus over utilised. Getting the correct price for natural resources is an ongoing issue at all levels of the energy policy debate. Externalities, subsidies for oil and gas research, and the public goods nature of environmental amenities contribute to under-pricing energy and land resources. Concerns over competitiveness with trading partners further complicate the pricing of energy and land resources. This under-pricing contributes to sprawl development.³²

Aging Housing Stock and the Renovation Market

Canadians spend significant amounts renovating their homes. Spending on alterations and improvements reached about \$28 billion in 2004.³³ This may be attributable in part to the fact that Canada's housing stock is aging. More than 46 percent of the country's housing stock was built before 1970.³⁴ Of dwellings constructed prior to that year, 44 percent were in need of major repairs. As renovations are required, energy efficiency measures may well be considered and incorporated.

For the 54 percent of housing stock built after 1970, much of it likely has never been upgraded. Not surprisingly, central Canada and the eastern provinces contain a considerable percentage of this older stock. Significant percentages of space heating equipment fall into age brackets that will offer replacement opportunities in the near term. Natural Resources Canada's *Energy Use Outlook* attributes large energy savings over the next decade to the replacement of older, inefficient space heating equipment and appliances with relatively efficient new products. While replacement will occur in due course, as the useful life of the equipment comes to an end, opportunity exists to accelerate this cycle.

Regulations/Voluntary Guidelines

Nowhere in Canada do regulations require green residential building, although some minimum green technologies, materials or practices may be incidental to regulated standards such as Canada's National Building Code or National Plumbing Code. Other codes, such as the Model National Energy Code, do not apply to residential housing. These codes, however, do not promote best practices; rather, they set minimum legal standards.

Voluntary guidelines are more commonplace than regulations. For example, Health Canada's Exposure Guidelines for Residential Indoor Air Quality may advocate practices similar to those found in green building standards. In January 2007, the federal government introduced the

³¹ CaGBC *Municipal Green Building Toolkit*, Chapter 4, p. 9.

³² *Land Use and the Built Environment*, p. 24.

³³ Canadian Mortgage and Housing Corporation. *Canadian Housing Observer 2005* (Ottawa, 2005), p. 27.

³⁴ *Canadian Housing Observer 2006*. See table: Dwelling Condition by Tenure and Period of Construction, Canada, 2001, p. 101.

ecoENERGY Initiative to help Canadians use energy more efficiently, boost renewable energy supplies, and develop cleaner energy technologies. The Energy Star program is designed to assist consumers in selecting energy-efficient products.

At the national level, the Kyoto Protocol, ratified in 2005, has committed Canada to a reduction of its greenhouse gas emissions by 2012 to 6 percent below 1990 levels. If Canada moves to meet this commitment, it is likely that the government will impose regulations requiring energy efficiency standards throughout the building sector.

Policies

Canada does not have a national building or housing policy. The provinces and territories are responsible for designing and delivering housing policy and programs within their respective jurisdictions. Although many provinces have policies relating to greening new government funded buildings, they have not established policy related to green residential building. In fact, it is municipalities that have led the way in setting policies and guidelines around green construction across the country.

While jurisdictions are not yet mandating green housing, some municipalities are instituting incentives for green housing and adopting guidelines and voluntary standards. A case in point is Whistler, BC, where the municipality is encouraging all new housing to meet its Whistler Green building standard. The municipality is currently reviewing the possibility of making this standard mandatory for all new construction.³⁵ The city of Vancouver is currently developing a green building strategy that will apply to high-density residential buildings. The object is for buildings to meet a new minimum performance baseline that meets civic and environmental objectives.³⁶

For the most part, local governments have established guidelines and plans to promote sustainability in communities and housing. Vancouver's recently launched EcoDensity program is one such example. It is designed to create greater density throughout the city in a way that lowers environmental impact, ensures the existence of necessary physical and social amenities, and supports new and different housing types as a way to promote greater affordability. Many other municipalities have incorporated policy statements in their official community plan (OCP) to support smart growth planning principle or green design. Municipal bylaws and capital expenditures must align with the OCP.³⁷

At the federal level, the government has undertaken several key policy-related initiatives in the areas of sustainability and urban issues.

- The Prime Minister's Caucus Task Force on Urban Issues, established in 2001, completed its mandate at the end of 2002. It examined the role of the federal government in addressing opportunities and challenges facing Canada's urban regions.³⁸
- National Roundtable on Environment and Economy. In 2003 the NRTEE published a State of the Debate Paper concerning environmental quality in Canadian Cities. It made a broad range of recommendations, with particular emphasis on federal fiscal policy as it

³⁵ See: <http://www.whistler.ca/content/view/219/226/>

³⁶ *CaGBC Municipal Green Building Toolkit*, Chapter 5, p. 10.

³⁷ *CaGBC Municipal Green Building Toolkit*, Chapter 5, p. 3.

³⁸ Sgro, J., *Canada's Urban Strategy: A Blueprint for Action. Prime Minister's Caucus Task Force on Urban Issues*, (Ottawa: November 2002).

relates to urban form, including, for example, recommendations to encourage the efficient use of energy and land.³⁹

- The External Advisory Committee on Cities and Communities is intended to provide the Prime Minister with recommendations and advice as part of the government's New Deal for Canadian Municipalities.⁴⁰ The mandate of the Committee includes: developing a long-term vision on the role that cities should play in sustaining Canada's quality of life by looking at such issues as the environment, competitiveness and social cohesion; providing advice as policies are developed related to cities and communities; and enriching the discussion of policy options by bringing regional and issue-specific expertise to the table.

Economic Policies

While Canada has no national economic policy promoting green building, all levels of government have the opportunity to employ economic policies as incentives to building green. For example, at the provincial level, Hydro-Quebec offers cash grant for homes built to Quebec's green residential standard, Novoclimat.⁴¹ At the municipal level, certain cities have offered economic incentives for green buildings and renovations. The City of Toronto provided financial incentives to citizens to replace old water-consuming toilets with reduced water consumption models. (The incentive proved less costly than increasing the capacity of the city's infrastructure by adding a new treatment facility.⁴²) Cities have also attempted to tie certain development costs to the property, which can allow the financial capital cost of green features to be shared by all owners over time and not borne solely by the developer or initial owner. These costs are transferred with the property to the new owner when the building/unit is sold. Employing this strategy, a Toronto development financed its high efficiency heating system by including the costs in the residents' strata fees.

Financial institutions are also playing a role in using economic policies to promote green building. The CMHC, for example, offers a 10-percent mortgage loan insurance premium refund to buyers purchasing energy-efficient homes.

2.1.5 Building and Development Sector Primary Actors

Canada, Mexico and the United States are all expected to experience increasing housing demand for over the next few decades, particularly Mexico. In Canada, the public, governments, and the building industry are the key players on the supply side of the building and development sector. Decisions made by these players in responding to this demand will determine housing form and location as well as building standards and construction materials. These decisions will ultimately influence urbanization patterns in the years to come. Consequently, support for green building by these actors can have far-reaching impacts.

³⁹ National Round Table on the Environment and the Economy. *State of the Debate: Environmental Quality in Canadian Cities: The Federal Role*, (Ottawa, 2003).

⁴⁰ The New Deal for Municipalities has three components: reliable, predictable, long-term funding; a new relationship among orders of government; and looking at federal activities through an urban lens.

⁴¹ <http://www.hydroquebec.com/residential/novoclimat/>

⁴² *CaGBC Municipal Green Building Toolkit*, Chapter 3, p. 14.

Federal Government

The federal government plays a limited role with regard to housing development, but a large role with regard to the provision of mortgage insurance, lending programs and taxation. This financial role enables the promotion of green standards through federal economic incentives.

Another role is the setting of standards that comprise the national building and plumbing codes, the purpose of which is to ensure that all building construction meets acceptable measures of fire safety, structural soundness, accessibility and environmental health.

The federal government has also been responsible for the development of key standards for green residential building, e.g., the EnerGuide and R2000 programs for homes. In the 1990s, CMHC launched Healthy Housing, a program that promoted design principles addressing occupant comfort, energy efficiency, resource conservation, environmental impact, and affordability. The program evolved into the Net-Zero Energy Healthy Housing Program, which advocated housing that adheres to the Healthy Housing principles and produces as much energy as it consumes. This program was recently renamed EQUilibrium Housing,⁴³ and its goal is to reduce a home's environmental impact to an absolute minimum.

