



Exploring The Connection Between Built And Natural Heritage

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RESEARCH REPORT

Exploring The Connection Between Built And Natural Heritage

Research Report

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Research Report



INTRODUCTION TO SECOND PRINTING

Since the first printing of *Exploring the Connection Between Built and Natural Heritage* in 2001, numerous developments in this subject area have occurred. These developments embrace both thinking and action in the conservation of built heritage as it relates to the natural environment.

During the past five years, the term “sustainable communities” has been used with increasing frequency. The federal government, for example, has established the Prime Minister’s Advisory Committee on Cities and Communities, as well as a new department, Infrastructure Canada. Both initiatives are oriented towards fostering sustainability.

The new federal Historic Places Program features the renewal of heritage

properties as a cornerstone of sustainable development.

For their part, provincial governments are promoting energy efficiency in retrofitting older buildings with a variety of incentive programs. Several pathfinding heritage rehabilitation projects, such as the Citadel Building in Winnipeg, are employing such techniques.

In the remediation of contaminated industrial sites, Canada has followed the example of the United Kingdom in recognizing “brownfields.” The National Round Table on the Environment and the Economy, in particular, has been active in addressing this challenge. Still, the Heritage Canada Foundation has emphasized that many of these brownfields also contain significant examples of industrial heritage buildings.

The continuing use of these structures should be part of the larger effort to give new life to the lands on which they stand.

Also in recent years, the urban ecology movement has been making a solid contribution to stewardship and improving the quality of life in Canadian communities. Cities such as Richmond, B.C., and Montreal now have thriving urban ecology centres. Through these centres, more Canadians, especially youth, now understand that the environment of older neighbourhoods often combines heritage houses and mature landscapes with ecosystems and migration corridors for wildlife.

There is increasing evidence that the stewardship of built and natural heritage go hand in hand, strengthening the practices of conservation in many different ways.

For more information, please see the Heritage Canada Foundation’s advocacy action Web site:

www.advocacyaction.ca

“Heritage conservation saves energy.”

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EXECUTIVE SUMMARY

The Heritage Canada Foundation (HCF) produced this report as part of its fundamental interest in the connection between natural and cultural heritage. The aim is to raise awareness of the environmental value of heritage buildings and their role in sustainability. Accordingly, this report provides an overview of the links between the preservation of built heritage, the conservation of natural resources and the goal of sustainability. While the primary concern of the Heritage Canada Foundation is the preservation of heritage buildings, it encourages the preservation of a range of older buildings that are an integral part of the landscape.

According to the Minister of Canadian Heritage, the Honourable Sheila Copps, during the last 30 years we have lost 21%-23% of pre-1920 heritage building stock to demolition. A recent study also found that 14.3% of older buildings are at risk. Buildings were more threatened in rural areas where there are few programs to help preserve them. The loss of this building stock is often unnecessary, is contrary to the fundamental elements of sustainable development, and is therefore not in the interests of healthy, integrated and sustainable communities. The perspective on stewardship of built heritage needs to shift to a presumption in favour of reuse rather than demolition.

There is a complex mix of legislation and programs at various levels of government that affects built heritage in both the public and private domain. In the private domain, the tax system is a key consideration when owners and developers are comparing the costs and benefits of maintenance and preservation of older buildings vs. demolition and replacement with new buildings or greenfield development. Fair taxation policies on heritage structures are imperative. At the federal level in Canada, the *Income Tax Act* has for decades resulted in a broad era bias against preservation and for demolition, while certain provincial and municipal governments have been more supportive of heritage preservation. The Department of Canadian Heritage is currently examining a range of policy and tax instruments to encourage private support and preservation of built heritage, and is consulting with provincial counterparts, municipal authorities and other interested

parties to consider what incentives would be required to encourage preservation of heritage structures. At a broader level, current economic incentives for resource use and disincentives for employment affect the conservation of resources, including buildings.

There has been a tendency in Canada to separate natural area protection from built preservation. Europe, on the other hand, more closely integrates planning, heritage preservation and, increasingly, sustainability. In the U.S.A., formal alliances between built preservationists and natural area conservationists had developed by the 1980s. This confluence created a climate in which built heritage goals were seen as supportive of natural preservation goals. For example, the National Audubon Society, a prominent natural area conservation organization in the U.S.A., moved its offices in the early 1990s into a recycled and retrofitted old office building as a reflection of its overall mandate of conservation. The society questions when public policy priorities will be directed to the retention of buildings, and so reap the rewards of savings in energy, reduction in the exploitation of new resources, alleviating of the solid waste disposal problem, and the creation of healthy, productive workplaces.

A number of reports have concluded that Canadians have yet to address fully the need to implement a broad range of policies that promote urban sustainability. One report suggests that we may need to rethink traditional planning, and design and retrofit our cities in ways that maximize social, economic and environmental benefits. This type of thinking opens a clear opportunity to make the link between the need for maintenance and preservation of existing building stock, protection of heritage and historical values, and environmental gains from doing so. A country's buildings constitute a huge investment in natural and human resources. By preserving buildings, demolition waste and new construction waste are eliminated, and embodied energy in the existing building materials is conserved. Moreover, natural environments from which building materials are derived are not disturbed while cultural and architectural heritage is preserved.

A recent poll found that Canadians place a high value on the historic environment. The Government of Canada announced in its Budget 2000 that it was committed to the development of initiatives that would support the restoration and preservation of Canada's built heritage. To build on this interest, models, tools and data are needed to answer questions related to the environmental costs and benefits of building preservation, adaptive use and retrofitting, demolition and rebuilding, and greenfield development. When alternatives can be compared, rational decision making is possible.

There are software programs currently on the market or near market readiness that compare factors that affect the environmental performance of buildings. Software programs have also been developed to increase the efficiency of retrofitting buildings, based on the recognition that proper maintenance extends the useful life of buildings. These programs seem to be appearing primarily in Europe, though the Canada Mortgage and Housing Corporation (CMHC) has been working for over a decade on its own version of software to estimate the lifecycle energy and environmental impact of residential buildings.

CMHC also recognizes that Canada's existing housing stock represents an "enormous pool of private capital," and renovation choices have a direct impact on the integrity, longevity and performance of these homes. Generating awareness of the value of heritage buildings in the construction and renovation industry will therefore encourage heritage preservation. Policies should support research and training that will maintain and enhance the performance of heritage buildings through maintenance, retrofitting and adaptive use. It is widely recognized that development impacts the existence and health of our natural environment. Yet, the link between built heritage preservation and environmental protection is not widely understood. As the health of our environment emerges once again as a key concern for citizens and all levels of governments due to growing threats such as climate change, those in the heritage preservation field must be ready with an environmental argument that can be aligned with these values and issues.

BACKGROUND AND PURPOSES OF THE REPORT

The aim of the Heritage Canada Foundation is to foster a climate conducive to the preservation of heritage buildings. It produced this report as part of its ongoing interest in the linking of natural and built heritage. Given the ascending importance of sustainability in the mandates of the Government of Canada, many provincial and municipal governments, organizations, industries, and among citizens generally, it has become imperative to raise awareness of heritage preservation as an important element in the movement towards sustainability. To do so, the Heritage Canada Foundation believes that a deeper understanding of the relationship between built heritage and the environment is required.

This report provides an overview of the links being made between the preservation of built heritage, the conservation of natural resources and the goal of sustainability. In this preliminary research the focus was on buildings, although it does address the larger environmental context of land use and land-use planning. As well, the report focuses on Canada, but pertinent literature from elsewhere has been incorporated. The report synthesizes the literature reviewed by outlining the established and emerging links, and includes examples of Canada's integration of them into actions and policies. The purpose is to

establish a base from which the Heritage Canada Foundation can foster awareness, understanding and collaboration amongst the various levels and departments of government, industry, non-governmental organizations (NGOs) and all citizens of the importance of preserving our built heritage for environmental as well as the more generally understood cultural reasons.

The Heritage Canada Foundation suggests that the argument for the preservation of built heritage should not be based solely on environmental criteria; rather, preservation should continue to depend on a recognized range of other criteria, such as aesthetic, historical, architectural, and social. The environmental argument, however, has the least currency in the decision making that leads to preservation or demolition of heritage buildings and must therefore be articulated so that it is considered one of the relevant criteria in these decisions.

That some buildings should be preserved primarily for their value as cultural resources is not in question; however, many more buildings should be preserved for their value as environmental resources.

To raise awareness of the links between the preservation of built heritage and the preservation of natural heritage

requires an understanding:

- 1) of the magnitude of the loss of our building stock through demolition;
- 2) that the loss of much of this stock constitutes an environmental loss to society due to the resources and energy embodied in the buildings; and
- 3) that this loss is a significant and often unnecessary setback in achieving sustainability targets and goals.

To promote an understanding of these points, this report outlines:

- 1) the links between the preservation of our building stock and society's goals for the conservation of nature and sustainability;
- 2) the environmental costs of the loss of the building stock and subsequent replacement with new building stock;
- 3) the importance of retrofit and energy conservation technologies and the construction/renovation industry to the conservation of the building stock;
- 4) the disincentives to, and incentives for, building preservation; and
- 5) how best to communicate the environmental facts and arguments for the preservation of our building stock and collaborate for the mutual goal of sustainability.

INTRODUCTION

Heritage preservation: values and public policy

A resource has heritage significance when value (e.g., historical, aesthetic) is attached to it. Values in different eras will enhance different visions of what is an important heritage resource. In mid-19th-century North America, built heritage was valued as a symbol of patriotism. During the 1960s, there was a growing concern about urban decay, and the often troubling response, “urban renewal,” resulted in the demolition of many older buildings and neighbourhoods. The 1960s and 1970s correspondingly witnessed concern for the aesthetic and community value inherent in heritage buildings and areas. The oil crisis of the mid-1970s then prompted awareness of the environmental value of buildings due to their embodied energy. It is this environmental value, which has gained greater relevance in the past decade as a result of the growing social and political concerns about sustainability, that this report addresses.

