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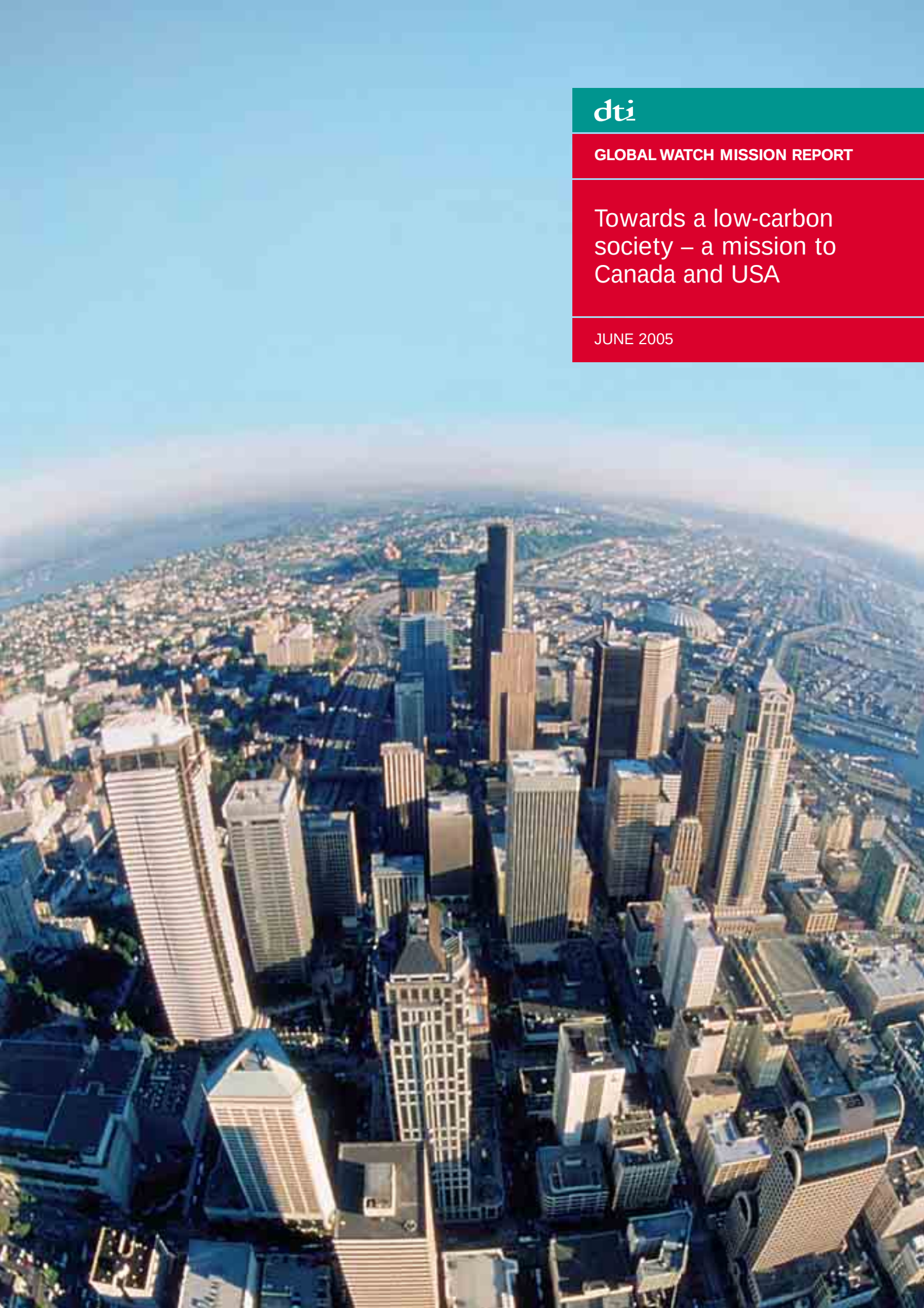
GLOBAL WATCH MISSION REPORT

Towards a low-carbon society – a mission to Canada and USA

JUNE 2005



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Cover picture: Skyline of Seattle, Washington, USA

Towards a low-carbon society

– a mission to Canada and USA

REPORT OF A DTI GLOBAL WATCH MISSION
JUNE 2005

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EXECUTIVE SUMMARY

The INREB Faraday Partnership's overall aim is to instigate a programme of activity that will help to deliver a low-carbon society in the UK. This is based on a minimum 60% reduction in carbon dioxide (CO_2) emissions in buildings from the 1997 Royal Commission on Environmental Pollution (RCEP) base. To achieve this aim, two interrelated approaches are promoted:

- An integrated approach to energy conservation to reduce demand in buildings
- Utilising new and renewable energy technology to meet that reduced demand

INREB was therefore well placed to coordinate a DTI Global Watch Mission to investigate the Canadian framework for large-scale carbon reduction in the built environment. This was the focus of an east coast mission team 'A'. In addition, a west coast mission team 'B' investigated carbon reduction in buildings and communities in Canada. A particular focus for this team was the Leadership in Energy and Environmental Design (LEED) green building performance rating system developed in the USA. It was for this reason that mission team 'B' also visited the USA to review some LEED accredited buildings in the USA as well as Canada.

So, two mission teams visited Toronto and Ottawa (Mission A) and Vancouver and Seattle (Mission B) in June 2005, and their findings are summarised under three key headings:

- Framework for a low-carbon society
- People and places – large-scale initiatives
- Sustainable building projects

Framework for a low-carbon society

- The importance of a clear low-carbon framework in Canada and the UK was identified based on shared learning of how the two countries currently legislate. Canada's legislative powers are held provincially and can inform the UK where national standards and targets need to be delivered more locally through the regions.

- The UK can learn from the Canadian sustainable 'drivers for action'. For example, the Canadians' passion for their country's natural heritage and subsequent desire to protect the global environment. The UK might emulate this by creating greater environmental awareness through the regional development agencies (RDAs).

- Demonstrable evidence was gained through the mission that Canadian organisations have available significant funding and resources for up-front funding support for low-carbon projects. Activities include: investigative work into best practice; the evaluation of similar projects; extensive key stakeholder consultation to help drive low-carbon innovation in Canada. There is opportunity for the UK to review how such funding and resourcing is made available in Canada to assist the low-carbon agenda in the UK.

- The UK's knowledge and experience of deregulation of energy markets should be shared with other parts of the world including Canada and the USA.

People and places – large-scale initiatives

- The importance of strong and inspirational leadership in delivering significant carbon reduction was highlighted on the missions. Ideally this will be from politicians and the private sector – people who are prepared to lead by example and provide the vision to help make the deep cuts in carbon emissions required.

- To deliver low-carbon buildings and communities will require an integrated, interdisciplinary approach. A combination of technical, non-technical and political disciplines is needed to achieve deep cuts in CO_2 emissions. All those involved in the supply chain of creating buildings and communities including policymakers, planners, architects, engineers, builders and occupiers have a part to play in ensuring the development achieves a low-carbon outcome.

- There are opportunities for shared learning in the way Canada and the UK are trying to improve their urban environments especially in the area of affordable housing.

- The LEED performance assessment system does not currently accommodate community-scale development. Clear targets and standards for this must be a priority for both countries given the significant number of community-scale projects currently being developed.