Provincial Governments

Land use planning at the provincial level involves multiple statutes and agencies. These, in turn, vary by province. In general, however, statutes pertaining to land use are a provincial responsibility that can be delegated to other bodies such as local governments. Although provincial governments draft the applicable building codes, provincial governments generally authorize local governments to deal building through power over activities such as zoning and the issuing of building permits.

Municipalities/Local Governments

While municipalities may be the greatest force behind green building and have a variety of tools through which to regulate land use, they are still subject to provincial frameworks or regional government growth management strategies that can support or work against urban sustainability. Local governments can develop official community plans that provide a general statement of broad objectives and policies respecting the form and character of existing and proposed land use and servicing requirements in the area covered by the plan. They can use zoning bylaws to regulate the use and density of land, buildings and structures. And they can establish green building policies and targets or demand-side management programs that encourage water conservation, waste reduction and recycling.⁴⁴

Associations and Trade Groups

Building developers, trades and consultants are the other major player driving green building. The Canadian Home Builders Association (CHBA) represents the residential construction industry across the country. It provides information, education, and training for members, serves as an advocate on issues affecting the residential construction industry, and provides tools and resources to the public for buying, building, and renovating homes. The CHBA has been developer and promoter of green standards, having assisted the federal government with the

⁴³ See: http://cmhc.ca/en/en_001.cfm

⁴⁴ *CaGBC Municipal Green Building Toolkit*, Chapter 1, p. 6.

development of the R2000 standard. The CHBA is also responsible for the adoption and promotion of the Built Green Standard for Alberta and BC.

The Canadian Green Building Council (CaGBC) administers the LEED rating system in Canada. It was created to promote and accelerate the design and construction of high performance buildings. The Council, comprising design and building industry representatives, has created a vision for a transformed built environment leading to a sustainable future. Through its membership, the CaGBC works to identify industry-based opportunities to affect market transformation by promoting better environmental building practices through professional training and awareness. The CaGBC also works collaboratively with local decision-makers to design tools for municipal policy-making and programs for green building implementation.

Both these professional associations have great potential to move the green building agenda forward in Canada through the promotion of recognized green standards and the provision of training and education to their members, the public, and decision makers.

Financial and Appraisal Institutions

Despite the positive economic performance of green homes, banks, real estate agents, values and appraisers have been slow to recognize the benefits of green buildings. A recent study by the GVRD found limited evidence linking green building features and related performance in terms of valuation. In other words, a green building that is not appraised any differently than a conventional building is shortchanged by from not having the green performance of its green features adequately valued. Players in these industries have an obligation to be informed and the potential to move green building forward, first, by recognizing that value is a consideration in building design and, second, by ensuring that appraisals properly reflect the attributes of green buildings,

The CMHC and a handful of other financial institutions are moving in this direction by offering a mortgage loan insurance premium refund to households that purchase an energy-efficient home or make energy-saving renovations.

Other Key Players:

Other key players in the housing and building market include:

- Private sector: designers, architects, engineers, product distributors and manufactures, home inspectors, building consultants.
- NGOs: Net-Zero Energy Home Coalition, Federation of Canadian Municipalities, Urban Development Institute Canada.
- The public: homebuyers and owners.
- Standards organizations: Canadian Standards Association.
- Utilities commissions

2.1.6 Supply Chain of Materials and Products

While the basic materials are likely procured locally, certain products related to green housing are currently traded across America. These include high efficiency glazing, mechanical systems and electrical components.

2.1.7 Assessment of Industry Issues

Supporting the development of a green and sustainable residential construction industry requires an understanding of the challenges to innovation facing the industry. As shown in Figure 2, challenges facing the industry include:

1. Industry fragmentation
2. An industry focus on price and first cost instead of value
3. Lack of performance targets beyond the minimum code requirements.

These challenges result in increased environmental impacts of housing, a cyclical boom bust cycle in the industry and unmet user needs.

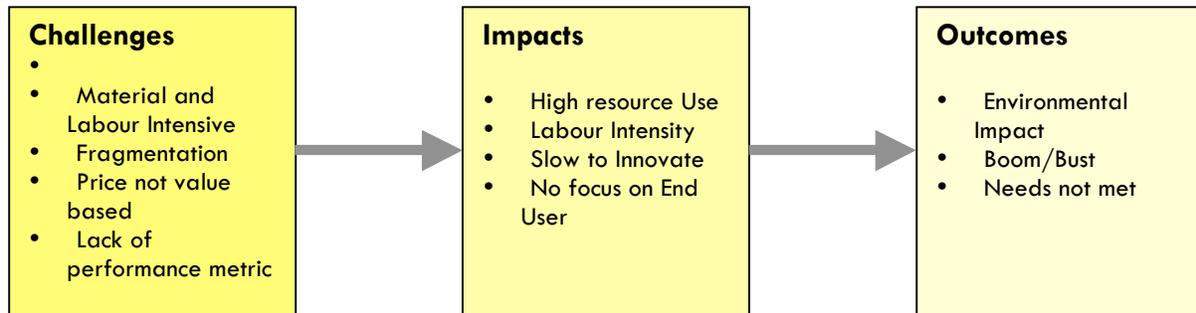


Figure 2: Industry Challenges, Impacts and Outcomes

Chapter 3: Benefits of and Barriers to Green Residential Building

3.1 The Benefits of Green Residential Building

The Benefits

As discussed in Chapter 1, green residential homes have potential to generate environmental, social, and economic benefits at both the building and the community scale. Specific examples follow.

Environmental

Residential housing design from construction materials to appliance selection has environmental impacts. When compared to conventional housing, green housing can significantly lessen these impacts by:

- increasing energy efficiency and reducing greenhouse gas emissions – Climate change contribution associated with a conventional inefficient building can be reduced by more than 70 percent when both material and energy use effects are minimized;
- reducing water usage – Green building strategies can reduce potable water needs from 10-50 percent and the generation of sewer waste from 50-75 percent;
- improving indoor air quality – The use of non-toxic materials and natural ventilation is less harmful to the environment and to the health of occupants;

- consuming fewer resources for construction and operation – The use of local and reused materials can reduce construction and demolition waste by up to 90 percent and reduce operational waste by 60 percent; and
- promoting the use of innovative green technologies.⁴⁵

How we use land in terms of space and intensity has a tremendous impact on sustainability and liveability, influencing our transportation choices, our reliance on infrastructure, and our integration into the community. Smart growth planning advocates compact neighbourhoods, a variety of transportation choices, diverse housing opportunities, and preservation of open spaces and environmentally sensitive areas. Residential development that adheres to these principles can reduce sprawl and create structural shifts from single-family detached homes to multi-family buildings.

Social

The World Health Organization has included housing and health in its list of environmental health indicators. This is a strong indication that the condition of housing, from building material to air quality, can directly affect occupant health. Green homes can:

- reduce occupant exposure to allergens and molds through the use of less toxic materials and climate-specific building design;
- promote occupant health, wellbeing, and productivity through improved indoor environmental quality, enhanced penetration of daylight, improved thermal quality, and natural ventilation;
- adapt, through design solutions, to occupants' changing needs and capabilities (e.g., physical) over their lifetime; and
- provide occupants with a level of security from fluctuations in energy pricing by producing their own energy.

Green housing can also have social implications at the community scale, such as:

- encouraging the development of local skills and expertise in the area of green construction practices and building technologies;
- contributing to more liveable neighbourhoods;
- reducing costs associated with vehicle-dependent communities;
- comprising part of an affordable housing strategy, particularly through multi-family housing, which is more affordable to own, operate and maintain due to reduced input and operating costs, shared infrastructure costs, and reduced land requirements;
- providing an adequate supply of mixed housing types; and
- creating greater opportunities for socialization and leisure activities.

Economic

Green buildings provide greater value than conventional buildings through:

- lower operating costs from reduced energy and water consumption;
- reduced maintenance costs through material efficiency and durability;
- opportunities for cost offsets through grants, incentives and subsidies;
- lower depreciation;
- higher return on investment; and

⁴⁵ CaGBC *Municipal Green Building Toolkit*, Chapter 1.