In addition to determining what is of value, heritage preservation requires a consideration of the responsibilities arising from that value. Responsibilities may require trade-offs between different and sometimes competing values. In this sense, debate about heritage issues and policy formation is no different from debate and policy formation on other public issues, such as health, that are regulated or supported to either hinder or promote certain activities for the public good. Whether heritage conservation generally is a value held by a nation, province or even a particular region or city will therefore affect what is considered a trade-off, and which trade-offs are considered worthy of support by society and governments. For instance, at the

federal level in Canada, the *Income Tax Act* has for decades resulted in a broad era bias against preservation and for demolition. Conversely, depending on the city, region and province one lives in, heritage preservation may be encouraged by society and governments (e.g., Victoria, B.C., and the province of Quebec).

It is useful to begin this discussion by asking the following four questions. These provide a brief introduction to the issues surrounding heritage and natural conservation.

Where are we now?

According to the Minister of Canadian Heritage, the Honourable Sheila Copps, in the last 30 years we have lost 21%-23% of pre-1920 heritage building stock to demolition. In 1989, only 17.8% of the Canadian housing stock was built prior to 1941,¹ and we have lost much of that since. Similar statistics have been reported based on a study done last year, in which a sample of stock included in the Canadian Inventory of Historic Buildings (CIHB) was revisited. The CIHB was an ambitious undertaking that ultimately recorded basic documentation of more than 220,000 buildings in all parts of Canada, primarily during the early 1970s. The recent study determined that we have lost 23% of the original sample in urban areas and 21% in smaller centres. Commercial and industrial buildings in areas of high industrial growth have been demolished at a higher rate (33.3% and 26.3% respectively). The study also found that 3.4% of older buildings are currently in danger from neglect and 10.9% from redevelopment pressures, making a total of 14.3% at risk. Buildings were *more* threatened in rural areas—21% are at risk—where there are few programs to help preserve them.²

There is a complex mix of legislation and programs at various levels of government that affects built heritage in both the public and private domain. In the private domain, the tax system is a key consideration when owners and developers are comparing the costs and benefits of maintenance and preservation of old buildings vs. demolition and replacement with new buildings or greenfield development. The Department of Canadian Heritage is currently examining a range of policy and tax instruments to encourage private support and preservation of built heritage, and is consulting with provincial counterparts to consider what incentives would be required to encourage preservation of heritage structures.³ While the situation is improving at the federal level, there is much still to be done, and the Heritage Canada Foundation continues to advocate for fair treatment of built heritage in the tax system. As was noted at HCF’s 2000 Conference, if the U.S.A. experience over the last 25 years is any guide, tax incentives could have “a dramatic effect” on Canada’s cultural landscape.

Does heritage preservation equal sustainable development?

The loss of our heritage building stock is often unnecessary and does not take into account the fundamental elements of sustainable development. For example, economic activity cannot be disengaged from the biophysical and human environment. Sustainable development also recognizes the interconnections amongst goals, issues and communities, and considers communities holistically as physical and human entities. As the Brundtland report states: “These are not separate crises: an environmental crisis, a development crisis, an energy crisis.

¹ CMHC, “The Condition of Canada’s Housing Stock,” *Research and Development Highlights 2* (Ottawa: CMHC, 1991), p. 2.

² Margaret Carter, *Towards a National Trust*, Proceedings, Heritage Canada Foundation Conference, September 14-17, 2000, Calgary (Ottawa: Heritage Canada Foundation, 2001), pp. 30-33.

³ Government of Canada, *Connecting to the Canadian Experience: Diversity, Creativity and Choice*, the Government of Canada’s Response to *A Sense of Place, A Sense of Being*, the Ninth Report of the Standing Committee on Canadian Heritage (Ottawa: Minister of Public Works and Government Services Canada, November, 1999), p. 58. See also Government of Canada, “Budget 2000.” http://www.sft-ddt.gc.ca/sftddt_e.htm

They are all the same.”⁴ Similarly, the loss of our heritage building stock is an environmental, historical, aesthetic and cultural loss—all the elements that together create “sense of place.” This loss is not in the interests of healthy, integrated and sustainable communities.

Where do we want to go?

The perspective on stewardship of built heritage needs to shift to a presumption in favour of reuse. As it stands, the burden to demonstrate the case for preservation rests with groups of interested citizens, often seen as an elite. Currently, the challenge is to prove that an old building is so valuable that it ought to be saved; rather, the owner/developer should be required to prove that an old building *cannot* be adapted to new uses.⁵

To be effective, this shift in perspective must be supported by society. It is worth reflecting on the argument of a land economist that one of the main obstacles to sustainable development is the unwillingness of the public to adopt economic incentives that would induce individuals to change their behaviour. Too often, we expect governments to solve problems that are outside their capacity, because we have not yet accepted responsibility and costs for what we are demanding them to do.

The government then fails to take appropriate measures.⁶ For example, while citizens generally support the need for a reduction in greenhouse gases (GHGs), there is continued resistance to rising fuel costs and actions that would reduce energy use.⁷ Alongside the ongoing need to educate citizens about environmental issues is the need to inform them about the links between heritage preservation and sustainability.

While it is important that professional preservationists understand these links, stakeholders and the general public must also be made aware of them in order to affect decision making. This could be accomplished through a concerted program to foster an understanding of our buildings and structures and the role that they play in people’s daily lives. Consequently, the destruction of built heritage would seem less a sign of progress and more an affront to our aesthetic sensibilities and our connection to history and the natural world, which is the source of the materials that builders and craftspeople used to create the buildings that have become today’s heritage.

Who gains and who loses?

This question requires one first to consider that a development action often forecloses future development options.

Once a wetland or group of heritage buildings is destroyed, for instance, the act cannot be reversed. Nor does one always have the option of making a particular development decision. First, the power for that decision may be beyond an individual’s or group’s sphere of influence. For example, many people in Ontario have no option but to purchase electricity generated by nuclear power. Second, economic or other policies may render a choice financially unfavourable in comparison with other choices. In the context of heritage preservation, fair taxation policies on heritage structures are imperative to allow rational choices to be made. At a broader level, current economic incentives for resource use and disincentives for employment affect the conservation of resources, including buildings.

Preserving heritage buildings, as with many sustainability issues, will often result in a win/win solution by simultaneously achieving a range of goals. It must also be considered, however, that not all preservation and development options may be accommodated. The concept of sustainability encourages debate about development options, their societal costs and benefits, and trade-offs between competing goals.

⁴ World Commission on Environment and Development (WCED), *Our Common Future* (Oxford: Oxford University Press, 1987), p. 4.

⁵ Michael Kluckner, *Vanishing Vancouver* (Vancouver: Whitecap Books Ltd., 1990), p. 12.

⁶ Cornelis van Kooten, *Land Resource Economics and Sustainable Development: Economic Policies and the Common Good* (Vancouver: UBC Press, 1993), p. 175.

⁷ Note that tourism studies have found that once people are thoroughly informed of the consequences of a particular development they are quite capable of reasoned response. See David G. Simmons, “Community participation in tourism planning,” *Tourism Management* 15, 2 (1994), pp. 98-108.

LINKING HERITAGE PRESERVATION WITH NATURAL CONSERVATION AND THE GOAL OF SUSTAINABILITY

Establishing the links

There are countless references both within and outside Canada to the connection between the preservation of cultural and natural heritage. Often, one finds responsibility for its protection lies within the same government department, legislation or organization. The World Heritage Convention, the U.S. National Park Service, Parks Canada, the Australian Heritage Commission and France's system of Regional Nature Parks are just a few of the many government and other organizations that are responsible for, and make the link between, natural and cultural heritage. For example, one of Parks Canada's guiding principles states: "People and their environment are inseparable. Protection and presentation of natural and cultural heritage takes account of the close relationship between people and the environment."⁸ The Department of Canadian Heritage states that, through "stewardship of Canada's natural, historical and cultural heritage, we will preserve the collective memory of the nation and... understanding, knowledge and appreciation of Canada."⁹ In 1969, the passage of the *U.S. National Environmental Policy Act* (NEPA) similarly reflected this emerging awareness by stating that the federal government must make it possible for the nation to "preserve important historic, cultural, and natural aspects of our national heritage."¹⁰ The Historic Preservation Planning Program of the U.S. National Park Service currently views the preservation of historic resources—including historic buildings, traditional places and landscapes—as part of public policy for land use, economic, environmental and social strategies to strengthen communities.

Links are often made by referring to the protection of cultural landscapes. Cultural landscapes are representations of

the interaction of humans, land and history. They are defined by building forms and patterns of land use, and may represent a particular era or layers of time.

Examples in Canada include the outports of Newfoundland, farming patterns in various parts of Canada, as well as townscapes such as Lunenburg, Nova Scotia. Cultural landscape protection in Canada is not well advanced as there has been a tendency to separate natural area protection from cultural preservation.

Europe, on the other hand, has a more developed system of cultural landscape protection. This is partly due to the fact that separation of natural and cultural preservation simply is often not feasible because they do not share the vast tracts of wilderness we enjoy in Canada. France, for instance, has a system of 38 Regional Nature Parks that integrate natural and cultural heritage. The concept, born in 1967 "of love and reason," requires local governments to join with the national government in a contractual process to protect and sustain the landscape. The mission of Regional Nature Parks explicitly integrates natural and cultural values and current economic and cultural realities. The mission is as follows:

- to protect the national heritage, particularly by appropriate management of nature and landscapes;
- to contribute to rational land-use planning;
- to promote economic, social and cultural development and improve the quality of life;
- to attract, educate and inform the public; and
- to conduct experimental or exemplary action in the above fields and contribute to research programs.¹¹

Ecomuseums also emerged in France in the early 1970s, often linked with the Regional Nature Parks system. The unify-

ing theme of ecomuseums is the interpretation of both the local environment and heritage to enhance revitalization and rejuvenation of local traditions and identity.