- The importance of appropriate marketing and communication in raising awareness to the general public. Identifying issues the public can meaningfully engage with should be a priority. In Canada, highlighting the potential loss of local environmental quality because of pollution, greenhouse gas (GHG) emissions, etc, could be replicated in similar UK marketing strategies.

Sustainable building projects

- The LEED performance assessment method for buildings has achieved rapid market penetration in Canada and the USA. This has been greatly assisted by the creation and use of the accreditation process for professionals, who have excellent support in the form of guidance documentation and web resources from the US Green Building Council (USGBC). The valuable lessons learned by the LEED approach should be reviewed by DEFRA to inform the assessment of the environmental performance of buildings in the UK.

- LEED for low-rise residential developments has not yet been adopted in Canada. The UK EcoHomes standard may be beneficial to Canada in this respect to reward developments achieving standards beyond minimum regulatory requirements.

- The UK has expertise in the design, specification and installation of low-carbon technologies but limited manufacturing of such technologies. The current small UK industry in domestic combined heat and power (CHP), wind, heat pumps, solar thermal and photovoltaics should be better supported by government so the UK can export such technologies worldwide.

- It would be helpful if building specifiers in the UK had databases of information on sourcing local recycled and reusable materials.

- INREB's role as an interface between the construction and energy sectors and UK academia is an important one in terms of identifying 'industry needs'.

- The mission teams were inspired by the promotion of lifestyle sustainability in creating enthusiasm for the low-carbon agenda in North America. To achieve a low-carbon society in the UK will require 'buy-in' from ordinary people and we can learn a lot from the Canadian/US approach in this respect.

1 INTRODUCTION

1.1 Background

A fundamental issue affecting our society this century is climate change. Increasing concentrations of greenhouse gases (GHGs, in particular carbon dioxide (CO_2)) are causing the global climate to change, and evidence suggests that unless this trend is reversed, more adverse effects – such as weather extremes – will be experienced.

To address this, the government's 2003 Energy White Paper has set the UK on a path to a minimum 60% reduction in overall CO_2 emissions from the 1997 Royal Commission on Environmental Pollution (RCEP) base. Such a reduction will not only contribute to stabilising global emissions but will help create a low-carbon society in the UK.

Buildings and communities account for over 45% of the CO_2 emitted in the UK. A 60% reduction target for the built environment is therefore ambitious, and one that will only be achieved through a holistic approach to the improvement of the energy performance of both new and existing buildings and communities. Significant carbon reduction will require an increase in the use of energy efficiency measures to help reduce demand, and low-carbon technologies / renewable energy to meet that reduced demand. It will also require consideration of the emissions arising from the operation of buildings and communities, eg the impact of resident lifestyles, and the increasing use of energy-consuming appliances and vehicles.

Such an integrated approach forms the focus for INREB, which aims to accelerate the uptake of low-carbon technologies and renewable energy, in combination with strategies to reduce the energy demand from buildings, and alongside consideration of operational carbon emissions.

It is within this context, and with the aim of helping the UK develop a better understanding of the role and significance of buildings and communities in helping to mitigate climate change, that in June 2005 INREB undertook a DTI Global Watch Mission to investigate how the issue of carbon reduction in the built environment is being tackled in North America.

Two teams undertook one-week parallel studies on the east and west coasts of Canada and the USA:

- The east coast team considered large-scale carbon reduction in the built environment, and visited Ottawa and Toronto to explore the local, regional and national strategies, policies and initiatives in place to help reduce the emissions associated with cities and major community developments in Canada.

- The west coast team, which visited Vancouver and Seattle, focused on the strategies, design and construction of a range of buildings and communities, to investigate how carbon reduction approaches vary across different scales of development in Canada and the USA.

The primary focus of both teams was Canada but the west coast mission team also visited projects in the USA. The reason for this was that the west coast team was examining the communities' and buildings' scale with a particular focus on the Leadership in Energy and Environmental Design (LEED) green building performance rating scheme which was developed by the US Green Building Council (USGBC) – the team visited buildings in Canada and the USA to examine the respective countries' achievements in terms of LEED-rated buildings.

This report brings the findings of the two studies together to demonstrate how the learning from an integrated approach to carbon reduction in the built environment in Canada and the USA can help realise a low-carbon society in the UK.

1.2 Mission overview

Climate change is a global issue, requiring international action to address the challenges that are consequentially arising, from both the cause and the effects of increasing GHG emissions. Canada, as a significant emitter of GHGs, is taking the issue seriously and through local, regional and national action, is demonstrating that it is committed to making deep cuts in emissions to help mitigate climate change[1].

In December 2002 the Canadian government ratified the Kyoto Protocol, following five years of discussion with provincial/territorial governments and stakeholders. It made a commitment to reduce the country's annual GHG emissions by 6% below actual 1990 emissions, during 2008-12. However, with emissions in 1990 at around 596 Mt, and in 2003 at a level already 24% above this[2], the country has set a challenging target[3].

The effects of climate change are already being observed in Canada on an increasingly regular basis. Events such as the British Columbia forest fires in 2003, the Prairie drought in 2004[4], and the destructive floods that were experienced in central and southern Alberta during the mission week itself, following a period of unprecedented rainfall, have demonstrated how vulnerable Canada's communities are to extremes of weather.

These highly visible and devastating impacts of climate change are clearly one of the drivers for Canada to tackle the cause of climate change, but the mission also highlighted several other important reasons why Canada is taking action to reduce its GHG emissions. During the week, the health and air quality benefits, the benefit to

1 Canada is also putting significant resource into work on adaptation strategies for climate change, but discussion of these is unfortunately outside the remit of this report. For more information on adaptation, see the Government of Canada's climate change website: *www.climatechange.gc.ca*

2 GOVERNMENT OF CANADA, 2005. *Moving Forward on Climate Change – A Plan for Honouring our Kyoto Commitment*. Ottawa: Government of Canada

3 See Appendix A – *Key facts and figures* – for further detail

4 GOVERNMENT OF CANADA, 2005. *Moving Forward on Climate Change – A Plan for Honouring our Kyoto Commitment*. Ottawa: Government of Canada

economic competitiveness and international responsibility were all cited as key drivers for action (see Section 2.1 – *Canadian national framework* – for further detail).

The issue of climate change and GHG emission reduction, and the relevance of Canadian actions to the UK, were the focus of mission investigations in June 2005. A number of proposed community-scale and constructed building projects were also visited in the USA. During the week, both study teams had opportunity to explore the programmes and projects in place to reduce GHG (in particular CO_2) emissions from the built environment, and to discuss the issues with a range of people. Visiting government bodies, active organisations, and showcase building projects, mission participants were able to build an understanding of the problems faced by Canada and the USA and consider the success of actions being taken to mitigate climate change.

1.2.1 East coast study

The east coast study – *investigating large-scale carbon reduction in the built environment* – aimed to explore the strategies, policies and initiatives in place to help reduce the large-scale carbon emissions associated with cities and major community developments in Canada. Visiting Ottawa and Toronto, in the province of Ontario, the mission team were able to gain a unique insight into best-practice actions being undertaken across a variety of scales, ie national, regional and local level.

During the week, a wide range of organisations were visited, reflecting the integrated approach to studying large-scale carbon reduction, and the expertise and interests of the interdisciplinary team. Meetings with federal (national) government departments and agencies in Ottawa, and municipal (local) and non-governmental organisations (NGOs) in Toronto, helped build an understanding of the impact that carbon reduction policies are having, for example on construction and infrastructure planning; of how targets are being translated into community action and regeneration projects; and whether actual carbon reductions are being achieved.