- greater marketability.

On a larger scale, the reduction in resource consumption leads to a reduced demand for, and therefore funds directed to, developing and maintaining infrastructure. This can benefit developers, consumers, and municipalities. Market transformation is another potential economic benefit. Green building certification schemes such as LEED aim to encourage market transformation by creating and supporting a demand for green products, green technologies and green services. Further, as the LEED standard favors locally manufactured products, wide scale use of this building standard can stimulate local economic development through the creation of a green building industry.

3.2 The Barriers to Increased Green Residential Building

Despite considerable knowledge related to the techniques and technologies required to implement green residential projects, numerous barriers, real and perceived, regulatory and non-regulatory, have slowed the pace at which green residential building is becoming standard practice in Canada. This section provides an overview of the barriers classified as the “five A’s”:

1. Availability
2. Accessibility
3. Awareness
4. Affordability
5. Acceptance

Availability addresses the availability of current technology to satisfactorily meet desired green building standards. Certain barriers limit the availability of higher performance green building components in the Canadian market. For example, there is an absence of high efficiency hot water tanks in Canada. As well, certain products are designed for the average North American dwelling. This means that builders and developers cannot use the most energy efficient or environmentally low impact products for their specific region or climate. Local capacity to design and construct certain green building products, such as photovoltaic systems, is also lacking in Canada.

Accessibility refers to the ability of the market to respond to the improvements required for green building products/systems/standards for residential buildings without undue supply constraints or other limitations. Having a sufficient number of market actors/players (manufacturers, distributors, manufacturers, installers/contractors) with expertise or interest in green residential construction is one part of the challenge. The other is having a construction industry willing to adopt new practices and a regulatory industry able to accept new practices and technologies. Builders and developers generally prefer to repeat past successes rather than assume the risk of innovation and are reluctant, therefore, to adopt new practices such as advanced framing or air-tight construction or to attempt to meet green standards. Furthermore, our legal and administrative institutions have created regulatory barriers, such as building codes and planning, zoning and health regulations that can hamper green building by impeding the easy adoption of technological innovations and new land-use patterns by key actors. For example, an absence of green building equivalencies in building codes perpetuates the use of conventional construction materials, since proving compliance can be onerous and costly. Zoning bylaws can

also thwart such green planning practices as increased density, by restricting secondary suites, infill development, and the number and location of private entrances.

Awareness refers to the industry actors' knowledge of the relevant green building technologies, products and practices. The lack of education, training and technical expertise within the building industry and within relevant municipal departments can slow use of green building technologies and the adoption of green building standards, making building green more difficult, time-consuming and costly.

- a lack of training and education in green design and construction;
- a lack of technical understanding of green building materials, methods and systems among building industry members—designers, developers, contractors and inspectors;
- poorly accessible information on green products and building systems;
- a lack of information on performance and cost attributes of building elements, which can force projects to depend on specialized consultants;
- a lack of understanding of the interactions between the many green building standards;
- a lack of product information such that designers and builders risk costly call-backs to remedy green products that may not perform as intended;
- traditional project design/delivery processes that discourage integration, keeping each project phase working in isolation, with different project goals and separate budgets;
- longer up-front planning/design time requirements;
- delays and greater cost to obtain green equivalencies or project approvals; and
- a lack of experience in the building trade and/or the absence of data on given green technologies and innovative practices, leading to a perception of undue risk.

Affordability addresses the financial barriers related to technologies and processes required to build green. Affordability can be defined on a first cost and a life-cycle cost basis. For example, although green buildings can be less expensive to build and operate, higher capital costs, including the additional costs of design, analysis, engineering, energy modeling, commissioning, etc., can act as deterrents to building green. The tendency of the development community to base decisions on a first cost basis rather than through life-cycle costing poses a significant barrier to the adoption of higher performance components. This is particularly evident in the residential sector, where building builders/developers do not intend to retain ownership of the property beyond completion.

Other affordability barriers include:

- Service fee structures do not account for the recovery of long-term savings. Additional costs for green building incurred by developers cannot be easily passed on to owners.
- A lack of incentives for builders and designers means that they do not profit directly from a building's operational cost savings, environmental performance or worker productivity.
- Integration among incentive programs (e.g., rebates, loans, technical assistance) is lacking, and confusing application procedures exist.
- Certain bylaws (e.g., development cost charges that fail to consider a green building's lower environmental impact) make green technology and innovations less competitive.
- Costs associated with obtaining green standards such as LEED or Built Green can be a disincentive to certification.
- The process of applying for building code equivalencies can cost in both time and money.

- Financing decisions are generally made for the short-to-medium term, an obstacle for green buildings, which may not realize economic gains within this timeframe.
- Property valuers and appraisers have also been slow to recognize the value in green features.
- Hidden subsidies to automobile infrastructure and distorted perceptions of the feasibility of car travel in more populated regions promote the residential housing status quo.

Acceptance refers to the acceptance of the green building materials, practices and standards as the norm by both the supply- and demand-side actors. On the supply side, although Canada’s three levels of government are involved in residential housing development in one form or another, no level has set specific policies, standards, or targets to encourage or regulate green residential building. The financial and insurance sectors have also been slow to accept green buildings in terms of valuing social and environmental benefits or performance and recognizing long-term potential for economic gain. These risk-adverse industries continue to demonstrate a general preference for financing and insuring traditional building projects rather than those using new and innovative green technologies.

Although interest in green building on the part of developers and homebuyers is growing, market demand is still small. Barriers to wider acceptance also include:

- consumer preferences for low-density detached single-family homes with private yards;
- a “not in my back yard” (NIMBY) position to mixed use and higher density;
- vested interests of developers with large tracts of land on the urban periphery;
- pressure placed on municipal councils by the development industry to approve developments on a site-by-site basis;
- a perception among individuals and the building trade that green buildings are more expensive to build;
- a lack of appreciation by homebuyers of the long-term cost savings and associated benefits of green building practices;
- a lack of public and industry education around green building;
- the absence of a one-stop source for green products, technical information, and best practices for the building trade; and
- a misperception that environmental protection and land development are incompatible.

A national vision and shared goals for green residential construction are likely to evolve around a wide-scale realization of the benefits from green building discussed in section 3.1. Targets could be linked to these benefits, and strategies to achieve these targets could be focused on removing barriers to green buildings. However, reaching this stage, the initial step of establishing a national vision for green residential building, will require the coordinated efforts of government actors.

Chapter 4: Government Coordination

4.1 Coordination Among Multiple Levels of Government

One of the greatest hurdles Canada will face in contributing to a North American vision for green residential building or in developing a national vision, goals, targets, or strategies will be the Canada's regulatory environment and current lack of a unified approach to green residential building. Developing a Canada-wide vision will require a degree of coordination among all levels of government and necessitate an understanding of jurisdictional conflicts and opportunities for harmonization.

4.1.1 Jurisdictional Conflicts

In Canada, all levels of government are involved in housing issues to one degree or another. Standards, policies and funding support for green building initiatives vary across jurisdictions. Although constitutional authority for housing is vested with the provinces and territories, responsibility for housing standards and land-use planning is generally delegated to local governments. At the federal level, a number of government departments influence housing policy and technologies. CMHC, for example, deals with home mortgages, conducts research on housing issues, and pilots initiatives such as the EQUilibrium Housing project. The National Research Council is responsible for the National Building Code and other construction-related codes, and Natural Resources Canada and its Office of Energy Efficiency set energy efficiency standards and run building initiatives such as R2000 and EnerGuide. Industry Canada deals with emerging technologies, which are often related to energy production.

The number of government actors, each with their own interests, mandates and priorities, will make it particularly difficult to get agreement around a unified vision. Within the federal government alone, there is no unified approach to green residential building across the many departments that directly affect housing. Policies and programs in one department do not necessarily support or enhance green building initiatives promoted through another. At the municipal level, municipal or regional growth strategies that promote sustainability planning and encourage green building can be at odds with municipal bylaws that serve to obstruct or prevent such initiatives. Varying mandates may stand in the way of developing standards for green building techniques or technologies. Provinces, for instance, have a vested interest in promoting their own green or energy-efficient technologies over adopting "imported" ones.