In the U.K., English Heritage, the Countryside Commission, English Nature and the Environment Agency have collaborated to develop a way of thinking that integrates the historic environment with sustainability. The approach broadens the notion of heritage to include a consideration of the whole environment, its different aspects and the options for their management. It requires a response to possible change in the historic fabric that is less rigid than in the past in order to reconcile environmental conservation with development while maximizing the contribution of historic resources to sustainability. Though not without its problems, and still in an early phase of application, they have found that concurrent evaluation of a range of both cultural history and nature conservation values, and collaboration amongst different environmental interests, are important steps in linking environmental and cultural conservation.¹²

A study that analyzed the history of conservation policies in an area of the U.K. also concluded that the integration of planning and heritage preservation in pursuit of sustainability is necessary. From an initial focus on preservation and protection of "important" features of the historic fabric, a more progressive interest in integrating conservation and other planning concerns has emerged. The changing nature of motivations means that conservation proposals and initiatives will most likely be geared to restoration and adaptation of buildings to accommodate viable and sustainable end uses, and enhance the quality of life. The study emphasizes that the relationship between heritage preservation and macro economic and political trends, such as sustainability, is becoming

⁸ Canadian Heritage, *Guiding Principles and Operational Policies* (Ottawa: Supply and Operational Services Canada, 1994), p. 7.

⁹ Government of Canada, Executive Summary, *Strengthening and Celebrating Canada for the New Millennium*, Planning Period 1997-1998 to 1999-2000 (Ottawa: Minister of Public Works and Government Services Canada, 1998).

¹⁰ Samuel N. Stokes, et al., *Saving America's Countryside: A Guide to Rural Conservation*, for the National Trust for Historic Preservation (Baltimore and London: The Johns Hopkins University Press, 1989), p. 208.

¹¹ Regional Nature Parks: Promoting and Preserving. http://www.parcs-naturels-regionaux.tn.fr/un_parc/index_en.html

¹² Lyndis Cole, et al., "What matters and why," *Conservation Bulletin* 33 (January 1998), pp. 8-10.

more pronounced. It is “now clear that sustainable planning has taken over from conservation at the high point of the socio-political agenda... [conservationists] can best direct their energies at exploring and exploiting this complementarity.”¹³ English Heritage agrees that sustainability “can and must be pursued if the historic environment is to be valued as a key part of the Government’s wider agenda for sustainability.”¹⁴

By 1980, formal alliances between built preservationists and natural area conservationists had developed in the U.S.A. Organizations in the two fields co-operated on legislation, federal funding and other issues of common concern as they began to recognize that they shared the same philosophy. The president of the U.S. National Trust for Historic Preservation pointed out that “the same ethic [exists] behind protecting wildlife, guarding the beauty of fragile natural areas and saving gasoline, fuel oil and electricity.”¹⁵ In a similar vein, the National Audubon Society, a natural area conservation organization in the U.S.A., moved its offices in the early 1990s into a recycled and retrofitted old office building as a reflection of its overall mandate of conservation. Their philosophy in relation to this project encapsulates the essence of the conservation movement:

While Audubon House itself makes but a small contribution to mitigating the environmental impacts of building, hundreds of thousands of buildings renovated or constructed along the same lines could

make an indelible difference in the economy and the environment—saving millions of dollars of energy costs, reducing the need to exploit new sources of energy, recycling valuable natural resources and thus alleviating the growing solid waste crisis, and creating healthy, productive workplaces. . . .¹⁶ The question remains: When are we going to redirect the priorities and incentives of public policy to reap these rewards?¹⁷

The Institute for Cultural Landscape Studies, founded in 1997 at Harvard University, similarly works in the overlap among three interrelated fields: historic preservation, natural areas conservation, and land-use planning.¹⁸

As mentioned, the connection between natural and cultural conservation in Canada does not appear to be as evident as in some European countries, nor does it generally attract as much support from governments as in Europe or the U.S.A. In the introduction to the proceedings of a Canadian conference dedicated to linking cultural and natural heritage, the editor laments that these linkages are often ignored and states that natural and cultural conservation “should be linked conceptually so that we can consider if the approach to valuing, inventorying, protecting, using and interpreting one is relevant to the other.”¹⁹ Nevertheless, in addition to the work of the HCF, there do exist examples of local as well as regional organizations working for the conservation of cultural and natural conservation. Of note is the crossborder Quebec-Labrador

Foundation/Atlantic Center for the Environment (QLF), which for nearly 40 years has been supporting the rural communities of Eastern Canada and New England and creating models for stewardship of natural resources and cultural heritage. It is the emergence of sustainability, particularly as it applies to the urban context, however, that seems to be the most prominent link between heritage preservation and environmental conservation in Canada.

Sustainable cities, land-use patterns and heritage preservation

Canada is the fourth highest per capita energy user and producer of greenhouse gases (GHGs). Our per capita fuel consumption is up to three times higher than that of Europeans.²⁰ And, while Canada’s GHG intensity per unit of output in the economy is improving (energy-related CO²/GDP), per capita energy use and CO² emissions continue to rise.²¹ Canada is not in the forefront of sustainable urban solutions. A Canadian project undertaken in the early 1990s on the application of sustainability to the built environment found that one must look to Europe for lessons, where the movement is more advanced.²² Before returning to the Canadian scene, therefore, it is worthwhile once again to look abroad.

There are a number of notable lessons from the study mentioned above, in which researchers visited 30 ecological community projects in Denmark and Sweden. First, a table was created listing those features

¹³ Andrea Mageean, “Assessing the impact of urban conservation policy and practice: the Chester experience 1955-96,” *Planning Perspectives* 14, 1 (1999), pp. 69-97.

¹⁴ Pam Alexander, “Sustaining the Historic Environment,” *Conservation Bulletin* 36 (December 1999), p. 2.

¹⁵ Michael L. Ainslie, Foreword to *New Energy From Old Buildings*, ed. by Diane Madex (Washington, D.C.: The Preservation Press, National Trust for Heritage Preservation, 1981), p. 16.

¹⁶ Peter A. A. Berle, Foreword to *Audubon House: Building the Environmentally Responsible, Energy-Efficient Office*, by National Audubon Society and Croxton Collaborative, Architects (New York & Toronto: John Wiley & Sons, Inc., 1994), p. xii.

¹⁷ Randolph R. Croxton, Foreword to *Audubon House: Building the Environmentally Responsible, Energy-Efficient Office*, p. xvii.

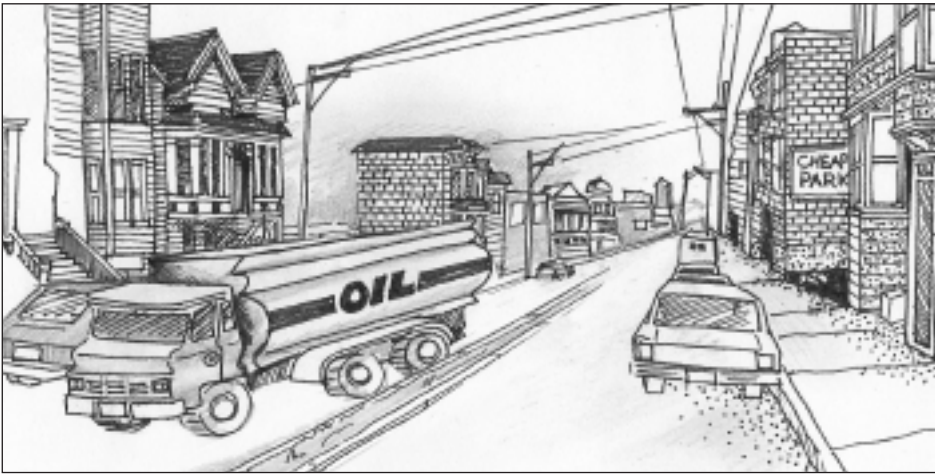
¹⁸ Institute for Cultural Landscape Studies, Harvard University. <http://www.icls.harvard.edu/about.htm>

¹⁹ John Marsh, Introduction to *Linking Cultural and Natural Heritage*, ed. by John Marsh and Janice Fialkowski, Proceedings of a Conference at Trent University, Peterborough, Ontario, June 11-13, 1992. Frost Centre for Canadian Heritage Development Studies, Trent University, 1995, p. ix.

²⁰ OECD/IEA, *Energy Policies of IEA Countries: 2000 Review* (Paris: IEA Publications, 2000), p. 43.

²¹ Environment Canada, “Canada’s Greenhouse Gas Emissions 1990-1999,” (2001). http://www.ec.gc.ca/press/2001/010711_b_e.htm; OECD/IEA, *Energy Policies of IEA Countries*, p. 40.

²² William T. Perks and David R. Van Vliet, *Assessment of Built Projects for Sustainable Communities* (Calgary: Faculty of Environmental Design, University of Calgary, with assistance from CMHC, September 1993), pp. 1-3.



suggested as characterizing a high degree of sustainability in community planning and building. It served as a summary checklist for the range of features being considered. Retention and renovation of existing buildings, and preservation of buildings and environments of cultural value were considered necessary criteria in the assessment. Second, they found that human resources development was an important outcome from more than ten years of community project work. A broad range of private practitioners and municipal officials had become experts in the many aspects of sustainable community design, including participatory techniques for user-participant planning and design. Third, the applied context of demonstration projects and continuous experimentation is a necessary condition to build up this expertise.