Through the study, the team aimed to address the following questions:

- What are the key drivers for carbon reduction in Canada? Are there any targets/goals in place? What are the main challenges faced by Canada?
- What are the national, regional and local strategies, policies and voluntary initiatives in place to help reduce the large-scale carbon emissions associated with cities and major community developments?
- How do these policies, strategies and initiatives fit in with the broader aim of sustainable development within Canada? What are the key issues faced under the sustainable development agenda?
- How are the initiatives funded, supported and implemented? How are the national/regional policies being translated into local/community action?
- How successful are the initiatives and what impact are they having? How is this being measured?
- What are the successful actions/projects? Are the lessons learned from these being disseminated? How are successful initiatives being brought into the mainstream?
- What are the not-so-successful actions/projects? What have been identified as the main barriers to success?

A full itinerary and summary of east coast visits can be found in Appendix B.

East coast mission team

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Contact details for the east coast mission team can be found in Appendix C.

1.2.2 West coast study

The west coast study – *investigating carbon reduction in buildings and communities* – aimed to explore how carbon reduction is being achieved through the design and construction of a range of domestic and non-domestic building types and proposed community-scale developments. Visiting Vancouver (British Columbia, Canada) and Seattle (Washington, USA) in the Pacific Northwest, the team focused on:

- A regional perspective of British Columbia: based on a visit to Greater Vancouver Regional District (GVRD) (Section 2.2).

- Financing green projects: based on a visit to VanCity – providers of green financing (Section 3.2).

- Sustainable community-scale initiatives: visits to major sites in Vancouver and Seattle offering opportunities to create vibrant low-carbon neighbourhoods (Section 3.3).

- Sustainable building projects: Electricity in Vancouver and Seattle is 'cheap', being generated predominantly from hydro. The drive for low-carbon building development in the Pacific Northwest is therefore more holistic within a framework for creating 'green buildings'. This approach is encapsulated in the Leadership in Energy and Environmental Design (LEED) rating system and covers: sustainable sites; water efficiency; energy and atmosphere; materials and resources; indoor environmental quality; and innovation and design process (Chapter 4), with building studies used to highlight strategies deployed.

The choice of a Canadian and US city allowed the deployment of LEED to be explored in two separate countries. The LEED rating system allows a more holistic approach to achieving a low-carbon solution in the context of an overall sustainability strategy.

During the week, many consultancies were visited, mainly on the sites of the buildings they had designed. Interdisciplinary working was evident, with many projects described by an architect and engineer in tandem. The ultimate aim of the mission team was to develop an understanding of how to achieve carbon reductions in buildings at an individual building and community scale within the context of the issues relevant to the broader sustainability agenda.

A full itinerary and summary of west coast visits can be found in Appendix B.

West coast mission team

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Contact details for the west coast mission team can be found in Appendix C.

1.3 Key findings and recommendations

The recommendations have been organised under three headings:

- Framework for a low-carbon society
- People and places – large-scale initiatives
- Sustainable building projects

Framework for a low-carbon society

- An integrated legislative framework

To guide free market forces and help drive the low-carbon agenda, there is a need to set a clear legislative framework and ensure that policies are integrated across all governing levels. The mission highlighted that the current frameworks in place in Canada and the UK, while having started from very different points, appear to be moving towards similar positions – the Canadians recognising that while legislative powers are held provincially, federal targets and aspirations will have limited impact; and the UK recognising that national targets and standards need to be delivered more locally through the regions, who until recently had no legislative powers to enforce action. There therefore exists the potential for significant learning from the approach taken by both countries in understanding how legislation can be integrated to help create a low-carbon society.

- Drivers for action

The mission visits and meetings demonstrated that the UK and Canada have many similar drivers to move towards a low-carbon society; for example, increasing energy costs; international targets and obligations; recognising that resource efficiency can lead to gains in competitiveness and help secure sustainable growth. They also highlighted, however, that Canadians have strong drivers for sustainability that are evidently reducing carbon emissions in other

ways. Amongst the most notable is that the best examples of regional actions are driven by the Canadians' passion for their country and natural heritage and subsequent desire to protect the global environment. This regional drive towards greater environmental awareness could be emulated in the UK by the regional development agencies (RDAs).

- Up-front funding and resource

The UK construction industry is a project-driven industry, whereby sufficient time or budget is rarely available to allow the project team to gain the required knowledge and undertake the necessary up-front work in what is a relatively new field, ie the delivery of low-carbon buildings and communities. Demonstrable evidence was gained through the mission that Canadian organisations have available to them significant funding and resources that can be invested into up-front effort to build solid foundations from which projects can be taken forward. Up-front investigative work into best practice, the evaluation of similar projects, extensive key-stakeholders' consultations are helping to drive low-carbon innovation in Canada. There is opportunity for the UK to understand how such funding and resources are made available in Canada and how such actions can help the low-carbon agenda.

- Deregulation

The UK has probably the best experience and knowledge of deregulation of the energy market. The opportunities to use this knowledge in other markets including Canada should be reviewed.

People and places – large-scale initiatives

- Moving projects forward: leadership and partnership

Project investigations during the mission emphasised that leadership and partnership are important in ensuring the success of low-carbon initiatives. Leadership is critical, whether it is from a politician who is eager to further the cause in a political arena; a driven community member keen to show the way locally; or from an entire organisation with the critical mass to bring about change. Without strong leadership to support low-carbon initiatives, it is all too easy for them to fall by the wayside. Partnership working is crucial if all aspects of sustainability are to be embraced in a project. Partners can bring with them additional knowledge, skills and resource that tend not to be found in a single organisation but that can dramatically help improve efficiency of delivery. This report discusses some of the projects that have received the support of a strong leader and that have effectively been delivered through partnership.

There is a need to get one person who understands how to pull all aspects of sustainability at a local level together to drive things forward (local pioneering leadership) – the private sector is essential to the delivery process where local entrepreneurs can work closely with the utilities, politicians and utilities for community-sized regeneration.

- An integrated design approach

The study tour identified the need for a multidisciplinary, integrated approach in order to achieve ambitious targets. A combination of technical, non-technical and political disciplines is needed in order to realise deep cuts in CO_2 emissions. The most successful projects visited had taken this multidisciplinary approach. One of the key outcomes of the mission is the need for this interdisciplinary approach to the problem of climate change and the need to take action at the local to regional level. It is important to have the support and understanding of the local politicians and the wider community in order to achieve ambitious targets.

- Sustainable urbanism

Both the UK and Canada are trying to turn around their urban environments through their respective Sustainable Communities Plan and the New Deal for Cities and Communities. There is an opportunity for far more shared learning in this area, especially in the area of affordable housing. Community-led design can be a positive way of selling sustainability in new urban areas.

- Innovative procurement

Demonstrated examples of innovative procurement and delivery vehicles allowing real partnership between public and private investment on the community scale in Canada could be replicated in the UK.

- Community standards

LEED does not currently accommodate community-scale development. Canada appears to be struggling with issues similar to those in the UK in terms of how to develop targets and standards for communities as opposed to individual buildings. Toronto Community Housing Corporation is feeding back information to the US Green Building Council (USGBC) and the Canada Green Building Council (CaGBC) on the issues that are not really dealt with. For communities, LEED will need to be more localised, ie it needs to be adapted to make it more appropriate to the provinces with their wide range of climates and cultures.