Building codes differ from province to province and zoning bylaws from municipality to municipality. However, some regulatory decisions made the federal level will directly affect the potential range of actions possible at lower levels of government. Examples would be changes to federal energy efficiency regulations dictating new minimum efficiency standards for home appliances and equipment, or increasing "green" components in the national building code. These changes would require provinces to amend their related legislation. In the absence of regulatory changes, leveraging common interests and shared goals will be instrumental in developing a green residential housing vision.

4.1.2 Opportunities for Government Coordination

All levels of government in Canada profess an interest in both environmental preservation and energy conservation. This interest manifests itself through a variety of policies and programs, often dealing with sustainable community planning, green building and/or energy efficiency. The majority of Canada's provinces have instituted policies requiring new provincial buildings to achieve LEED standards. Many of the larger urban centers have established green building policies or have set LEED standards for new municipal buildings. The federal government has been instrumental in piloting and promoting green residential building programs such as R2000, EnerGuide for Homes, and Equilibrium Housing.

Sustainable community planning generally incorporates or promotes green residential practices. More and more communities across Canada are incorporating sustainability guidelines or principles in their official community plans or in the creation of sustainable communities. Through its various initiatives to understand and assist municipalities in addressing key economic and environmental challenges, the federal government has shown a strong interest in such issues as the environment and sustainable community planning in municipalities. A recent National Round Table on the Environment and the Economy report even sets out a vision of urban Canada in 2050 that is based on the large-scale implementation of sustainable planning principles and energy-efficient measures.⁴⁶ In fact, all three levels of government share a growing interest in developing and implementing energy efficiency measures. Whether due to rising energy prices, climate change, or public pressure, governments have been developing policy or implementing measures for energy efficiency. The soon-to-be-released *Clean Air Act* will articulate the federal government's role in addressing climate change issues.

These shared interests and objectives could be leveraged to build a common vision for green residential housing in Canada. This resulting vision must be supported by goals and targets and moved forward through the development of corresponding strategies.

⁴⁶ National Round Table on the Environment and the Economy, *Advice on a Long-term Strategy on Energy and Climate Change* (Ottawa, 2006), See: http://www.nrtee-trnee.ca/eng/newsletter/Summer2006E/summer_2006_e.pdf

Chapter 5: Goals and Targets

5.1 The Implementation Framework – Developing Goals and Targets for Residential Green Building

Creating a North American or national vision for green residential construction will require coordinated effort by government and industry actors—not only to create this vision but also to establish goals and set corresponding targets. Following the European example of a vision and strategy for sustainable construction, it is anticipated that a North American approach will be scaleable, with goals and targets internationally supported by implementation targets at the national, local level and/or building scale. However, a key to moving this agenda forward will be to ensure that our goals and targets are flexible and adaptable.

5.1.1 Rationale for a Management Framework

A practical way of creating targets and strategies for a North American approach to green building is to utilize a management framework or logic model. As shown in Figure 3, this program model provides a structured way to ensure transparency, consistency, and accountability at all levels of program development and implementation. It also ensures that inputs are linked to desired outcomes by allowing for the continued evaluation of targets and strategies against objectives.

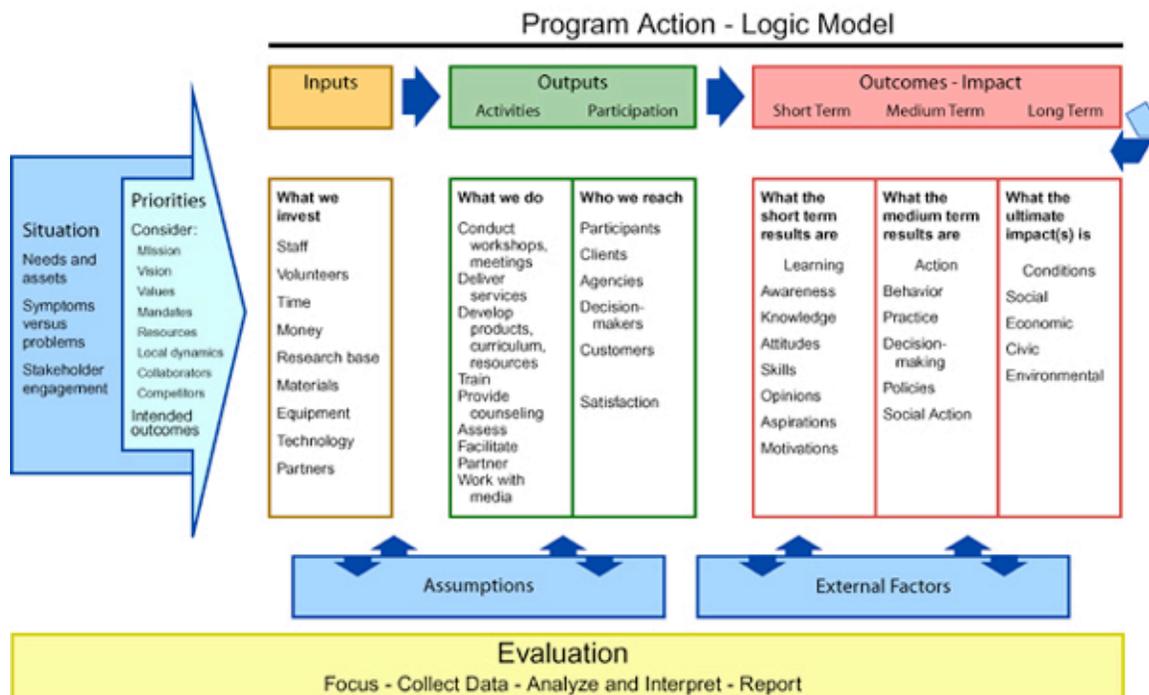


Figure 3: Logic Model⁴⁷

⁴⁷ Source: <http://www.uwex.edu/ces/pdande/evaluation/evallogicmodel.html>.

The main components this framework are situational analysis, identification of inputs, outputs and outcomes, and the evaluation of assumptions and external factors. These steps can be applied to any process or program used by municipal, national and international governments.

Situational Analysis

A situational analysis can be as simple as working through the above flowchart presented, or represent a detailed baseline analysis of the state of green residential building at the local and national, levels. It is important to conduct a situational analysis and to identify priorities and potential synergies and barriers as context for identifying “low hanging” fruit. At this stage, priorities and targets will be identified.

Identification of Inputs

Inputs to be considered include resources (financial or in kind), contributions, or investments that go into the program (e.g., marketing support from the communications department for an R2000 homes marketing program).

Identification of Outputs

Outputs of a program can include activities, services, events and products that reach people who participate or who are targeted. These are generally direct outputs of the program (e.g., marketing materials for a R2000 housing program).

Identification of Outcomes

Desired outcomes are often identified at the beginning of the program planning process and the program designed around them. Ideally it is an iterative process that identifies outcomes, and verifies that they can be achieved given the resource available (inputs) and anticipated outputs. Outcomes are the results or changes for individuals, groups, communities, organizations, communities, or systems. Programs may have short-, medium-, and long-term outcomes. For example:

- Short term: A 20 percent increase in the number of R2000 homes built in the community.
- Medium term: All new construction is R2000.
- Long term: The municipality is recognized as a leader in energy-efficient new homes.

External Factors

As the outcomes become longer term, more external factors may come into play, which can influence the program action. For example, the federal government could introduce a new incentive program that significantly subsidizes R2000 home construction. An analysis of external factors including issues such as energy supply, price shocks, and projected growth and demographics is particularly important for programs in which governments are investing significant resources.

Chapters 2 and 3 provided the situation analysis for the state of green residential building in Canada and a look at inputs to some green building initiatives. The next section identifies desired outcomes and targets from green building initiatives currently underway in Canada.

5.1.2 Canadian Green Residential Initiatives

To date, only one federal government initiative and one industry association has set concrete goals or targets around green residential building. As discussed earlier, provinces and municipalities have developed green building guidelines and policies to promote the construction of green residential buildings but none are mandatory; therefore, no clear targets have been established. The federal government has several initiatives that have yielded loose goals and objectives around sustainable communities and the proliferation of green housing technology. These high-level visions and initiatives, along with the handful of concrete targets, may provide direction in establishing clear national and local level green building goals and targets.