Fourth, the growing public awareness about environment, pollution and global sustainability, “particularly by comparison with Canada,” has produced a reinforcing or synergistic effect on the developments mentioned above. Fifth, when a panel of fifteen Canadian experts in the Calgary area was convened to review the case studies from Scandinavia, the response was overwhelmingly positive, and participants commented on the importance of the translation of the concept of sustainability into results. The central role of demonstration projects was agreed upon, largely as a way to reduce the risk of testing the market for new ideas, as well as a means of public education. Finally, the authors stressed that an important difference between Scandinavia and Canada was that in Canada neither municipalities nor senior

governments any longer play a “significant or deeply-meaningful, pro-active and inspirational role in stipulating the performance of residential community projects.”

Moreover, people in Canadian cities are not in any meaningful sense in a position to act locally on global concerns, or “in other words, to reform our physical environment models, the manner in which they are produced, and the manner in which they are cared for (stewardship).”²³

Not long after, the Canada Mortgage and Housing Corporation (CMHC) published a report on Canada’s progress in urban sustainability entitled *The Ecological City: Canada’s Overview*. It similarly stated that the “information compiled here strongly suggests that Canadians have yet to fully address the need to implement a broad range of policies that promote urban sustainability...If the situation is not addressed, it will further erode our capacity to promote urban sustainability in the near future, and will continue to result in a declining quality of life for Canadian urban dwellers...”²⁴ There are several facts about land-use patterns in non-rural Canada since the Second World War that underlay the reasons for, and momentum behind, these patterns. As the report states, there are two assumptions upon which urban development has been based: the availability of cheap and abundant energy sources and limitless availability of land and water resources. This has led to the proliferation of spacious, “energy-inefficient homes and buildings” on primarily greenfield sites. The transportation modes and distances resulting from urban sprawl also mean that GHG travel emissions per household in low-density outer suburbs are up to three times higher than in integrated, non-vehicular oriented inner-city neighbourhoods.²⁵ Preserving heritage structures due to their tendency to be centrally located and part of a compact, efficient urban form could be encouraged as integral to the intensification efforts that have been undertaken by many municipalities in

²³ Perks and Van Vliet, *Assessment of Built Projects for Sustainable Communities*, p. 5.

²⁴ Federation of Canadian Municipalities (FCM), *The Ecological City: Canada’s Overview*, prepared by FCM for CMHC (Ottawa: CMHC, May 1995), p. 23.

²⁵ CMHC, *Greenhouse Gas Emissions from Urban Travel: Tool for Evaluating Neighbourhood Sustainability*, prepared by IBI Group for CMHC (Ottawa: CMHC, February 2000), p. 46.

recent years.²⁶ Intensification reverses a traditional trend in Canada of promoting low-density suburban development through inequitable tax and subsidy treatment among municipal governments.²⁷

There are other reports, organizations and institutions in Canada that reflect a growing concern with sustainability in the built and urban environment as well as the necessity to integrate heritage resources into planning. For instance, in *Planning for Sustainability*, the Royal Commission on the Future of the Toronto Waterfront (RCFTW) described a number of principles that were recommended for land-use decision making. One of these was to recognize that every decision to develop or redevelop land involves a decision about the environment. Another principle stated that there should be a systematic investigation, analysis, and integration of information about the existing physical, natural and heritage environments and include the relationships among them.²⁸ A report recently released by English Heritage supports these principles. From a major review of policies related to the historic environment, and an in-depth survey of the thoughts and values about heritage preservation held by conservationists and lay people alike, the study concluded that there are five main messages:

1. Most people place a high value on the historic environment.
2. People want to be involved in decisions affecting their environment.
3. The historic environment is seen as a totality. People value places.
4. More will be achieved if all governments, organizations, schools and interested people work in partnership,

with strong leadership and adequate resources.

5. Everything rests on sound knowledge and understanding.²⁹

The National Round Table on the Environment and Economy (NRTEE) also undertakes work that advances sustainability and affects heritage buildings. Established in 1989 as the key federal initiative in Canada on sustainability, its goal is to create an institutional forum that openly discusses issues and acts as a catalyst for identifying, explaining and promoting the principles and practices of sustainable development. To this end, it regularly produces publications on specific issues that it has examined through research and the convening of roundtables. It also makes recommendations to the federal government on green budget reform and issues statements on the state of our overall direction vis-à-vis sustainability. The NRTEE recently released such a statement identifying four emerging challenges for Canada in the next decade.³⁰ Two of these challenges are relevant to this discussion.

First, in addressing the challenge of “managing urban spaces to create healthier environments,” the NRTEE notes that, along with a host of other environmental problems, current urbanization patterns have resulted in the loss of buildings with heritage or historical value. City officials need to adopt better planning strategies, including urban revitalization. The statement goes on to say that in some cases we may need to turn traditional planning on its head, including rethinking infill opportunities, redevelopment of brownfield sites and generally designing and retrofitting our cities in ways that maximize social, economic and environmental benefits.

This type of thinking opens a clear opportunity to make the link between the need for maintenance and preservation of existing building stock, protection of heritage and historical values, and environmental gains from doing so. The NRTEE Budget 2000 recommendations emphasized that there is a “conservation dividend” to be captured from investments in community systems. The NRTEE notes that, while the federal 2000 Budget allocated \$125 million to municipalities for “green” investments, a more active role and co-operation with provincial and municipal governments is required in the future.³¹ Investments in existing private as well as public buildings need to be considered as part of the community systems that could provide such a dividend.

Second, NRTEE’s challenge of “conserving the natural environment” is supported by the overall argument that maintaining and preserving the building stock also helps preserve our natural environment through reduction of waste, resource and energy use. Further, the statement promotes private transfers of land to conservation trusts and conservation easements as “highly effective examples of voluntary measures that can be pursued.”³² The federal 2000 Budget reduced capital gains by one-half on donations of ecologically sensitive land. The Government of Canada also announced in the Budget that it will encourage initiatives to preserve and restore the built heritage in Canada. This is an opportunity to pursue, possibly with the NRTEE and other interested parties, similar measures that would protect the built resources on and about these lands, and similar tax treatment for donations and easements on built heritage.³³

²⁶ FCM, Canadian Urban Research and the Environment (CURE) Database and Information Project of the Federation of Canadian Municipalities (1994) in FCM, *The Ecological City*, p. 29.

²⁷ FCM, *The Ecological City*, pp. 27, 162.

²⁸ FCM, *The Ecological City*, p. 93.

²⁹ English Heritage, *Power of Place: the future of the historic environment* (London: English Heritage, 2000), p. 1.

³⁰ NRTEE, “Achieving a Balance: Four Challenges for Canada in the Next Decade.” http://www.nrteetnee.ca/eng/programs/Current_Programs/Millennium/Millennium_Statement_Health_e.htm

³¹ NRTEE, “Achieving a Balance,” p. 7.

³² NRTEE, “Achieving a Balance,” p. 5.

³³ The NRTEE’s Habitat Conservation Stewardship Fund, proposed in the NRTEE’s Budget 2000 recommendations, also serves as a possible model for a similar program for built heritage as well as an opportunity for collaboration on shared natural and cultural heritage conservation concerns. http://www.nrtee-trnee.ca/eng/programs/gbudget/budget2000_summary_e.htm

EMERGING AWARENESS OF THE ENVIRONMENTAL ELEMENTS OF THE BUILDING STOCK

A country's buildings constitute a huge investment in resources and energy, not to mention labour. It is estimated that the embodied energy of Australia's built environment, for instance, is equivalent to 10 years of its energy usage.³⁴ The Toronto Regional Architectural Conservancy (TRAC) recognizes that by preserving buildings, demolition waste and new construction waste are eliminated and embodied energy in the existing building materials is conserved. Moreover, natural environments from which building materials are derived are not disturbed and cultural and architectural heritage are preserved.³⁵ An editorial in a British industry publication, *Building*, concurs that it makes more sense than ever to refurbish old buildings since it conserves the planet's resources and complies "superbly" with new-found sustainability policies. Indeed, this new reasoning for preservation is welcomed so that the conservation/redevelopment debate can be rationally made for each project by considering both new and "well-worn" arguments.³⁶ The Canada Mortgage and Housing Corporation (CMHC) similarly states in its 1998 *Renovator's Technical Guide* that, lately, we have come to appreciate that buildings have an impact on our environment, and environmental costs should affect decisions made on a project.³⁷ In short, we now know that buildings "leave an

enormous environmental footprint."³⁸

Accordingly, CMHC now incorporates the promotion of Healthy Housing principles into their vision. Interest in this vision came about in response to the need for healthy indoor environments and housing development that does not deplete or damage the Earth's resources. The principles are: occupant health; energy efficiency; resource efficiency; environmental responsibility; and affordability. This means that design should incorporate recycled or reused items, use durable materials and incorporate energy-efficient systems and retrofits. Disposal of waste, community planning, site planning, and other land-use and density issues are to be considered for their environmental impact.³⁹ CMHC has also made some progress in the promotion of renovation over demolition, advocating it as one phase in the strategy for incorporating the 3Rs in construction.⁴⁰

Just as there have been efforts to develop models and tools to determine the impact of land use on transportation GHG emissions⁴¹ and other urban sustainability concerns,⁴² models and tools are needed to answer questions related to the environmental as well as economic costs and benefits of building preservation, adaptive use and retrofitting, demolition and rebuilding, and greenfield development. When alternatives can be compared, rational decision making is possible. The

basic environmental elements of the existing building stock to be addressed are waste and embodied energy. Operating energy and costs are also considerations and are affected by building design and the availability and installation of retrofitting systems and technologies.