- Enthusiasm for lifestyle sustainability

The mission learned of the importance of appropriate marketing and communication in raising awareness with the general public; of identifying what people like and how they like it; of building up public support by identifying issues the public can engage with. Canada has addressed climate change in terms that Canadians understand, such as air pollution, the urban renaissance, etc. The UK has begun to do this through its Climate Change Communications Strategy but should identify the issues that will further engage the UK population. As in Canada, this might include highlighting the potential loss of local environmental quality of life through environmental concerns such as pollution, GHG emissions, etc.

- The importance of marketing and communication

The guidance, case studies and encouragement aimed at municipalities, eg in Ontario, could be fruitfully cultivated by RDAs in the UK.

Sustainable building projects

- Performance assessment

The LEED performance assessment method for buildings developed in the USA has adopted a market-led approach and has achieved very rapid market penetration in Canada. This has been assisted by the creation and use of the accreditation process for professionals. The accredited professionals are well supported with guidance documentation and web resources from the USGBC. Valuable lessons from the way LEED has been implemented in Canada and the USA have been learned. These experiences should be reflected on by the Department for Environment, Food and Rural Affairs (DEFRA) to inform environmental performance assessment of buildings in the UK.

The LEED standard for low-rise residential developments has not yet been adopted in Canada and the use of this standard would help to reward developments achieving standards beyond minimum regulation requirements. The UK longer term experience of implementing the EcoHomes standard may be beneficial to Canada in this respect.

- Small-scale renewables

The UK has a strong lead in the use of small-scale renewable technologies. However, this has been mainly in terms of their specification, design and installation and not in their manufacture. The small UK industry in domestic combined heat and power (CHP), wind, heat pumps, solar thermal and photovoltaics (PV) should be supported so that a more mature industry can be developed that, in the long term, will be able to export to countries such as Canada.

- Construction materials issues

Reusable materials in the UK could be put on regional databases for easy local sourcing for specifiers and contractors as in Canada. In the UK it is currently done on a national basis.

- Practice-led research

Practice-led research should be stimulated by academics – there is a need for a dialogue between research and what industry needs. A key undertaking for the research community could be the identification of the 'lower hanging fruit', ie the energy efficiency and low-carbon technology 'quick wins' which will maximise cost benefits to contractors.

2 FRAMEWORK FOR A LOW-CARBON SOCIETY

2.1 Canadian national framework

Canada has an abundance of natural resources including significant reserves of oil, gas, timber and coal; it has a relatively small population that is highly concentrated into a small number of urban areas[5], leaving vast tracts of sparsely populated and more easily exploited land. It has a large and successful nuclear programme and it already has some of the largest hydroelectric power generation schemes in the world – in some provinces accounting for over 90% of its electricity consumption (see Exhibit 2.1 and Appendix A.2).

Despite all of this – a position that would be the envy of many industrialised countries – Canada signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. It has embraced the Kyoto Protocol and has now embarked on a national strategy to reduce GHG emissions and to move towards a low-carbon economy. Not only this, but Canada has a strongly federal system which significantly limits the powers of central government to use command and control, especially in the area of energy policy[6].

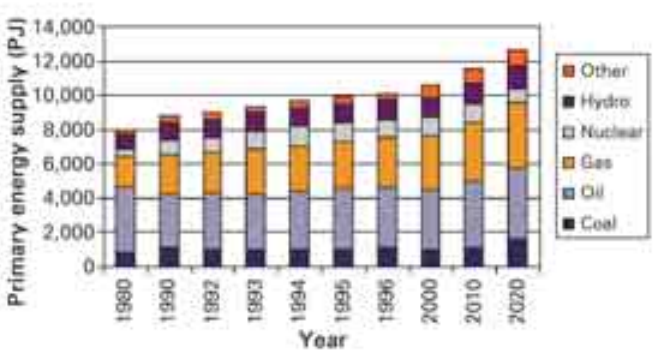

Exhibit 2.1 Primary energy supply: breakdown of sources in Canada, 1980-2020

Yet at every level of government and across all sectors there is, to varying degrees, action to increase energy efficiency and diversity of supply, and to reduce GHG emissions.

In these terms Canada should not work, but as Minister of State John Godfrey[7] stated: 'Canada doesn't work in principle but works in practice'.

Initially there would appear to be few parallels between the UK and Canada. The UK is one of the most densely populated countries in the world; Canada is one of the most sparsely populated, with half the population of the UK and over 40 times the land mass. However, there are parallels to be drawn between the two countries and significant opportunities for learning on both sides; in particular, there are opportunities for the UK to promote its knowledge, skills and services to Canada. Given this, the drivers for Canada to become a low-carbon economy would in

5 80% of total population live in urban areas

6 The Energy Council of Canada (ECC) summarises the split between federal and provincial governments as follows: *The provincial governments own the natural resources, and they are responsible for most aspects of regulation and energy sector development within their geographical boundaries. The federal government is responsible for harmonising energy policy at the national level, promoting regional economic development, frontier lands, offshore development, inter-provincial facilities, plus international and inter-provincial trade. Both levels of government are involved with energy research.*

7 Ministry of Infrastructure and Communities, which is responsible for the New Deal for Cities and Communities (NDCC)

many ways have to be stronger than they are in the UK. The next section looks at these national drivers and how they are being translated, through policy and strategy, to action at a provincial, city and municipal level.

Drivers for a Canadian low-carbon economy

Resource efficiency

Like many economies, and despite abundant natural resources, Canada recognises that increasing resource efficiency has an important role to play in improving its competitiveness in all sectors. By extracting more value out of a given resource, the final product or service can be delivered at reduced cost and sometimes with improved quality. That this may have an added benefit of helping to protect the environment is simply a bonus. Canada has had some success in decoupling growth from energy with a steady 1% annual increase in energy efficiency, with Canada now having the world's fourth fastest rate of increase of energy efficiency[8]. However, as a result of increasing growth in all sectors, actual energy use continues to grow.

Sustainable communities

In a close – and somewhat surprising – parallel with the UK, Canada is experiencing a decline in the quality of its urban environment. With a growing population concentrated into urban areas and with few opportunities to increase the capacity of transport and energy infrastructure to allow continued suburban sprawl, there is a recognition that there has to be an urban renaissance that begins to look at how communities can become more sustainable in the medium to long term. While the term 'sustainable communities' does not focus solely on GHG emissions, it does address issues around transport, energy production, distribution and consumption and health and is an explicit part of national Canadian policy and strategy[9]. Of possibly greater importance in the longer term is that this agenda begins the phase shift in community, local and national politics that makes action to reduce GHG emissions a real ambition.

Increasing energy costs

Like most economies, Canada is experiencing a period of increasing fuel prices. While fuel costs, especially petrol, are lower than in the UK, the recent relative high price is now having an impact on the public's perception about fuel efficiency, and a longer term view that low fuel costs are a thing of the past. Individuals and families are being reminded that Canada's huge natural resources do not isolate them from the longer term global trends.