Canada's Housing Vision

The *2006 Report on Energy and Climate Change*, prepared by the National Round Table on the Environment and the Economy, sets out a vision of urban Canada in 2050 that is tied to a scenario of GHG emissions reduced by as much as 60 percent from today's levels.⁴⁸

*Housing densities have increased and Canadian homes are much more energy efficient – solar heating and power systems are the norm. The majority of jobs are in services and light manufacturing, and these land uses are integrated into residential developments so that it has become more common to live and work in the same “walkable” neighbourhood or work at home a few days each week... Canadians who travel to work are more likely to use public transit, which has become more efficient and convenient as a result of higher density and improved design.*⁴⁹

Although this vision clearly involves sustainable community planning principles and green building initiatives, it does not specify how the 60 percent emission reduction target can be achieved beyond deploying all the potential GHG reduction technologies, particularly in the areas of personal and freight transportation, and residential and commercial buildings.

EQuilibrium

In 2006, the federal government launched the first phase of a net-zero energy housing initiative. This initial phase is part of a five-year, community-scale demonstration aimed at completing 1,500 net-zero energy homes across Canada by 2011. Run by CMHC, the goal of the EQuilibrium initiative is to demonstrate a new approach to housing in Canada by supporting the building of sustainable, healthy houses that are also affordable and efficient in terms of both energy and resources. Twelve pilot projects were recently selected for the building of demonstration homes. EQuilibrium homes will be designed to produce as much energy as they use on an annual basis, delivering electricity back to the grid. The homes will also promote water conservation, healthy indoor environments, durability, and reduced pollutant emissions.⁵⁰

Net-Zero Energy Home Coalition

This coalition of representatives from Canada's building and construction industry has set out the following vision:

⁴⁸ The advisory report assumes Canada has a population of about 45 million in 2050, a larger economy—more than double in real terms—and growth in oil and gas production that outstrips growth in domestic demand. The analysis is limited to existing technologies.

⁴⁹ National Round Table on the Environment and the Economy, *Advice on a Long-term Strategy on Energy and Climate Change* (Ottawa, 2006), See: http://www.nrtee-trnee.ca/eng/newsletter/Summer2006E/summer_2006_e.pdf.

⁵⁰ See: http://www.cmhc-schl.gc.ca/en/inpr/su/eqho/eqho_008.cfm

Through the combined use of on-site renewable energy generation and energy efficiency technologies and appliances, new home construction design by 2030 will meet a net-zero energy standard, resulting in the benefits of an expanded renewable energy industry in Canada, cleaner air, climate protection, and recognition for Canada as the world's first to adopt a national residential strategy for net-zero energy building design and construction.⁵¹

To reach this vision, Net-Zero proposes a national plan for all new home construction that combines R2000/Energy Star or higher energy efficiency standards with a minimum 3kW photovoltaic rooftop array or equivalent on-site renewable energy generation source. Implementation incentives would include GST exemption (up to 75 percent) and PST or equivalent exemption (100 percent), with other incentives for early adopters.

Kyoto Commitments

Canada's former Liberal government ratified the Kyoto Protocol, committing the country to reducing emissions of greenhouse gases to 6 percent below 1990 levels—i.e., a 240-megatonne (MT) reduction in GHG production by 2012. The same government drafted a Climate Change Plan for Canada, in which it acknowledged that the built environment plays a significant role in GHG emissions and committed Canada to taking measures to lower emissions related to urban transportation and building energy use. One of these measures was requiring R2000 energy efficiency for all new housing by 2010.⁵² While it is unclear where the current government stands in relation to meeting Kyoto targets, rising energy prices and increasing public and political pressure may induce the government to set some clear energy reduction targets.

5.1.3 International Green Residential Initiatives

Canada may be moved to set housing emission targets or other green standards by following best practices and initiatives arising in other countries.

Architecture 2030

Launched in 2006, Architecture 2030 has as its goal a phased-in approach to carbon neutrality in the built environment by 2030. This initiative is supported by major building players in the United States, including the American Institute of Architects (AIA), the US Green Building Council (USGBC) and Leadership in Energy and Environmental Design (LEED), as well as by the US Conference of Mayors and the American Society of Heating, Refrigerating and Air-Conditioning Engineers. The Royal Architecture Institute of Canada (RAIC) has also signed on as a supporter.

This approach would see all new buildings, developments and major renovation projects designed to use half the fossil fuel energy they would typically consume. The fossil fuel reduction standard for all new buildings would be increased to 60 percent in 2010, to 70 percent in 2015, to 80 percent in 2020, to 90 percent in 2025, and, finally, to carbon-neutral by 2030. Critical to the success of this initiative is the definition of a baseline by which to measure all energy reductions. Baselines and corresponding reduction targets have been set for residential for energy-use reduction.⁵³

⁵¹ See: <http://www.netzeroenergyhome.ca/aboutthecoalition.htm>

⁵² *State of the Debate: Environmental Quality in Canadian Cities: The Federal Role.* See: http://www.nrtee-trnee.ca/Publications/PDF/SOD_Urban_E.pdf

⁵³ <http://www.architecture2030.org/home.html>

United States Green Building Council

Although the USGBC's LEED for Homes is currently in its pilot stage, the Council has targets for market penetration. The LEED for Homes program is designed to provide industry best practices on how to “green” any new home. The voluntary program will target that country's top 25 percent of green homebuilders. However, the expected penetration of this +/-500,000 homes/year market is not known.⁵⁴

Zero Energy Homes

At the same time, the US Department of Energy's Zero Energy Homes (ZEH) initiative is bringing the concept of no-emission homes to homebuilders across the United States. The program was launched in 2002 with a 20-year goal of increasing the widespread availability of new residential buildings that produce as much energy as they consume and are competitively priced. While standard ZEH designs are still a few years off, a recent report from the National Association of Home Builders' Research Center suggests that zero energy homes could hit the homebuilding mainstream by 2012.⁵⁵

Residential Sector Vision:

Residential Buildings are designed, constructed, operated and decommissioned in a manner that supports a healthy, vibrant, inclusive and environmentally efficient economy, to support the well-being of and meet the needs of Canada's citizens in a sustainable manner, and be sensitive to and work in harmony with natural systems.

5.2 Proposed Vision Statement

A North American vision for green residential building could result in the creation of a common set of sustainability principles and planning tools for green construction, with each country having region/context-appropriate policies and programs to address differences in building codes, regulatory environments, and climate. These tools would be used to enhance quality of life and balance environmental, economic, and social considerations and would reduce environmental impacts through construction, operation and retrofit activities which focus on minimizing on a broader life-cycle basis rather than short-term costs.

Achieving this vision will require more than just mitigating the environmental aspects of the construction industry. Rather, it will require a new industry perspective—one that fosters long-term thinking, broad capacity building and evolution to a service-based industry. This is reflected in the objectives proposed below for a green residential construction industry.

5.3 Implementation Impacts

As noted in Chapter 1, green residential homes have potential to generate environmental, social, and economic benefits at both the building and community scale. The Canadian government and Net-Zero Energy Home Coalition have articulated and quantified the implementation impacts of some of the initiatives discussed in the previous section.

⁵⁴ <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1611>

⁵⁵ See: <http://www.nahbrc.org>

Environmental

The Climate Change Plan for Canada⁵⁶ was designed to achieve the following GHG emission reductions through sustainable community planning and the use of green building techniques:

- increased use of urban transit, alternative approaches to passenger transportation, and sustainable urban planning (7 MT);
- demonstration of integrated strategies, technologies and planning to reduce urban transportation emissions (0.8 MT);
- energy efficiency improvements to existing buildings (1.2 MT);
- energy efficiency evaluations for homeowners (0.7 MT); and
- R2000 energy efficiency for all new housing by 2010 (0.7 MT).

Moving towards R2000 homes alone has the potential for huge reductions in energy consumption. New homes built to the R2000 standard use at least 30 percent less energy than a conventional new home.⁵⁷ Each building constructed to an efficiency level 35 percent better than the current energy code will save 10,000 tonnes of emissions and some \$2 million in energy costs over its life.⁵⁸ Net-zero energy homes by 2030 would reduce NO_x, SO_x and GHG emissions by up to 325 megatons over a 50-year period and lessen the need for construction of large-scale power generating stations across Canada.