Construction and demolition waste

Canada is one of the largest per capita producers of waste on Earth. Construction and demolition (C&D) waste is a major component of the waste stream. Depending on the methodology used, the city or region researched, existence of recycling programs, and the year of the waste stream assessment (there is a marked fall-off in C&D waste in periods of recession, for example), estimates of C&D waste in Canada and the U.S.A., as a proportion of the total waste stream, range from 10-33%, with a conservative estimate of about 20%.⁴³ It is a source of environmental concern due to its sheer volume and because of leachate and other problems related to disposal and reprocessing.⁴⁴

William Rathje is an American garbologist who spearheaded the Garbage Project at the University of Arizona in the early 1970s, and who then went on to

³⁴ Selwyn Tucker, "Embodied Energy," *CSIRO Built Environment Online Brochures* (2000), p. 1. <http://www.dbce.csiro.au/ind-serv/brochures/embodied/embodied.htm>

³⁵ Ontario Construction and Demolition (C&D) Waste Reduction Strategy Team, *Keeping C&D Materials Out of Landfills: Conserving Resources and Minimizing Waste in the Construction Industry*, for Waste Reduction Office, Ontario Ministry of Environment and Energy (Queen's Printer for Ontario, October 1993), p. 15.

³⁶ Martin Spring, "Second Opinion: The refurbishment of old buildings makes more sense than ever before—but only if it's for the right reasons," *Building* 264, 34 (August 27, 1999), p. 37.

³⁷ CMHC, *Renovator's Technical Guide* (Ottawa: CMHC, 1998), p. 2.

³⁸ Ed Cohen-Rosenthal et al., "Build it Right: Cleaner Energy for Better Buildings," *Research Report No. 10* (Washington, D.C.: Renewable Energy Policy Project with American Council for an Energy-Efficient Economy, March 2000), p. 2.

³⁹ CMHC, *Renovator's Technical Guide*, p. 8.

⁴⁰ CMHC, *Construction and the Environment* in consultation with the Canadian Home Builders' Association (Ottawa: CMHC, 1993), p. 48.

⁴¹ CMHC, *Greenhouse Gas Emissions from Urban Travel*.

⁴² FCM, *The Ecological City*.

⁴³ William Rathje and Cullen Murphy, *Rubbish!: The Archeology of Garbage* (New York: Harper Collins Publishers, 1992); Ontario Construction and Demolition (C&D) Waste Reduction Strategy Team, *Keeping C&D Materials Out of Landfills*, p. 1; CMHC, *Housing Deconstruction Project*, prepared by dEsign consultants for CMHC (November 1996), p. 1; See also Hamish Wilson "Resources and Energies," *Linking Cultural and Natural Heritage*, pp. 19-31.

⁴⁴ Isa Walker and Max Dohmann, "Environmental impact of demolition waste—an overview on 10 years of research and experience," *Waste Management* 16, 1-3 (1996), pp. 21-26.



study garbage and landfills for over two decades. Rathje developed ten commandments on garbage. One was to focus on the “big ticket items”—paper and C&D waste. Another was to use money as a behavioural incentive.⁴⁵ Rathje notes that for years U.S.A. favouritism on behalf of virgin materials has been, and to some extent still is, built into mechanisms such as railroad freight rates and the federal tax. This, in turn, results in a lower rate of reducing, reusing and recycling. A C&D waste study in Canada similarly determined that the current tax structure often encourages waste generation inadvertently, for instance, by offering lower taxes on vacant land than unoccupied buildings, thereby encouraging demolition.⁴⁶

Reducing the C&D waste stream has been the subject of numerous studies and strategies in Canada, particularly in the early to mid-1990s. Concern was partly a reaction to bans on dumping residential construction materials in landfills, which had become commonplace.⁴⁷ As well, the *Ontario Waste Management Act*, passed in April 1992, committed Ontario to a 50% diversion of wastes from disposal in landfills by the year 2000, using a base

year of 1987, when 9 million tonnes of municipal solid waste was generated. Using the conservative estimate of 20%, this would mean that approximately 1.8 million tonnes of the waste generated in 1987 consisted of C&D materials.

The Greater Toronto region, because of its sheer size, impending landfill shortages, and the new legislation, was particularly active in strategies for reduction. For instance, the Construction and Demolition (C&D) Waste Reduction Strategy Team was formed in April 1992 at the invitation of the Waste Reduction Office of the Ontario Ministry of the Environment and Energy. Its purpose was to summarize current construction industry waste management and diversion practices, identify barriers to greater diversion, and devise action plans. In addition to the overall realization that C&D waste was a growing problem, of particular importance to heritage preservation was Action Plan 23, which was mandated to develop building conservation guidelines that would enable municipalities to thoroughly assess a structure’s potential for reuse or recycling. Action Plan 5 supported this direction by promoting building maintenance programs

in recognition of the fact that the preservation of the material resources in the existing building stock is essential to maintaining buildings in active use⁴⁸. Note that this type of initiative is considered essential in Europe. From their considerable experience, they have learned that taking measures to promote maintenance and repair is a necessary and cost-effective method of preserving heritage buildings.

The Canada Mortgage and Housing Corporation (CMHC) has also been active in numerous studies and projects related to demolition and waste. Reflecting what Rathje advocated, one study concluded that economics will play a strong role in the adoption of waste management practices: “There is little incentive for builders to practice waste minimization unless costs increase for recyclable materials and/or dumping, or regulations change.” The growing concerns of the public and governments that drive the trends affecting waste management in new construction could also increasingly impact decisions on preservation of existing buildings vs. demolition and rebuild or greenfield development. The trends identified are:

⁴⁵ Rathje and Murphy, *Rubbish!: The Archeology of Garbage*, pp. 240-241.

⁴⁶ Ontario Construction and Demolition (C&D) Waste Reduction Strategy Team, *Keeping C&D Materials Out of Landfills*, p. 36.

⁴⁷ CMHC, *Challenge: Reducing Residential Construction Waste*, prepared by the Energy Technology Access Group (Ottawa: CMHC, March 31, 1992), pp. 1, 10-11.

⁴⁸ Ontario Construction and Demolition (C&D) Waste Reduction Strategy Team, *Keeping C&D Materials Out of Landfills*, p. B-5.

environmental degradation; public awareness of adverse consequences; dwindling landfill capacity; availability of new landfill sites; increasing urbanization; and increase in haulage and tippage fees.⁴⁹

Another CMHC study documented the deconstruction—rather than demolition—of three abandoned, badly deteriorated and fire-damaged early-19th-century buildings. The goal was to show that, through planning and commitment, what is typically treated as wastes generated from demolition can become resources. In this pilot project, a 91% diversion rate was achieved and the \$10,000 revenue generated from material sales offset the higher labour costs incurred. In other words, resources were preserved and length of employment was increased. As a comparison, a traditional demolition of this magnitude would produce an estimated 33 bins of waste; this project produced only eight. Disposal fees would traditionally have been \$12,000; for this project they were \$1,200, also showing the impact that future increases of tippage fees may have on the costs of demolition. Labour costs, on the other hand, were reversed, amounting to \$3,050 for traditional demolition vs. \$27,300 for the deconstruction project. Net costs for the deconstruction project were \$29,000 vs. \$27,000 for a traditional demolition of this magnitude.⁵⁰

This study is mentioned for three reasons. First, it shows that if demolition does occur, it is feasible to preserve historic materials at no additional expense over conventional demolition. Second, it demonstrates how, acting as an incentive, a shift in taxation to resource use from employment could positively affect the preservation of heritage materials, reduce waste and increase employment. Third, if

advances in deconstruction are made, it could feasibly be used as an environmental argument against preservation of existing buildings, since the resources are largely being recycled. Nevertheless, as mentioned at the outset of this report, there are numerous values to consider in an evaluation of built heritage; therefore, deconstruction should only be used as an argument against preservation if a building does not sufficiently embody these other heritage values.

Embodied energy

It is now fairly common to see trade and professional magazine editorials, as well as scholarly journals, proclaim that since “buildings currently constitute the single largest energy-consuming human creation,” we must begin to design our buildings more sustainably.⁵¹ Though less frequently, some also view the embodied energy of existing buildings, and how we are to conserve that energy, as worthy subjects. As one editor observed, old buildings represent capital of two kinds. First, economic, in that “we inherit a massive investment of resources and energy from our ancestors which we should destroy only with the greatest deliberation and analysis of potential gains and losses in material terms.” Second, they represent cultural capital, the “essential link between past and future.”⁵²

The focus on the embodied energy of buildings began to gain momentum in the mid-1970s as a result of the oil shock. There were a number of influential studies undertaken in the U.S.A. at this time that confirmed anecdotal claims that older buildings were usually more energy-efficient than new ones, and that there was a large degree of embodied

energy in buildings.⁵³ Since then, there has also been a growing interest in the environmental impact of building materials, including their embodied energy. Research in these areas has been undertaken in a number of countries, including Canada. As well, the building industry shows interest in this area, reflected through a number of conferences, such as the First Conference on Sustainable Construction. Held in Tampa, Florida, in 1994, embodied energy was one of the main issues.⁵⁴

Put simply, the embodied energy of a building is the total energy that can be attributed to bringing it into its existing state; often the energy used in demolition is included. Calculating embodied energy, however, is complex. Consequently, wide variations remain in the published figures. Analysis may be carried out at a number of levels, and accuracy diminishes the further removed the analysis becomes from the item under consideration. It is also site specific, as different transportation requirements and variations in energy efficiency in manufacturing will affect calculations. Nevertheless, accuracy is increasing by taking these factors into account. The sometimes dramatic variances in these factors from place to place means, however, that calculations are not easily transferable from country to country or even region to region.⁵⁵ Calculations for each country, and sometimes region, must therefore be made to ensure usefulness in comparisons. This also means a version of software developed to compare building materials, including embodied energy, for use in one country would not be appropriate for another.⁵⁶

Early studies by the U.S. Energy Research and Development Administration showed that the least

⁴⁹ UMA Engineering Ltd. and the Regina Home Builders' Association, *New Residential Construction Waste Management Plan: A Feasibility Study*, prepared by Energy Pathways Inc., for FCM, CHBA, Canadian Housing and Renewal Association and CMHC (October 10, 1996), pp. 9, 10.