Poor air quality

A number of Canadian provinces and many urban areas suffer from very poor air quality, a significant proportion of which is blamed on activity in the USA. This has resulted in a high level of awareness of the impacts of energy production, and in Canada a policy of closing down coal-fired power plants. Not only has this resulted in, anecdotally at least, a greater awareness of climate change issues amongst the general population, but also the creation of a pressure to find a substitute for coal-fired generation. Problems with pollution have also defined the language used by Canada in its climate change policy. There is little or no talk of carbon reduction; instead it is put in terms of GHG emissions, which means that Canadian policy tends to be more wide ranging than that in the UK.

8 NATURAL RESOURCES CANADA, 2005. *Improving Energy Performance in Canada – Report to Parliament Under the Energy Efficiency Act 2003-2004.* Natural Resources Canada

9 Both the Ministry of Infrastructure and Communities through the New Deal for Cities and Communities (NDCC) and the National Round Table on the Environment and the Economy (NRTEE) are addressing a broad sustainable communities agenda that includes these elements

International relations

This final point is a more subtle driver for Canada, but one that potentially is the most significant. Canada's relationship to the USA is sometimes defined by opposites. In the case of energy policy, the USA's reluctance to accept climate change as an urgent and immediate problem and refusal to ratify the Kyoto treaty has been one of the spurs for Canada's acceptance of one and ratifying of the other. The effect of US energy policy on air quality in Canada only serves to underline this.

Canadians also strongly believe that, as an international issue requiring global action, countries across the world need to take joint action to tackle climate change. The country is therefore committed to participating in international efforts to share and build new knowledge on how climate change can be addressed. As a developed country, Canada is also keen to lead the way in reducing GHG emissions through technological development.

Barriers to change

This is not to say that Canada does not have its share of barriers to large-scale carbon reduction. In addition to the almost universal issues of ensuring sustainable growth and competitiveness shared by most advanced industrial nations, for Canada to develop a national large-scale programme is in many ways counterintuitive. The abundance of natural resources is a very important part of the Canadian economy and has meant that those resources are relatively cheap and in no immediate danger of being exhausted.

The federal government structure in Canada also means that provinces have a high degree of autonomy and there is a very clear separation of powers over energy policy. It has meant that Canada has failed to develop many of the things taken for granted in the UK, such as buildings standards that apply across the country and that are enforced. Canada has a number of standards such as R-2000 and EnerGuide for (new) Housing that are not mandatory. In the case of R-2000, less than 400 homes are eligible of over 200,000 new house starts. However these barriers are well understood at a national level and, at the very least, in the case of the tensions between different governments being worked around, and in other cases being turned into opportunities.

National Canadian policy and strategy

The ratifying of the Kyoto Protocol by Canada in 2002 means that it now has a firm target for a reduction in GHG emissions of 6% below 1990 levels in the period 2008-2012. The setting of this target guides many of Canada's policies, strategies and choice of delivery vehicles. A great deal of activity predates this (see Exhibit 2.2) but is set against a background of increasing emissions (see Exhibit 2.3 and Appendix A.1).

Year	Action
1973 and 1979	Energy conservation and renewable energy sources promoted
1990	New set of federal measures to encourage investment in corporate and consumer efficiency and alternative energy (EAE)
1992	Canada signed and ratified UNFCCC
1997	UNFCCC in Kyoto, Japan, agreement to reduce GHG emissions to below 1990 levels
1997	The federal budget provided C$60 million over three years for new initiatives to improve energy efficiency in new commercial buildings; encourage commercial building retrofits; provide for energy performance assessments of houses; and stimulate demand for cost-effective, commercially available renewable energy systems for space and water heating and cooling
2000	Funding renewed and further extended to March 2006
2002	Canada ratified the Kyoto Protocol

Exhibit 2.2 Timeline of GHG emission reduction actions in Canada, 1973-2002

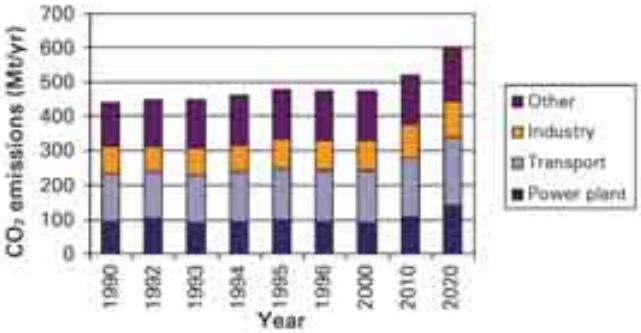

Exhibit 2.3 CO_2 emissions by sector in Canada, 1990-2020

At a national level there are three main bodies that are driving forward GHG emission reduction in Canada:

- The federal government
- Natural Resources Canada (NRCan)
- The National Round Table on the Environment and the Economy (NRTEE)

While the federal government has been the main driver for adopting a GHG emission reduction strategy, the main vehicle for delivery of this has been NRCan. The role of NRTEE is more subtle but potentially very important. Although established by the federal government, it provides a forum to 'think the unthinkable' and by doing so helps to develop the long-term strategy for Canada, as well as keeping the short and medium term targets and goals 'honest'.

The Canadian position has seen a radical change in a relatively short period of time. For a number of years there was a move to deregulate which included blocking standards for buildings, regardless of sectors which inevitably had an impact on the energy efficiency of domestic, commercial and industrial buildings. More recently, Canada has committed itself to a wide ranging strategy to reduce GHG emissions beginning with the first in a series of Climate Change Action Plans (CCAPs) in 2002. These have outlined the national strategy, set targets and put in place funding to help deliver them. The approach taken reflects all of the drivers outlined above and addresses climate change in terms that relate to the Canadian experience, and is summarised in the 2005 plan as follows:

'Our Climate Change Plan will contribute significantly to cleaner air for Canada's cities, enhance biodiversity, help to preserve wild spaces and generally improve the quality of life for Canadians.'

The plan is couched heavily in terms of air quality, the outdoor environment and quality of life – all of which are real issues for a large proportion of Canadians, but the plan itself is very much focused on the Kyoto targets and GHG emission reduction. The actual approach taken to delivering this again reflects the concerns of the Canadian economy and political structure by highlighting the benefits of the plan in improving competitiveness; using market forces not market intervention to deliver change; developing a 'partnership' approach among Canada's governments to try to resolve the tension between national, provincial and municipal government; engaging citizens through programmes such as the One Tonne Challenge (see Section 2.4); creating sustainable agriculture and forest sectors which still represent important industries in Canada; and finally creating sustainable cities and communities.

This approach comprising the six elements above is supported with federal investment of ~C$10 billion through to 2012, primarily delivered through the following funding routes:

- The Climate Fund: C$1 billion
- Partnership Fund: C$250 million, possibly rising to C$2-3 billion
- Renewable Energy: C$200 million for the Wind Power Production Incentive (WPPI), C$100 million for the Renewable Power Production Incentive (RPPI) and C$300 million for tax incentives for efficient and renewable energy generation
- Programmes: C$2 billion for existing climate change programmes

These initiatives are estimated to have the potential to reduce annual GHG emissions by ~270 $MtCO_2$ (equivalent) in the 2008-2012 timeframe, ie fully address Canada's 'Kyoto Gap' as described in Appendix A.1.

It has been NRCan's responsibility over the last ten years to deliver many of the national energy efficiency programmes. NRCan has a dual role in being responsible for both the use of Canada's natural resources as an important part of the economy, and energy efficiency – a combination that does not always fit easily[10]. One senior politician characterised its approach as being continuingly 'suck and blow'. The breadth of its energy efficiency programmes cannot be denied – they cover housing, buildings, industry, transportation, renewable energy and programmes to tackle federal in-house action as well as intergovernmental cooperation.