Objectives of a Green Residential Construction Sector	
Environmental Stewardship Reduce consumption Renewable use of resources Internalization of costs by occupants	Value, Not Price Life-cycle thinking Define and monitor performance Communicate performance
Innovative and Learning Create environmental tools New materials and products Continual improvement	Knowledge-based, Service-oriented Information-based processes Enhance quality Provide service, not product

Social

Homes built to R2000 standard or by EQuilibrium or Net-Zero principles would provide better indoor air quality, thereby helping to safeguard the health of for occupants. Good health translates into less strain on the health care system as well as broader savings in the form of fewer lost workdays and increased productivity.

A proliferation of net-zero energy homes would require decentralized renewable energy technologies and on-site generation, leading to the addition of residential-scale renewable energy production to meet household needs. Community energy systems would allow communities to become more energy self-sufficient and resistant to fluctuations in energy supply and price.

⁵⁶ Although this plan will not be implemented, it is still worth discussing as the Clean Air Act, currently in development, may have similar targets for the reduction in GHGs.

⁵⁷ R2000 certification is about 40 percent above building codes.

⁵⁸ See: http://www.nrcan-rncan.gc.ca/media/newsreleases/2007/200704a_e.htm.

Economic

R2000 homes create energy savings for homeowners. For conventional homes built after 2000, the average annual energy cost is approximately \$2,300; the average cost for R2000 homes is \$1,700. Both the Net-Zero and R2000 homes would lessen the strain on municipal energy infrastructure, lowering the costs for maintenance and distribution.

Nationally, the Net-Zero Coalition predicts expanded manufacturing bases in sectors such as the solar thermal and photovoltaic industries. The coalition estimates the creation of up to 5,100 jobs in the Canadian photovoltaic sector as well as the construction of upwards of 40 new factories, resulting in \$900 million in tax revenue to governments. Using the Pembina Institute's estimate that every \$1 million invested in on-site renewable electricity systems results in the creation of eight jobs, implementation of the Net-Zero Energy Home proposal has the potential to yield a total of 168,000 new jobs.⁵⁹

⁵⁹ See: <http://strategis.ic.gc.ca/epic/site/rei-ier.nsf/en/nz00062e.html>

Chapter 6: Strategies

6.1 Actions and Strategies

In earlier sections, we have described the need for a North American vision for green residential building, entailing the creation of a North American vision, as well as goals and targets at the national and local levels. At this time, Canada or its municipalities have no clear visions for green residential beyond a desire for a general increase in green building. Only a handful of green residential targets linked to specific programs have been identified. In many cases, strategies to reach these targets are lacking. As discussed in Chapter 3, numerous regulatory and non-regulatory barriers are preventing the deeper market penetration of green residential building across the country. An initial goal for Canada, therefore, can be the removal of these barriers to allow the proliferation of green housing. Strategic actions must address both the regulatory and non-regulatory barriers that currently affect the full range of actors in the building process.

6.1.1 Market Transformation Strategies

Market transformation occurs when market barriers—including frictions and failures—are reduced, thereby allowing the adoption of new products, techniques and practices in a sustained manner. In terms of green buildings, the market can be considered as having been transformed when buildings recognized as ‘green’ become normal practice. Rather than prescribing the construction of buildings with specific ‘green’ building characteristics, the goal is to transform the market so that ‘green’ buildings are demanded and supplied, and so that the marketplace innovates continuously toward increasingly improved performance.

Market failures are part of the normal operation of free markets that interfere with product and service improvements that can be expected through competitive innovation. They are not self-correcting, but require public intervention, and include:

- asymmetrical distribution of information: buyers are unaware that buildings with dramatically improved resource consumption rates are available or possible at prices similar to status quo facilities;
- unpriced externalities: energy rates are lower than they should be because they fail to account for the cost of greenhouse gas emissions and carbon sequestration;
- public goods: the benefits of investment can be enjoyed without paying for it, as in the case of corporate investments that increase the cost of products to the firm while reducing air pollution for the public;
- interference with the market: any constraint hindering allocation of resources to the highest and best use (e.g., construction codes that prescribe methods of achieving levels of performance can be less effective and efficient than would be possible if the market were able to innovate, and hence they are often modified to specify performance only).

Market frictions, on the other hand, are normal to the marketplace and are often a reflection of rational decision-making that considers return on investment, available capital, variable discount rates (given various investment horizons), and risk. Direct measures to reduce these frictions can

disturb the efficient operation of the market, and must be used with an understanding of that impact. But often such frictions reflect a deeper failure in the market. This is the legitimate area for government intervention, as addressing a market failure reduces a market friction.

Market transformation strategies accelerate what might otherwise be a natural process and involve implementing strategies that are made up of a number of tools in a sequential manner, with different tools appropriate at different stages of the market diffusion process. Since a range of organizations is best able to implement the various tools, collaboration and coordination amongst the different agencies and groups are both essential components of the smooth transition toward market transformation.

6.1.2 Regulatory Strategies

Land use, building design, and construction materials and practices are the subjects of extensive regulations. Although regulations work to provide health, safety, and environmental standards, certain regulations can actually work counter to improving these standards. For example, regulations can impede the proliferation of green building by hindering or preventing the adoption of green designs and/or technology that could have positive environmental impacts or enhance occupant health. Existing regulations can also perpetuate the current land use patterns that tend to support unsustainable growth—i.e., low-density developments and urban sprawl.

A regulatory barrier can be defined as “a barrier that makes the regulatory system more cumbersome for innovative projects, or where a regulation creates an economic or other barrier.”⁶⁰ These can include zoning bylaws, development cost charges, code requirements, approval processes for rezoning and development permits, and approval processes for building permits and occupancy permits.

The following strategies are designed to address the key non-regulatory and regulatory barriers to green residential building. Although there is no scope here to discuss all market and regulatory barriers and their corresponding strategies, the recommendations below are designed to serve as possible solutions to key barriers that prevent transforming the Canadian market and regulatory environment to allow for the proliferation of high performance green residential buildings.

Strategy #1 – SHARED DIRECTIONS

STRATEGY

Promote the expectation that the construction of high performance buildings will become common practice in Canada.

PURPOSE OF STRATEGY

This strategy seeks to raise awareness of the environmental and economic benefits of high performance construction.

⁶⁰ For a detailed explanation of regulatory barriers, see West Coast Environmental Law, *Cutting the Green Tape: An Action Plan for Removing Regulatory Barriers to Green Innovations* (Vancouver: April 2002), p. 25.

PRIORITY RECOMMENDATIONS

1.1 Develop/adopt <i>high-performance-enabling strategies / building policies</i> to influence green buildings and to phase them into the regulatory environment for residential sector.
1.2 Explore <i>opportunities for partnerships</i> (federal government, Canada Green Building Council, utilities, municipalities)
1.3 Develop / adopt <i>enabling strategies</i> for the private sector

Strategy #2 – GUIDELINES AND STANDARDS

STRATEGY

Develop a consistent set of performance targets supported by local best practices.

PURPOSE OF STRATEGY

Guidelines and standards set minimum levels for satisfactory performance and compliance behavior in the industry. They should be used, therefore, to backstop local best practices discovered through other strategies that encourage innovation, or to force new minimum standards where improvement is environmentally and/or politically urgent (e.g., greenhouse gas reductions to meet climate change obligations). A consistent and non-contradictory suite of standards will help galvanize the industry to work together to solve common problems quickly. To address consumer confidence in ‘green’ product reliability, commonly accepted and easily verified product labeling and building performance assessment protocols will reduce ‘green-washing.’ Three key performance standards for residential buildings exist in Canada—Built Green, LEED for Homes, and R2000. Technical knowledge on how to design and build to meet these standards is needed. It is also suggested that design professionals be trained and regularly tested to self-certify projects and avoid the formal process if formal recognition is not required. Universal application in all building jurisdictions is the goal.

PRIORITY RECOMMENDATIONS

2.1 <i>Establish an integration team</i> to help coordinate independent green guidelines and standards initiatives occurring across the country.
2.2 <i>Adopt</i> a set number of standard building evaluation tools best suited to region/climate/density. Promote adoption in provinces and municipalities, and facilitate their translation to other building types and market segments.
2.3 Develop an <i>inter-jurisdictional ‘green’ building technical guideline</i> (a multi-faceted toolkit) for residential construction (new/renovation, detached/townhouse/multi-unit, low-/med-/hi-rise).