⁵⁰ CMHC, *Housing Deconstruction Project*, pp. 4, 5.

⁵¹ Catherine Slessor, “Physics and Phenomenology,” *Architectural Review* 207, 1235 (January 2000), pp.16-17.

⁵² “What’s the Point of the Past?,” *Architectural Review* 201, 1200 (1997), p. 4.

⁵³ See Madex, ed., *New Energy From Old Buildings*; and Richard G. Stein, *Architecture and Energy* (New York: Anchor Press, 1977).

⁵⁴ Norbert Senf, “Sustainable Construction: Has it Reached Critical Mass?,” *MHA News* 7, 1 (Spring 1995), pp. 1, 2.

⁵⁵ D. J. Harris, “A quantitative approach to the assessment of building materials,” *Building and Environment* 34 (1999), pp. 751-758; “Embodied Energy Research at the University of Brighton.” <http://www.bton.ac.uk/environment/RESEARCH/ELBRU/Embodied%20Energy%20INTRO.htm>

⁵⁶ “Green for Life, Software Review: Envest,” *Building* 265, 8142, 25 (June 23, 2000), pp. 56-57.

energy-efficient structures are those built between 1940 and 1975.⁵⁷ Pre-1940 buildings tend to maximize natural sources of lighting and ventilation, and are built for consideration of site, environment and climate. They often have thick walls, deep porches (in the South) and strategically placed mature landscaping that regulate the temperature in the building. At the same time, it must be recognized that some old buildings may never be as energy-efficient as some newer ones, particularly in the case of large commercial buildings.⁵⁸ Higher operating costs will usually reflect this fact; however, a study in the U.S.A. that compared federal heritage buildings to office buildings in the private sector actually found that operation and management costs for the heritage buildings were 10% less than those for the private office buildings.⁵⁹ Regardless, older buildings contain large amounts of embodied energy and require fewer resources to upgrade and restore than would demolition and redevelopment, or greenfield construction. Therefore, studies and estimates show that total energy use—embodied energy and operating energy—is typically comparable only after 30 years. In other words, it takes about 30 years before energy savings will be realized by building new rather than renovating an older commercial or other large building.⁶⁰ Moreover, given the trends towards an increase in embodied energy relative to operational energy as a proportion of total energy consumed over the life of large commercial and residential buildings, it will be increasingly necessary to reuse these buildings or materials.⁶¹

There are software programs currently on the market or near market readiness that compare the environmental aspects of building materials and other factors that affect the environmental performance of buildings. These seem to be appearing primarily in Europe. (Envest, for example, was developed in the U.K. by the Building Research Establishment.) Of particular note is the emergence of specific retrofitting software in Europe, where neither demolition and replacement with new building stock nor greenfield development is seen as a viable option for achieving environmental, economic or social goals. One example is the two-year research project—a collaborative effort between various organizations and experts from seven countries—that developed a European diagnosis and decision-making methodology and multimedia tool for apartment building refurbishment. Called EPIQR, its purpose is to identify the most appropriate refurbishment or retrofitting actions, together with an initial cost estimate, taking into account energy and indoor environmental quality issues. The development of this tool was based on the recognition that proper maintenance extends the useful life of buildings. A similar tool for office buildings (TOBUS) was scheduled for completion by the end of 2000. Taken together, these should “be able to handle retrofit assessments for the majority of the existing building stock.”⁶²

In Canada, CMHC has been working for over a decade on its own version of software to estimate the lifecycle energy and environmental impact of residential buildings. Called OPTIMIZE, it is currently being revised from a version

(OPTIMIZE 3.1) published in 1995 in order to improve usability. The 1995 version was itself an interface and data update of the original OPTIMIZE, developed in 1990. The aim was to create a tool that would be able to “track the energy transformations caused by residential building, and by so doing, to better gauge the environmental impact” of a building. CMHC decided to utilize energy transformations as a surrogate for environmental impact because they are closely tied to consequences with which they were concerned (e.g., air emissions). Also, energy inputs are readily measurable and have already been quantified by industry and catalogued by Statistics Canada. It will be necessary to assess the updated program and data to see if, and how, it can be used to compare old with new buildings.⁶³

Retrofitting and the role of the construction/renovation industry

As mentioned, concerns about the availability of oil in the 1970s and rising environmental awareness have caused increased interest in the energy performance of the existing and new building stock. The Department of Energy in the U.S.A. instituted a number of programs in the late 1970s and early 1980s to help homeowners conserve energy and to research and develop better materials, methods and processes for retrofitting buildings. In Canada, notably through Natural Resources Canada (NRCan), CMHC and the Institute for Research in Construction, there has been a great deal

⁵⁷ Baird M. Smith, *Conserving Energy in Historic Buildings*, Preservation Brief #3 (Technical Preservation Services for Historic Buildings, National Park Service, 1978), p. 1.

⁵⁸ Madex, ed., *New Energy From Old Buildings*.

⁵⁹ Robert Moreau, *Towards a National Trust*, Proceedings, HCF Conference, pp. 8-10.

⁶⁰ Selwyn Tucker, “Embodied Energy,” pp. 2-3; Dan Lake, (1997). <http://ecodesign.arch.wustl.edu/546a/STRATEGIES/BUILDINGS/EMBODIED%20ENERGY/Audubon.html>

⁶¹ CMHC, *Optimize 3.1: A Spreadsheet for Estimating the Life-cycle Energy, Material Flow, Environmental Impact and Costs of Residential Buildings and Assemblies*, User’s Manual, prepared by Sheltair Scientific Ltd. (Ottawa: CMHC, November 1995); The University of New South Wales, Faculty of the Built Environment, Sydney, Australia, “Sustainability and Resources 2” (September 1999), p. 1. <http://www.fbe.unsw.edu.au/Learning/material-notes/sus2.htm>

⁶² C.A. Balaras, Foreword, Special Issue devoted to EPIQR, *Energy and Buildings* 31, 2 (February 2000), p. v.

⁶³ CMHC, *OPTIMIZE 3.1*.

of research into energy conservation technologies and retrofitting. There have also been, and still are, numerous programs aimed at energy conservation and retrofits delivered through different levels of government and organizations such as the Federation of Canadian Municipalities (FCM).

Despite this work, about 18-20% of the primary energy demand in Canada is used in the operation and maintenance of residential buildings alone.

According to numerous reports, there is still much room for energy-efficiency improvement using a cost-effective approach. A 1994 International Institute for Sustainable Development (IISD) report, *Employment and Sustainable Development: Opportunities for Canada*, documents economic development strategies that are financially viable, environmentally restorative, and socially responsible. Retrofitting existing buildings is one of the strategies.⁶⁴ Another Canadian study similarly set out an action plan that could cost-effectively reduce our GHG emissions through actions such as retrofitting.⁶⁵ A study in the U.S.A. claims that current technologies and practices offer cost-effective opportunities to reduce energy use in new and existing buildings by 30-70%.⁶⁶ As CMHC points out, today's new homes represent years of research and development. "Moreover, the science that describes their operation can now produce similar standards of performance in existing homes."⁶⁷

Getting this science and technology into the hands of building owners and the renovation industry is nevertheless problematic. The disparate nature of the

building industry that makes it difficult to organize also reduces the diffusion of technologies. Its complex interests tend to preserve the status quo. One study found that: "In short, changing technology seemed to require institutional change, increased co-operation, and new analytical tools and frameworks."⁶⁸ To understand the time frames involved, a CMHC report on technology transfer and innovation completed in 1990 found that significant diffusion of construction products in Canada from the date of their earliest marketing in Canada took between 7 and 30 years. Some of the products studied were: drywall, which took 30 years (by 1960); manufactured windows, which took 10 years (by 1955); active solar heating systems (not yet reached after 15 years); and the Tyvek air barrier (not yet reached after 7 years).⁶⁹

There are other aspects of retrofitting and upgrading as well as ongoing maintenance that are just as important as energy conservation retrofits to the preservation of the existing building stock, including heritage buildings. They, too, require an informed public and renovation industry to make choices that are environmentally sound, sensitive to the integrity of the heritage resource, and cost-effective. For instance, the National Capital Commission's (NCC) 1991 built heritage policy states that, though the craftsmanship of heritage buildings is often irreplaceable, when replacement is required, life-cycle costing tends to favour the use of traditional materials such as copper and slate.⁷⁰ Similarly, English Heritage launched a promotion campaign in 1996 for repair and replacement of roofs with traditional materials. They felt that fixa-

tion on initial costs was undermining the use of (for example) local traditional clay tiles and stone slate. What one gets by making a short-term economic decision, however, is not a "true value" for one's money if life-cycle accounting principles are applied. Nor is it the best choice for the physical environment, the local economy, the effect on aesthetics or credibility of the heritage structure. For example, in addition to lasting longer, use of traditional clay tiles also enhances local employment. English Heritage could therefore promote good conservation as being integrated with the environmental, economic and social development of the country.⁷¹

A 1994 CMHC study found, however, that homeowners do not typically have the knowledge required to assess the needs of their homes. Specifically, they have a general lack of knowledge when it comes to structural maintenance, upgrading, and energy performance, and an inability to assess the need for these improvements. CMHC recognizes that Canada's existing housing stock represents an "enormous pool of private capital," and renovation choices have a direct impact on the integrity, longevity and performance of these homes.⁷² CMHC also acknowledges that the renovation sector of the residential building industry is equal in importance to new construction in terms of its economic value and employment potential—about \$17.2 billion was spent on alterations in 1999, while new housing expenditures were \$23.9 billion.⁷³ Yet, little information exists on the renovation market. The renovation study found, for example, that the economic data that is collected is so

⁶⁴ Cynthia Pollock Shea, *Employment and sustainable development: opportunities for Canada* (Winnipeg: IISD, 1994).