Many of these programmes are delivered by a further range of organisations including the Office of Energy Efficiency (market transformation and alternative transport), CANMET (Energy Technology Centre and the Mineral Technology Branch (R&D)), the Electricity Resources Branch (market transformation initiatives for renewable energy) and the Science Branch of the Canadian Forest Service (R&D in the use of forest biomass for energy).

The final key national organisation NRTEE was established in 1994 and is 'dedicated to integrate environmental preservation and economic development, in order to sustain Canada's prosperity and secure its future'. It is currently the only crown agency that reports directly to the Prime Minister who in turn directly appoints its 24 members, drawn from leaders in business, the community and academia. While it does have a broad environmental remit, it has been asked to identify how Canada can meet its Kyoto obligations in advance of it hosting the 2005 Conference of the Parties (COP 11) in Montreal at the end of November.[11]

Case study: the New Deal for Cities and Communities

If there is one programme that illustrates the Canadian approach to GHG emission reduction it is the New Deal for Cities and Communities (NDCC). This federal programme is based on the top slicing of federal gas tax revenue which goes directly from federal government to the municipalities (mainly urban areas), largely bypassing the provinces.

The funding is substantial, starting at C$600 million in the first year and rising to C$2 billion annually. It has the aim of government working collaboratively and in harmony in four priority areas of sustainability – environmental, economic, social and cultural – through a number of programmes including infrastructure renewal and the Green Municipal Fund (GMF). Although the funding goes directly to the municipalities, it has been the job of the Ministry of Infrastructure and Communities to get the cooperation and agreement of the provinces on their overall allocation of resources and programmes.

The NDCC is a GHG programme, but it is set within a broader agenda of sustainable development that addresses air quality, urban renaissance and strategy, transport, infrastructure and housing. It highlights the challenges facing Canada – reversing urban decline, limiting suburban sprawl, how to effectively engage provinces and how national GHG targets can be met through local action.

Exhibit 2.4 Case study: the New Deal for Cities and Communities

10 Energy production remains a significant part of the Canadian economy – 6.5% of GDP and in 1997 over C$27 billion in exports

11 The NRTEE initial strategy will: (1) Provide general direction on how Canada can achieve deep and long-term GHG reductions while positioning itself for maximum economic benefit; (2) Recommend short-term policies for long-term reductions in GHG emissions; (3) Examine the contribution of both domestic and international actions, using other aspects of NRTEE's energy and climate change reference; and (4) Supply a set of metrics to help track Canada's progress towards a low-carbon economy and compare its economic and environmental performance to that of other countries.

While there may be a question mark over the independence of a body that is directly appointed, it appears that the seniority and experience of NRTEE appointees means that there is a real determination to provide independent and robust advice to government. This role is going to be vitally important if Canada is to take the long-term view needed to meet Kyoto targets and deliver the improvements in resource efficiency to enable to it become a low-carbon economy.

Canadian and UK national perspectives

In many ways the UK and Canada are coming from very different perspectives, but are moving towards the same point. Canada has a federal system that does not lend itself to top-down target setting, but is having to find new ways to ensure that the autonomy of the provinces does not become a barrier to meeting Kyoto targets. The UK has always been characterised by a highly centralised system with the majority of power and resources held by central government. Since 1997 this has changed, with establishing of the Scottish Parliament, the Welsh Assembly and the English Regions. This has created a new challenge for the UK to continue to meet its Kyoto targets, but through a much more devolved system of government. In both Canada and the UK there are new tensions between national and regional government to be resolved if the aim of both countries to have a low-carbon economy is to be met.

In both countries there are some very similar drivers over and above Kyoto targets that are helping to move the agenda forward. While Canadian energy prices are lower than in the UK, both are being subjected to long-term global trends that will see substantial fuel price increases, at least in the short to medium term. Both countries recognise that increasing resource efficiency can lead to real gains in competitiveness in all sectors and help to secure long-term sustainable growth.

Similarly there are very close parallels between the two countries in the challenge facing the urban environment. The move to the suburbs – and in the case of the UK, the countryside – has resulted in a poor urban environment that is under-resourced, under-populated and in long-term decline. Despite this, it is the urban centres which remain the major engines of growth in both countries; even more so in Canada where they account for over two thirds of its GDP.

The drivers for Canadian action, such as air pollution, combined with the very real tensions between governments, has also led to the use of more ambiguous language in policy. Again this contrasts with the UK which has a clear carbon reduction policy, firmly grounded in baseline improvements in energy efficiency and further changes in the diversity of energy supply. In the medium to long term the Canadian approach, while fully understandable, may result in less-effective strategies.

The gap between the two countries in the broader development of sustainable communities is much smaller. There are some similarities between the Canadian New Deal for Cities and Communities (NDCC) and the UK's Sustainable Communities Plan (SCP), both of which are trying – at least in part – to see the renaissance of the urban environment. The further investment in the UK in the growth areas also provides an added opportunity for the UK to develop leading-edge understanding of how to develop new communities that are sustainable economically, environmentally and socially. *The challenge of the urban renaissance is a substantial mutual learning opportunity for both countries and should be developed.*

The approach to carbon reduction in the UK has had a number of advantages that may have some potential to be developed into commercial opportunities in Canada. In many ways the UK has developed strategies, processes and products to deliver carbon reduction that have been developed much more than those in Canada. The introduction of energy efficiency elements into the building regulations since the 1970s gives the UK more experience of how this can be done effectively. Despite standards in Canada such as R-2000, it no longer represents the leading edge in energy-efficient design in the domestic sector.

With rating tools such as Standard Assessment Procedure (SAP), National Home Energy Rating (NHER), EcoHomes and the soon-to-be-introduced Code for Sustainable Buildings (CSB), the UK has far more experience, knowledge and capacity to deliver carbon reductions in the domestic sector. However, it is the Canadians who have identified the commercial opportunities and are now working with UK building companies to use the R-2000 standard. This characterises the approach of the Canadians that has emphasised the economic benefits and business opportunities of the low-carbon economy from the very beginning. The UK should learn from this and work to identify how it can develop more commercial opportunities in the future.

Canada has been moving towards the deregulation of energy markets for a number of years but does not appear to have done so with the same conviction as the UK. Concerns have been expressed about the impacts of deregulation in the UK, but it has been seen by many as a success. With the introduction of a robust regulatory regime and strategies such as the Energy Efficiency Commitment (EEC) and the Renewables Obligation, the UK is to a much greater degree using the market to help deliver broader, national policy objectives including carbon reduction. Similarly the UK has been at the forefront of developing emissions trading, which remains in the pipeline in Canada. At the very least this should be an opportunity for shared learning and may represent further commercial opportunities for the UK.

In terms of specific technologies, the UK's small funding programmes to promote the use of domestic and community-scale renewables, while not producing the cost reduction or manufacturing capacity hoped for, has led to the development of capacity, skills and knowledge in the design and installation of these technologies. This, combined with better building standards, may represent an opportunity for UK business in Canada. The exception to this is in ground-source heat pumps which are used far more widely in Canada and are beginning to penetrate the UK heating market. There are some potential learning opportunities from the Canadian experience for the small number of UK heat pump manufacturers.