Strategy #3 – ANALYTICAL MODELS

STRATEGY

Develop expert tools to quickly understand the impacts of alternative design approaches, and improve the effectiveness of available tools.

PURPOSE OF STRATEGY

To facilitate innovation, it is important to be able to see quickly the impacts of alternative approaches to system integration, product selection and various configurations in the use of renewable and non-renewable resource throughputs. Such factors include life-cycle costing and the impacts on municipal services, utilities, and distribution networks, especially as related to energy consumption and various modes of on-site and off-site energy production. It is also important to reduce the upfront costs and time intensities associated with existing simulation tools.

PRIORITY RECOMMENDATIONS

3.1 Develop a common, simple and user-friendly assessment tool for <i>infrastructure and environmental impacts</i> of capital development.
3.2 Develop a <i>life-cycle costing tool</i> that incorporates risk assessment.
3.3 Develop/adopt a user-friendly <i>energy consumption-modeling tool</i> (coordinate / package available tools: e.g., CBIP-EE4, DOE-2, HomeRun).
3.4 Develop valuation procedures to account for the benefit of owning and operating a green building.

Strategy #4a – FINANCIAL INCENTIVES: Supply Side

STRATEGY

Provide incentives to offset incremental costs of ‘green’ buildings to building **producers** where they are created by market failures and frictions, with clear exit strategies once new construction practices are entrenched.

PURPOSE OF STRATEGY

Where market pricing fails to account for the value of scarce resources because of unaccounted-for externalities (i.e., environmental and social costs not included in the price of materials and product and asymmetrical distribution of economic information), or where market frictions need to be overcome in the short-run (future values of current investments undervalued due to conservative discount rates), financial incentives may help alter market behavior. But it is necessary to ensure that other strategies quickly remove industry reliance on these mechanisms so that market competition continues to innovate toward greater efficiency in the allocation of scarce resources. It is important to remember that implementation of these strategies require that municipalities have bylaws allowing them to implement these financial incentives.

PRIORITY RECOMMENDATIONS

4a.1 Establish a team, including financial authorities within governments, to complete a <i>benefit/cost analysis</i> on all supply- and demand-side financial incentives listed.
4a.2 Revise <i>development cost charges</i> (DCC) to account for ‘green’ building features.
4a.3 Provide <i>zoning/development bonuses</i> for certified ‘green’ buildings.
4a.4 Develop and promote a national and international <i>marketing program for Canadian ‘green’ building products and services</i> .
4a.5 Leverage existing programs to provide financing incentives for private sector ‘green’ building upgrades.
4a.6 Provide a <i>one-stop service center</i> for access to all ‘green’ building financial incentives (supply- and demand-side audiences).

4a.7 Support government and industry partnerships to develop the capacity for supporting targeted **R&D in green building design, technologies and products.**

Strategy #4b – FINANCIAL INCENTIVES: Demand Side

STRATEGY

This strategy seeks to provide incentives to offset incremental costs of ‘green’ buildings to building **consumers** where they are created by market failures and frictions.

PURPOSE OF STRATEGY

Where market pricing fails to account for the value of scarce resources because of unaccounted externalities, asymmetrical distribution of information, etc. (see section 6.1), it is in the public interest to tax scarce environmental resources and/or to provide economic incentives to correct market behavior. These incentives are designed to remove the social wage from energy and resource pricing by first encouraging capital expenditures that neutralize the impacts of increased resource costs. They are directed at consumers and provide market signals and information that distinguish the building market and allow a higher valuation for green buildings.

PRIORITY RECOMMENDATIONS

4b.1 Establish and/or enhance sustainable mortgage programs to decrease interest rates, increase approved property value, decrease down payment to favor ‘green’ buildings.
4b.2 Work with assessment offices to investigate a property appraisal method that recognizes the value of ‘green’ built space.
4b.3 Provide grants and low-cost loans as a coordinated and integrated suite of opportunities for green materials, components, systems and buildings (new or retrofit).
4b.4 Encourage uptake of graduated utility rates to encourage conservation and penalize excessive consumption (of electricity, gas, water, sewer, storm water, etc.).
4b.5 Provide a one-stop service center for access to all ‘green’ building financial incentives (supply- and demand-side audiences).

Strategy #5 – AWARDS PROGRAMS

STRATEGY

Reward the entire team involved in the production of green buildings through high profile public recognition.

PURPOSE OF STRATEGY

Various stakeholders can use the status and market profile of being distinguished by their ability to participate in the production of ‘green’ buildings. For instance, developers can achieve higher triple-bottom-line accountability; contractors and consultants can market their demonstrated and recognized expertise, and the specialty equipment and material supply industry and market niche products to a larger market.

PRIORITY RECOMMENDATIONS

5.1 Showcase ‘green’ buildings built in Canada. Take an exhibition of these projects on a cross-Canada tour.
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5.2 Develop an <i>Awards Program</i> for finished projects, recognizing all categories of stakeholders in collaboration with industry and other building industry award programs.

Strategy #6a – INDUSTRY EDUCATION

STRATEGY

Provide technical training for actors in ‘green’ building production (coordinate with Strategy 2).

PURPOSE OF STRATEGY

Developers tend to repeat past successes to mitigate risk and maintain profitability. Given relatively low margins, they are reluctant to assume the risks of innovation. Building design consultants, concerned over liabilities, need access to technical information on theoretically valid and tested applications. Contractors need to understand how high performance installations differ from conventional practice. Commissioning agents need to understand how to evaluate ‘green’ performance.

PRIORITY RECOMMENDATIONS

6a.1 Establish a ‘virtual’ green building <i>technical resource and outreach center</i> with targeted materials for all stakeholders in the building industry.
6a.2 Develop partnerships with the development industry, trade and professional associations, public agencies, universities and non-profit organizations to cooperate on <i>curriculum development and training</i> , research and development, networking and continuous learning.
6a.3 Develop/implement a targeted <i>awareness campaign</i> to illustrate benefits of: a) improved bottom line (including life-cycle cost analysis), b) increased market value and return on investment, c) better learning environments, d) improved productivity, e) increased retail sales, f) increased comfort, g) intangible values.

Strategy #6b – PUBLIC EDUCATION

STRATEGY

Educate ‘green’ building consumers.

PURPOSE OF STRATEGY

To create consumer demand for green buildings through increasing public awareness and understanding of green buildings and their benefits. To increase the understanding that early decisions on green building elements will optimize resources and require the least investment. To increase general understanding amongst the public of the interrelationships between the built environment, economics, building performance and human health.

PRIORITY RECOMMENDATIONS

6b.1 Conduct a general <i>outreach campaign to key decision-makers</i> within the community.
6b.2 Support <i>point-of-purchase outreach</i> for homebuyers as well as consumers of home construction and renovation materials and services.
6b.3 Enhance <i>school curricula</i> with a unit on green buildings in addition to cross-disciplinary curricula on sustainable development and sustainable business.

Strategy #7 – PROCESS ALIGNMENT

STRATEGY

Expedite and facilitate all decision-making and approval processes within the building production and consumption cycle to favor high performance buildings.

PURPOSE OF STRATEGY

Sustainable building solutions require the integrated participation of all building stakeholders to overcome the ‘business as usual’ approach characterized by sequential decision-making. The decisions that shape performance expectations and the cost of buildings occur early in the process when the perspectives and expertise of only a few stakeholders take precedence. The cost of changing course to improve building performance increases as the building production process proceeds. It is important to increase innovative teamwork early in the process and to align the decision-making and approval processes of the different stakeholders.

PRIORITY RECOMMENDATIONS

7.1 Implement an <i>integrated permitting process</i> within municipal approval processes, including expedited processing for green building submissions.
7.2 Consolidate <i>government capital and operational budgets</i> and integrate interdepartmental government infrastructure development teams.
7.3 Disseminate information on <i>alternative forms of relationship contracting</i> (3P, Design-build, Build-Own-Operate, etc.)