⁶⁵ Pembina Institute and David Suzuki Foundation, *Canadian Solutions: Practical and Affordable Steps to Fight Climate Change* (October 1998), p. 11.

⁶⁶ Cohen-Rosenthal et al., "Build it Right," p. 3.

⁶⁷ CMHC, *Renovator's Technical Guide*, pp. 194, 216.

⁶⁸ Cohen-Rosenthal et al., "Build it Right," p. 2.

⁶⁹ CMHC, "Technology Transfer and Innovation in the Canadian Residential Construction Industry," *Research & Development Highlights* Technical Series 90-219 (Ottawa: CMHC, 1990), p. 2.

⁷⁰ National Capital Commission (NCC), *Built Heritage Policy* (Ottawa: NCC, February 1991), p. 6.

⁷¹ Susan Macdonald and Judy Hawkins, "Roofs of England: reviving a lost industry," *Conservation Bulletin* 32 (July 1997), p. 10.

⁷² Davis Foster, *The Renovation Market and Renovation Consumers*, Prepared for the Research Division of CMHC by Energy Pathways Inc. (Ottawa: CMHC, 1994), p. 3.

⁷³ CMHC, "Economic Impacts of Residential Construction," *Research Highlights*, Socio-Economic Series 69 (n.d.), p. 14.



aggregated that it reveals very little about the renovation market. CMHC also concluded that renovation contractors are in a unique position to influence homeowners' renovation decisions because they are often the only experts who are actively involved in the decision-making process.⁷⁴ Furthermore, while much work can be done on heritage buildings by professional renovators/contractors, it is worth noting that in the early 1990s it was estimated that there were only about 200 heritage professionals in the building field.⁷⁵

By following general building and heritage preservation research trends

in Canada and abroad, advocacy and collaborative efforts to preserve heritage buildings could be enhanced. In Canada, CMHC conducts, contracts and funds a great deal of research on housing issues, and is also particularly active in outreach programs and guides. In their latest publication of ongoing research, there are many studies and guides related to retrofitting and other environmental concerns that have relevance to, and could affect, heritage preservation, despite the fact that CMHC has no explicit mandate to protect older buildings (see Appendix).⁷⁶ Building research and trends outside Canada can be found

in journals such as *Building Research & Information*. Published in the U.K., it dedicated a special issue to the construction industry's increasing environmental and social sensitivity. A list of recommendations on R&D topics shows the breadth and depth of the discussion that is forming in Europe and the U.K. Topics covered include retrofitting for energy conservation, life-cycle analysis, improving waste management systems, developing methods for efficient use of raw materials, reuse and recycling of existing materials, and producing research-based information "to contribute to the 'ethical discussion.'"⁷⁷

⁷⁴ Foster, *Renovation Market*, p. 46.

⁷⁵ William B. Hockey, "Evaluation of cost in the reuse of buildings, particularly heritage stock, and the influence of preconstruction decision making in establishing intervention methodology," Master of Environmental Design Thesis, Faculty of Architecture, Technical University of Nova Scotia, 1992, p. 19.

⁷⁶ CMHC, *Current Housing Research* 7, 1 (Ottawa: CMHC, Spring 2000).

⁷⁷ Luc Bourdeau, "Sustainable development and the future of construction: a comparison of visions from various countries," *Building Research and Information* 27, 6 (Nov./Dec. 1999), p. 363.

DISINCENTIVES AND INCENTIVES

Federal disincentives to, and incentives for, preserving the building stock have already been mentioned in the Introduction. As the Heritage Canada Foundation has stated for years, changes to the tax system at the federal level cannot be overemphasized as an essential factor in the preservation of built heritage. Support at the federal level through tax incentives and removal of disincentives profoundly influences the decision making that affects older buildings throughout the country. As with natural conservationists, heritage preservationists cannot expend all their energies on threats to individual resources. This will not be effective at conserving resources at a regional and national scale.

In addition to direct federal influence through taxation policies, provinces and municipalities also provide varied and complex incentives and disincentives to the preservation of built heritage. For example, Ontario recently introduced a provincial sales tax rebate on building materials for restoration/rehabilitation projects.⁷⁸ There are also numerous programs, tax structures and other factors not directly connected with heritage buildings, but which influence decisions that affect built heritage. The mix of incentives and disincentives is important because, as a CMHC study of the construction industry and waste concluded, to effect change, attention must be focused on the issues faced by most businesses (e.g., rising costs, disposal bans and legislative actions). Moreover, specific information and action plans must be provided to raise awareness amongst builders and renovators.⁷⁹

As noted in the previous section, many governments and organizations view the provision of incentives for

energy conservation in buildings as an action that makes both economic and environmental sense. Retrofitting for energy conservation also affects the continued use of existing buildings, owing to its impact on both operating costs and comfort. Providing incentives, regulations and support to improve energy conservation in new and existing homes and commercial buildings is therefore one of the key actions suggested by the Pembina Institute and David Suzuki Foundation to fight Canada's contribution to climate change. They argue that a total annual GHG emission reduction of 143.6 megatonnes (Mt) is required, and 11.6 (Mt) could be eliminated by cost-effective, energy-efficient retrofits alone.⁸⁰ Increased incentives for such retrofits could greatly affect decisions that concern retention and reuse of the building stock.

Much of the recent work of the NRTEE could also affect built heritage. One initiative is a two-year program of the NRTEE's Economic Instruments Committee to review ecological fiscal reform in Canada. This type of reform shifts part of the tax structure away from income, value-added and payroll taxes towards a more "accurate reflection on natural resource usage." The program will also advance the use of market-based approaches for environmental improvement.⁸¹ Both could have repercussions for the renovation and building industry. This research parallels other initiatives and recommendations of the NRTEE, such as the promotion of eco-efficiency. Eco-efficiency means doing more with less, including reducing material inputs (especially of virgin and non-renewable materials), reduction of waste, using cleaner inputs, and improved water and energy efficiency. Taken together—tax

reform, market-based approaches and eco-efficiency—these could have a powerful effect on decisions affecting older buildings. It is worth adding that the U.S. General Accounting Office called the tax incentives for heritage buildings one of the "best anti-recession, pro-investment" techniques available to government.⁸²

There are also opportunities for the integration of heritage preservation programs with quality-of-life enhancement, a philosophy that has guided work in Victoria, B.C., and Québec City. Heritage buildings in both of these cities are viewed and supported as a form of public good. One of Québec's main granting programs, for example, helps owners restore certain historical elements affecting the exterior of buildings—considered an aesthetic public good for which society should share the cost of upkeep. Other programs encourage the reuse of centrally located industrial heritage buildings as live-in artist studios. Similarly, Victoria developed a financial incentive program that explicitly ties assistance to the creation of residential living in the downtown core. Moreover, the direct payback period to the city in increased tax revenue can be as little as two to three years.⁸³ This does not include the reduction of externality costs associated with the minimization of sprawl, construction and demolition waste, and resource use in construction. In the context of action on climate change, continued and intensified use of heritage buildings, which are often centrally located, reduces the need for building further from the core, which in turn decreases the use of private vehicles, travel times, and the production of GHGs.⁸⁴

As mentioned previously, heritage preservation is also widely viewed as a

⁷⁸ Gerald Killan, *Towards a National Trust*, Proceedings, HCF Conference, p. 15.

⁷⁹ CMHC, *Challenge: Reducing Residential Construction Waste*, p. 1.

⁸⁰ Pembina Institute and David Suzuki Foundation, *Canadian Solutions*, p. 11.

⁸¹ NRTEE, *Ecological Fiscal Reform in Canada—A Key to Achieving Sustainable Development Goals* (May 2001). http://www.nrtee-trnee.ca/eng/programs/Current_Programs/EcologicalFiscalReform/EcologicalFiscalReform_e.htm

⁸² Mark Rasmussen, *Towards a National Trust*, Proceedings, HCF Conference, p. 42.

⁸³ Steve Barber, *Towards a National Trust*, Proceedings, HCF Conference, pp. 40-41.

⁸⁴ CMHC, *Greenhouse Gas Emissions from Urban Travel*, p. vi.

quality-of-life issue in Europe. A study in the U.K., for instance, found that the emergence of this perspective in the late 1970s has meant that conservation strategies must be grounded in a “realistic consideration” of their role in the broad planning context. Further, the objectives of conservation policy and practice began to be achieved in the late 1970s largely due to the commitment of public funding and human resources, which increased public confidence and complementary private investment.⁸⁵ In fact, a recent study demonstrated that an investment of £10,000 by an organization leveraged £48,000 in funding from the private sector and public sources.⁸⁶ The U.S. Federal Historic Preservation Tax

Incentives, which are available for buildings listed in the National Register and certain historic districts that are substantially rehabilitated for income-producing purposes, have had a similar effect. The program has been responsible for more than 27,000 rehabilitation projects with private investment exceeding \$17 billion.

The issue of taxes as incentives for, or disincentives to, heritage preservation and related government policies such as resource conservation is an ongoing concern. It is an issue even in the U.K., where there is strong public and policy support for heritage preservation. In 1998, 19 heritage NGOs began an initiative to convince Government to introduce a single, harmonized rate of

5% value-added tax (VAT) on all work on listed buildings. The current rate on repairs to listed buildings is 17.5%, whereas most alterations are VAT-free. Alterations and repairs to non-listed buildings attract VAT, whereas new-build does not. By penalizing repairs, they argue, the present VAT regime “is at odds with Government’s policy, not just on the historic environment, but also on sustainable development, urban regeneration, and recycling of existing buildings to help meet housing needs.”⁸⁷ The current system of disincentives to refurbish properties encourages market failure and, consequently, English Heritage recommends that VAT be equalized at 5% for all building work.⁸⁸

⁸⁵ Mageean, “Assessing the impact of urban conservation policy and practice,” pp. 82, 91.