In many ways the UK is much further down the road to delivering large-scale carbon reductions than Canada. Some of this is the result of having a more centralised system of government, but also reflects more pressing issues in the UK including energy supply, urban decline and resource efficiency. However, as a result of this, there are some opportunities for UK businesses to develop commercial opportunities in Canada in areas such as energy assessment tools in the domestic and commercial building sectors; small-scale renewables; and emissions trading. There are also some significant learning opportunities for both countries in areas as diverse as the urban renaissance, energy market deregulation and the development of national, regional and sectoral strategies and policies to deliver large-scale carbon reductions.

2.2 Regional and subregional perspectives

Canada operates a federal (national), provincial (regional) and municipal (local authority) system of government, across which complex relationships exist. Federal government has responsibility for achieving the Kyoto target for Canada, yet has only limited control over a large number of the policy areas that need to be aligned to achieve the targets. Municipal governments are often referred to as 'creatures of the province', and although municipalities have political autonomy, the majority of their income is derived from provincial funds and their decision-making boundaries set by provincial policy. Provincial government therefore holds a key role to delivering a low-carbon economy in Canada.

The ten provinces and three territories are represented by elected parliaments, which have tax-raising powers through the Provincial Service Tax (PST). The provinces in Canada vary enormously in size, wealth, and population levels and densities. As Exhibit 2.5 indicates, over 60% of the population of Canada lives in just two provinces (Quebec and Ontario) and over 60% of Canada's land area is contained in just four provinces (Northwest Territories, Nunavut, Quebec and Ontario). Provincial population density does not exceed 25 people per km^2 in any of the Canadian provinces, and in Nunavut this figure is less than 0.02 people per km^2. This disparity means that there are great differences between the resources available to different provinces to deliver a low-carbon economy.

The larger provinces have a structure similar to federal government, with a number of departments having conflicting positive and negative impacts on delivery of low-carbon development. Typically, the infrastructure and planning departments have the greatest potential influence over carbon emissions. A more detailed look at the response of the Ontario provincial government is outlined below.

In addition to the provinces, some of Canada's larger municipalities have grown in power over the years. There has been a policy of amalgamation of some of the smaller municipal governments within large metropolitan areas into single large municipal governments. This has increased the powerbase of certain municipalities leading to a situation where all but four of the provinces are smaller than the three largest municipalities.

Regional and subregional actions for carbon reduction in Canada – case studies

The following case studies are discussed:

- Ontario Building Code
- Toronto and Region Conservation Authority
- Greater Vancouver Regional District
- Ontario Sustainable Energy Association
- University of Toronto at Mississauga

Ontario Building Code – an example provincial building code

The following text has kindly been provided by James Douglas, Manager Code Development, Legislation & Appeals, Building and Development Branch, Ministry of Municipal Affairs & Housing.

The Ontario Building Code (OBC) is a regulation under the Building Code Act 1992 and establishes minimum requirements that must be met when buildings are constructed, renovated, or undergo a change of use. The OBC sets out technical requirements for buildings, plus administrative requirements governing the building regulatory process. These requirements are uniform across the Province of Ontario. Conditions in existing buildings, where no work is proposed, are governed by municipal property standards bylaws and the Fire Code.

	Population		Land and freshwater area (km^2)				
	April 1 2005	% of total population	Total area	Land	Fresh water	% of total area	Density (people/ land km^2)
Canada	32,146,547	100	9,984,670	9,093,507	891,163	100	3.54
Newfoundland and Labrador	515,946	1.60	405,212	373,872	31,340	4.1	1.38
Prince Edward Island	137,774	0.43	5,660	5,660	0	0.1	24.34
Nova Scotia	936,921	2.91	55,284	53,338	1,946	0.6	17.57
New Brunswick	751,247	2.34	72,908	71,450	1,458	0.7	10.51
Quebec	7,577,080	23.57	1,542,056	1,365,128	176,928	15.4	5.55
Ontario	12,482,980	38.83	1,076,395	917,741	158,654	10.8	13.60
Manitoba	1,176,132	3.66	647,797	553,556	94,241	6.5	2.12
Saskatchewan	995,085	3.10	651,036	591,670	59,366	6.5	1.68
Alberta	3,236,906	10.07	661,848	642,317	19,531	6.6	5.04
British Columbia	4,232,507	13.17	944,735	925,186	19,549	9.5	4.57
Yukon Territory	31,277	0.10	482,443	474,391	8,052	4.8	0.07
Northwest Territories	42,957	0.13	1,346,106	1,183,085	163,021	13.5	0.04
Nunavut	29,735	0.09	2,093,190	1,936,113	157,077	21	0.02

Exhibit 2.5 Population and densities of the Canadian provinces[12]

Technical standards

The Canadian Commission on Building and Fire Codes (CCBFC), with the support of the National Research Council (NRC), develops the model National Building Code (including the Model National Energy Code for Houses (MNECH) and Model National Energy Code for Buildings (MNECB)). However, building regulation in Canada is a provincial responsibility. The federal government has no authority over building regulation and therefore the model National Building Code can only take effect when adopted, either in whole or part, by a provincial government.

The OBC is based on the model National Building Code but contains additional requirements to address unique provincial priorities and includes distinct requirements for public health and safety, accessibility, conservation and environmental integrity with respect to buildings, including on-site sewage systems, and energy efficiency. Ontario is the only province in Canada to mandate energy efficiency in its own building code by referencing the MNECB. It also references the ASHRAE 90.1 energy efficiency standard. However, the OBC does not reference the MNECH but has prescriptive requirements (eg minimum insulation levels for the building envelope of small residential buildings).

12 Adapted from tables found on *www.statcan.ca/Daily/English/050629/d050629d.htm* and *www40.statcan.ca/l01/cst01/phys01.htm*

Enforcement

Ontario's Ministry of Municipal Affairs and Housing (MAH), through its Building and Development Branch, is responsible for administering the Building Code Act 1992 and the Building Code. The Branch is also responsible for the following:

- Code development and policy support
- Code interpretation services
- Development of technical training
- Qualification and registration of a broad range of building practitioners
- Support to the Building Code Commission, which hears disputes over compliance with the Building Code
- Support to the Building Code Materials Evaluation Commission, which approves new innovative products

Municipalities are primarily responsible for Building Code enforcement. Under the Building Code Act 1992 they are required to appoint a Chief Building Official and as many inspectors as necessary.

Code harmonisation

In recent years MAH and its counterparts in other provinces/territories have worked with the NRC on ways to minimise the differences between the model national code and provincial building codes to eliminate duplication in code development. Among these initiatives was the development in 2003 of a joint consultation process for national and provincial codes, providing for a single consolidated consultation on both proposed national code and provincial code changes. In 2001 the Provincial/Territorial Policy Advisory Committee on Codes (PTPACC) was formed to provide policy advice to the CCBFC, and includes senior level representatives from provincial and territorial ministries responsible for building and plumbing safety regulation.

Next edition of the Building Code

The Building Code is subject to regular review, with the current edition dating from 1997. MAH, through the CCBFC and the PTPACC, has been participating in the coordinated code development process towards the next edition of the model National Building Code, expected for introduction in late 2005.

Ontario expects to release its new OBC, which will reflect changes made at the national level, in 2006, subject to government approval. In the current code cycle, the model National Building Code and the provincial codes are moving to an objective based code format. The direction in Canada towards these new codes reflects an international trend.