Strategy #8 – EMPOWER GREEN BYLAWS

STRATEGY

Amend Local Government Acts to empower municipal actors to facilitate green buildings and green developments.⁶¹

PURPOSE OF STRATEGY

Local Government Acts often inhibit or prevent municipalities from removing barriers inhibiting green building development. Although the powers of municipalities differ between provinces, some having broader regulatory authority than others, the provinces can remove or reform these regulatory barriers, allowing municipalities access to broader use of planning and zoning tools to promote green development. With additional power, municipalities can use bylaws to encourage sustainable communities through increased density, mixed zoning, redevelopment of brownfield sites, etc. (Certain bylaw-enabled strategies, such as negotiating lower DCCs for developments with lower servicing costs and allowing density bonusing for green development, have been discussed in Strategy 4.)

PRIORITY RECOMMENDATIONS

8.1 Allow municipalities to <i>enforce green development commitments</i> .
8.2 Amend the Local Government Act to allow <i>financial aid for cleaning up brownfield sites</i> .

⁶¹ *Cutting the Green Tape: An Action Plan for Removing Regulatory Barriers to Green Innovations*, p. 25.

Strategy #9 – ENHANCED REGULATION

STRATEGY

Amend building codes to allow for and to encourage green building practices.⁶²

PURPOSE OF STRATEGY

All buildings are required to meet the standards set by both national and also provincial codes. However, a number of green building practices are prohibited or discouraged by these codes. Utilizing green technologies often requires that equivalencies be granted in order to meet code requirements, but the absence of green building equivalencies or the lack of clear processes for obtaining them can perpetuate the use of conventional construction materials, since proving compliance can be onerous and costly. As well, construction codes do not currently promote best practices or contain environmental goals; rather, the codes set minimum legal standards. Regulations can be used to facilitate and promote the use of cleaner and greener building techniques and technologies—for example, by setting best practice standards for energy efficiency or by allowing grey water recycling and reuse.

PRIORITY RECOMMENDATIONS

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| 9.1 Amend building codes to <i>include clear processes for obtaining equivalencies</i> . |
| 9.2 Amend building codes to <i>promote best practices</i> . |

Strategy #10 – PRICING

STRATEGY

Use pricing mechanisms to set the correct prices for natural resources.

PURPOSE OF STRATEGY

There is a cultural dimension to resource consumption. How much and in what way our society consumes resources are the results of our collective and individual choices and expectations. The expectations around how and where we live and what are our behavior patterns indicate our accepted standard for comfort and convenience. These expectations and standards are so entrenched in our society that they are reflected in regulations such as building codes and bylaws that encourage single-family dwellings and have created land development patterns that encourage sprawl and automobile dependence. However, cheap and available resources, as well as subsidized infrastructure, land, and energy, have influenced these expectations and behavior patterns. In addition, resources are undervalued, as their cost does not account for externalities. For example, energy prices do not factor in the costs of greenhouse gas emissions and carbon sequestration. Employing pricing mechanisms to do so can help shift our expectations and change the way we use our resources and live our lives.

PRIORITY RECOMMENDATIONS

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| 10.1 Account for <i>externalities</i> in pricing natural resources. |
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⁶² *Cutting the Green Tape: An Action Plan for Removing Regulatory Barriers to Green Innovations*, p. 46

6.3 Evaluation and Analysis of Strategies

The strategies described above work towards market transformation and the removal of regulatory and non-regulatory barriers to green residential building. The application of an adaptive management model provides for the continued evaluation of strategies to ensure that they continue to move actors towards desired objectives. Once key goals have been met, new strategies can be developed that meet new or revised targets. For example, once certain market barriers have been removed, allowing for the proliferation of green building, more tangible building-scale or community targets can be set to allow key actors to assess their progress in greenhouse gas reduction, water conservation, storm water management, waste reduction, and recycling, and prioritize their green building initiatives.

Chapter 7: Recommendations

7.1 Actions for Implementation

Both regulatory and non-regulatory mechanisms can be used to accelerate market transformation and encourage the proliferation of green residential buildings and sustainable community development in Canada. For the strategies recommended in Chapter 6, implementation frameworks are presented, identifying challenges related to norms, financial considerations, market conditions, acceptance, and participation by various levels of government will be assessed for each of the prioritized action items. Monitoring the results of each suggested action is essential for determining the success of actions and applying continuous improvement principles to implementation programs. Consequently, for each action, an indicator has been proposed to enable monitoring of the impacts of each strategy.

Targets

Targets are an essential component to enhancing performance, as they provide a means to measure progress towards a stated vision. Each of the strategies identified above will have associated with it a set of impacts and an expected outcome. In aggregate, high-level environmental indicators and targets for the residential sector are summarized in Table 1.

Table 2: Environmental Targets for Residential Construction in 2030

Indicator	Target for 2030
Depletion of arable land resources and associated loss of habitat	All new residential development occurs within a defined Urban Containment Boundary
Non-renewable energy use and associated emissions of greenhouse gas emissions	Eliminate non-renewable energy consumption associated with construction and operation of the residence
Water consumption	Water needs are provided within the capacity of the local watershed
Consumption of non-renewable materials	Non-renewable materials are 100 percent recycled
Emissions of waste into the atmosphere, aquatic bodies and ground	Eliminate emissions of toxic waste into the atmosphere, aquatic bodies and ground that are associated with the construction, operation and demolition of residential buildings

Realizing the Vision

Following the European example, the three North American countries will require, first and foremost, a common vision for green residential building. It must be recognized that the barriers to the proliferation of green residential construction within Canada will be magnified by working across international borders. Both the diversity of the actors involved as well as the regulatory and non-regulatory barriers will need to be addressed and overcome.

Coordination, particularly at the strategic level, will require trilateral agreement on the objectives of a sustainable residential construction sector, including:

- A consistent and comprehensive protocol to promote environmental stewardship
- Tools to support innovation and learning
- Performance metrics and tools to support value over price, and
- Capacity building within the industry to support a knowledge-based, service-oriented industry.

Just as the European Commission drove the process in Europe, the creation of a common vision or framework for green residential building across North America will require the leadership of an organization representing the interests of all three countries. The CEC may provide an instrumental role in driving the process of establishing a North American vision.

It must be stressed that this is not only a job for governments. Other key players such as the building industry and the financial sector must recognize the value in green homes and have a desire to promote their construction. In the end, consumer demand will be the main driving force for green residential building. If green is seen as desirable, the market will respond.

Chapter 8: Conclusions

A North American vision for green residential building can generate significant environmental, social, and economic benefits for Canada, Mexico, and the United States, individually and collectively. A common approach across North America has the potential to green construction practices, promote accepted green building practices, harmonize green building standards, and facilitate trade in green building products and technologies, as well as creating local and international markets for green housing materials, components and technologies. However, the creation of a North American vision will require a concerted effort across multiple levels of government and key industry actors within each country. Issues caused by the diversity of the actors involved as well as the regulatory environments must be addressed and overcome.

Coordination, particularly at the strategic level, will require trilateral agreement on:

- sustainability principles and planning tools;
- green building objectives;
- common green building standards and rating systems;
- common green product testing methods/codes; and
- accepted green building technologies.

For Canada, Mexico, or the United States to participate in the development of a North American vision, it will be valuable for each country to have its own vision for green residential construction. A unified national vision could draw on common interests and objectives shared by key government and industry actors. For example, a Canadian vision for green building will require collaboration within and across all levels of government and throughout the industry sectors. It will also require a shared recognition of the importance of green residential construction in improving urban environmental quality, reducing environmental impacts, improving affordable housing, or in meeting Kyoto or energy efficiency targets. This resulting vision must be supported by national and local goals and targets and moved forward through the development of corresponding strategies. Given the numerous regulatory and market barriers that are currently preventing the widespread adoption of green building practices in Canada, market transformation strategies will be essential removing these barriers and mainstreaming green residential construction.

It must be stressed that realizing widespread green residential construction in Canada is not only a job for governments. A range of other key players must be interested in realizing the benefits from green residential building. The construction industry must see opportunities for increased competitiveness and positive transformations. The financial sector must recognize the value in green homes and have a desire to promote their construction. In the end, however, consumer demand will be the main driving force for green residential building. If green is seen as desirable, the market, and regulators, will respond.

Just as the European Commission drove the process in Europe, the creation of a common vision for green residential building across North America will require the leadership of an organization representing the interests of all three countries. The CEC may provide an instrumental role in driving the process of establishing a North American vision.