⁸⁶ English Heritage, *The Heritage Dividend: measuring the results of English Heritage regeneration 1994-1999* (London: English Heritage, 1999), p. 42.

⁸⁷ Hillary Weir, “New VAT campaign launched,” *Conservation Bulletin* 36 (December 1999), p. 24.

⁸⁸ English Heritage, *Power of Place*, p. 11.

SUMMARY AND CONCLUSIONS

It is compelling that so many organizations and government departments, both in Canada and elsewhere, include both natural and built heritage in their mandates. As well, it is widely recognized that development impacts the existence and health of our natural environment. The production of new environmentally sound buildings and building materials is generally understood to be part of making this development environmentally sustainable. A scan of *Architectural Publications Index*,⁸⁹ for example, is replete with references to “green” building materials and design. Yet, the link between preserving the existing building stock and environmental conservation is not widely understood. It is necessary to remedy this situation as the health of our environment emerges once again as a key concern for citizens and all levels of governments.

Collaboration with like-minded parties to advance mutual interests is increasingly important to the achievement of an organization’s goals. In addition to continuing advocacy with the Government of Canada on tax and other policies that affect built heritage, the Heritage Canada Foundation plans to

build on its experience of collaboration by approaching a number of key organizations and agencies. This will enhance efforts to link the preservation of built heritage with the environmental and quality-of-life mandates of various organizations and governments.

Institutions that have been identified as sharing interests include the National Round Table on the Environment and Economy (NRTEE), which is active in a number of initiatives related to sustainable cities, energy and resource conservation. The Canada Mortgage and Housing Corporation (CMHC), Canada’s main agency for housing issues, influences resource and land-use decisions through its extensive research and outreach activities with both consumers and the building industry. In recent years, it has placed institutional focus on Healthy Housing and environmental issues related to the housing industry. The Federation of Canadian Municipalities (FCM) similarly shares concerns with HCF about developing livable communities through efficient use of resources and balancing of interests. The Canadian Institute of Planners (CIP) also provides an opportunity to build on mutual goals related to efficient land-use planning that

improves our quality of life. Associations representing the construction and renovation industry are important partners in the practical, front-line work required to maintain older buildings. Possibilities for collaboration include promotion of the value of built heritage, and dissemination of information on various programs and policies that affect profits and decision making related to the retention and reuse of heritage buildings. A variety of environmental non-governmental organizations (ENGOS) directly make the link between natural and cultural preservation and may benefit from sharing joint concerns, advocacy and research interests with HCF. Where the link made by ENGOS is implicit, efforts could focus on making them explicit. Given HCF’s experience with more localized NGOs through programs such as Heritage Regions and Main Street, there may be immediate opportunities to collaborate with local community organizations on achievement of sustainability goals. Communication through the media and annual conferences represents continued opportunities to raise awareness and increase understanding of the issues related to built and natural heritage preservation.

⁸⁹ *RIBA Publications*, Architectural Publications Index, published for the British Architectural Library at the Royal Institute of British Architects (London: Construction House).

APPENDIX

*Selected List of Research Projects at Canada Mortgage and Housing Corporation (Spring 2000)***Building Materials**

- Building and Renovating with Salvaged Materials: A Reuse Workplan

Energy Conservation

- Analysis of the Impact of Energy Efficiency Measures in Multi-Unit Residential Buildings
- Documentation of Energy Efficiency Case Studies: 1055 Bay Street, Toronto
- Energy Efficiency Case Studies of Multi-Unit Residential Buildings
- Foundation Paper on Community Energy Planning
- Impact of Added Insulation on Air Leakage Patterns
- International Energy Agency (IEA): Energy Related Environmental Impact of Buildings
- Phase II: Advanced Technology Data Browser
- Rental Stock Envelope Survey
- Ventilation in 2 or 3 Unit Multi-Family Buildings Before and After Weatherization
- Needs Assessment for a Canadian Housing Retrofit Conference
- Optimize: A Method for Estimating the Lifecycle Energy and Environmental Impact of a House
- Energy Efficiency Case Studies: Monitoring a Dual Heating System Installation

- Energy Efficiency Opportunities Manual for Multi-Unit Residential Buildings
- Evaluation of Embodied Energy for the Conservation Co-operative

Housing and Taxation

- Literature Review: Tax Incidence in the Canadian Housing Sector

Property Management

- Contract Management Course for Residential Property Managers and Building Owners
- Multi-Unit Residential Building Management and the ISO 14001 Standard for Environmental Management Systems
- Canadian Residential Property Management Industry Profile

Renovation and Inspection

- Healthy Housing Inspection Checklist: CMHC Homeowner's and Homebuyer's Checklist for Maintenance and Repair
- Healthy Housing Renovation Planner: Renovate the Healthy Way
- Prioritized Practical Approaches for Essential Remediation, Repair and Maintenance Projects
- Disinvestment and the Decline of Urban Neighbourhoods
- Homeowner Motivation and Revitalization of Older Residential Neighbourhoods: A Study of Incumbent Upgrading in Winnipeg: Final Report

- Rental Repair and Renovation in Canada
- Renovation of Generic Housing Styles—Post-War One-And-A-Half Storey
- Renovator Training in Canada: An Evaluation and Situation Report
- Canadian Renovation Industry and the Internet: Usage Patterns, 1998-2001
- Guide for the Renovation of a One-Storey House Circa 1960-1979

Rental Housing

- Feasibility of Creating a Canadian Multiple-Unit Rental Housing Data Base

Sustainable Development & Healthy Housing

- Action Plan for Reducing Greenhouse Gases in Rural Communities
- Canadian Homes and Climate Change
- CentreSci: Participation and Housing Exhibit in the Montreal Interactive Science Centre at the Vieux Port
- Conservation Co-operative Case Studies Documentation
- Construction Resource Management Course—Phase II
- Healthy Housing Seminar
- Ryder Lake “Urban Village”: Development Plan for a Sustainable Community
- Sustainable Community Design
- Overcoming the Barriers to Sustainable Real Estate Development in Canada
- Planning Sustainable Communities

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PRINCIPAL SOURCES

Canada Mortgage and Housing Corporation (CMHC): Numerous research and other publications.

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English Heritage. *Power of Place: the future of the historic environment*. London: English Heritage, 2000.

A review of policies related to the historic environment of England, which was guided by a steering group and five working groups. A seminar involving 180 experts was also convened, and senior government officials were involved throughout. Other consultations included a commissioned survey of what people thought and valued about the historic environment and its future.

Federation of Canadian Municipalities (FCM) (1995) *The Ecological City: Canada's Overview*. Prepared by FCM for CMHC. Ottawa: CMHC, May 1995.

The overview highlights the importance of the sustainability of urban regions in achieving national and global sustainability and acts as a resource document. Its purpose is to help OECD member countries identify innovative integrated strategies to address the growing pressures on the economic, social and environmental conditions of urban regions.

Government of Canada. *Connecting to the Canadian Experience: Diversity, Creativity and Choice*. The Government of Canada's Response to *A Sense of Place, A Sense of Being*, the Ninth Report of the Standing Committee on Canadian

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The report reflects the initiatives the government took to respond to challenges in the cultural sector. It is guided by the October 12, 1999, Speech from the Throne, which clearly sets out Canadian cultural diversity as central to quality of life. The report contains 43 recommendations, several of which pertain directly or indirectly to heritage buildings.

Towards a National Trust. Proceedings, Heritage Canada Foundation Conference, Calgary, September 14-17, 2000. Ottawa: Heritage Canada Foundation, 2001.

This conference focused on the possible development of a national trust for Canada. It explored issues of stewardship, legal advocacy, the constituency, education, information, philanthropy, and granting.

National Round Table on the Environment and Economy (NRTEE): numerous statements, reports and publications.

The NRTEE was created to play the role of catalyst in identifying, explaining and promoting the principles and practices of sustainable development in Canada. It aims to provide decision makers with the information they need to make reasoned choices. The Web site lists ongoing activities and publications.

NRTEE. *State of the Debate on the Environment and the Economy: Greening Canada's Brownfield Sites*. Ottawa: NRTEE, 1998.

The report examines barriers to redeveloping brownfield sites and solutions to overcome them. Examines the state of information on the environmental condition of land and makes recommendations for its improvement.

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The report summarizes the solid waste management and waste diversion activities practiced by the construction industry in the province of Ontario in the early 1990s. It identifies the barriers to greater diversion, and describes a series of proposed action plans that would address these barriers, reduce waste generation, and optimize diversion.

Conservation Bulletin

The journal of the heritage conservation organization, English Heritage, provides current information and research briefs on their own work and other initiatives and issues affecting the preservation of heritage in the U.K. and Europe.

Building

An industry journal published in the U.K., it provides brief updates on current issues in the building industry.

Energy and Buildings

An academic journal published in the U.K., it has numerous articles, largely technical in nature, relating to older and heritage buildings. The focus is on retrofitting older buildings for energy conservation in a European context.

SUGGESTIONS FOR FURTHER READING

In addition to the sources found in the footnotes, readers may find the following useful to their research on heritage preservation and the environment.

Books, Reports and Articles

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Institutions

For a list of institutions relevant to the heritage preservation field, consult *The Heritage Directory 2001*, published by the Heritage Canada Foundation.

Industry and Academic Journals

Journals listed here are typically accessible in Canada either at university or government research libraries.

APT

Analytica Chimica Acta

Architects Journal

Architects Record

Architectural Review

Architectural Association Quarterly

Building and Environment

Conservation. Rehabilitation. Recyclage.

Energy Conversion and Management

Environmental Ethics

Journal of Air and Waste Management Association

Journal of Environmental Engineering

Progressive Architecture

RIBA Journal

Waste Management

Waste Management and Research

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