The current Building Code is a mixture of prescriptive and performance requirements. For most building projects, determining what is required and acceptable under the Code is straightforward. However, the Code does not explain why specific requirements exist and what they are intended to achieve. The lack of background information can complicate the approval and acceptance of new or innovative designs, materials or building techniques.

An objective-based Building Code would contain the current requirements but also provide additional information on the objectives and the scope of application related to every code provision. This additional information is intended to make it easier to interpret and apply the Code by clarifying why the Code says what it does. The new Code would facilitate proposals for innovative and/or cost-effective building solutions. Energy efficiency would be one of the objectives of an objective-based Building Code.

In addition to the format change, the next edition of the code may include technical changes that were consulted on, along with the objective-based format, in the spring of

2003 and reviewed by Ontario's Building Code Technical Committees. No significant changes are currently being proposed for the next edition of the Building Code, but the government of Ontario has established electricity conservation and GHG emission reduction as priorities.

Changes to the Building Code, whether as part of the regular code cycle or at points during the cycle, are usually consulted on with a wide range of stakeholders including:

- The municipal sector: building officials and the Association of Municipalities of Ontario
- The construction sector: home builders and general contractors
- The design sector: engineers and architects, interior designers, engineering and architectural technicians
- Product manufacturers
- Other interested parties such as consumer groups and the disabled community

MAH approach

MAH's approach has consistently been to take provincial priorities and directives to its stakeholders for consultation in order to understand the potential implications of policy decisions before they are made.

In doing so, MAH is better positioned to identify barriers, as well as mechanisms that can help to remove barriers to compliance, or facilitate a transition to full compliance (eg phased-in or incremental approach to policy development and implementation; additional training programmes to help builders, developers, designers and building officials better understand and uptake new regulations and policy directions). Additionally, consultation and information sharing at key points in the policy development/ implementation process allow MAH to bring stakeholders into that process and ideally establish buy-in and support before the regulations take effect.

Toronto and Region Conservation Authority

As noted elsewhere, Canadian policy to deliver a low-carbon economy is constrained by a lack of federal control over some of the most important policy levers, and further hampered by recent rapid suburbanisation. However, Canadians are proud of their natural landscape, with many people enjoying outdoor pursuits. Members of the public that we met on this mission were aware of general environmental issues, with some even conversant with international climate change policy. Even given this good level of awareness, there was less appreciation of how their actions impact on the climate and what steps they could take to reduce this impact.

The Toronto and Region Conservation Authority (TRCA) has recognised all these factors and has built a successful business out of linking environmental solutions to the natural environment. Established in 1957, TRCA manages the renewable and natural resources within an area of some 3,467 km^2, comprising nine watersheds, six participating municipalities, and housing ~3,200,000 people. TRCA has a core vision to promote 'a new kind of community – the Living City – where human settlement can flourish forever as part of nature's beauty and diversity'. The concept of the 'Living City' is built upon a natural foundation of healthy rivers and shorelines, greenspace and biodiversity, and sustainable communities. One of the reasons that TRCA flourishes is that it receives support (both financial and intellectual) from all levels of government, from municipal, through provincial to federal.

In addition to working to protect land and water resources, TRCA operates 11 parks and visitor centres, attracting 700,000 visitors annually. The Kortright Centre, situated about ten minutes north of Toronto and set in 350 ha of woodland, waterways and open

ground in the Humber River Valley, is one of the longest established and most sustainable of these centres. Over 130,000 people are attracted annually to the Kortright Centre by the natural environmental education programmes on offer, with the majority of visitors coming from local schools. Increasingly, however, Kortright is focusing on sustainability, and particularly low-carbon living, as an attraction in its own right.

The Power Trip Trail

The Kortright Centre has worked with renewable energy for over 20 years, but has seen interest in this rocket recently. In response, the centre has started to run a number of theoretical and practical courses for both children and adults, and has recently developed a 16 km energy trail housing one of Canada's largest demonstrations of renewable energy technologies. Along the trail are demonstrations of solar thermal installations, a selection of small-scale wind turbines, different photovoltaic (PV) systems, a biomass demonstration and a renewable energy cottage with integrated renewables and energy efficiency on one site.

Buildings

The Kortright Centre has a small number of publicly accessible buildings on site, and over the last few years has concentrated on integrating sustainable building principles with new builds. Notable examples of this include the GreenWorks and the Earth Rangers Centre.

The GreenWorks highlights three main areas of sustainable technology through its design and function: resource efficiency, wastewater treatment and renewable energy. The shell of the building is entirely constructed from

Exhibit 2.6 The Centre for Sustainable Living at the Kortright Centre

Exhibit 2.7 The GreenWorks building at the Kortright Centre

recycled steel and is designed to be thermally and electrically efficient. Inside, it houses a state-of-the-art working demonstration of how a wetland system naturally treats wastewater, not only providing an educational tool but also providing a cost-effective solution to dealing with sewage on site. Finally, the building uses passive solar design, aided by ground-source heat pumps and solar water heating to provide heat in the winter and to dump heat in the summer, and it has a 4 kWp PV array (designed to provide summer shading) to provide all electrical demands with some spare for the main visitor centre.

The new Earth Rangers Centre houses a small theatre, interactive educational displays and one of the world's most specialised wildlife centres and veterinary hospitals and will add another attraction to inspire Kortright's visitors. The building has been designed to fit with Kortright's sustainability principles by aiming to achieve a LEED 'Gold' rating. The centre has many unusual features, including nine 20 m long concrete Earth Tubes buried below the frost line to pre-temper the air prior to entering the building's air-handling unit; a 50% reduction in lighting energy requirements provided by north-facing skylights which are also used to accommodate solar panels for heating domestic water; and it is one of the first 100% radiant heated and cooled buildings in North America.

Outreach

The Kortright Centre uses the reputation that it has in the local community to forge links to local schools, business and healthcare facilities to provide assistance to others to better manage their carbon emissions. It is this approach that really makes it stand apart from other similar initiatives and ensures that its sphere of influence extends well beyond the boundaries of its site.

The Living City Centre Initiative

The Kortright Centre now has ambitious plans to engage leadership in bringing the community together to transform greater Toronto into one of the most sustainable city regions in the world. This will be focused around the Living City Campus – the existing Kortright buildings, supplemented by new onsite and offsite partner buildings – and the Living City Centre. The Living City Centre will be designed to be a catalyst for sustainable demonstration by demonstrating the best in sustainable technology and techniques and aims to achieve a LEED 'Platinum' designation. It will form the command centre for the final strand in the Living City Centre Initiative – that of Community Transformation. This will be a collaboration between business, government and society at large that will create and deliver programmes to achieve substantial improvement in the sustainability of the city region.

Exhibit 2.8 School outing at the Kortright Centre

Greater Vancouver Regional District

The following case study demonstrates that large-scale action is being taken across many areas of Canada and not just in the Province of Ontario.

The Greater Vancouver Regional District (GVRD) in British Columbia is a partnership of 21 municipalities and one electoral area, serving a population of 1,986,965 and an area of 282,066 ha. Greater Vancouver is the third largest region in Canada with a population which is steadily rising, from 950,000 when GVRD came into existence in 1967, to almost 2 million today.

GVRD has a responsibility for the supply and treatment of potable water, the collection and treatment of waste water, the management and disposal of solid wastes, air quality, management of development growth, regional parks and affordable housing and is therefore in a key position to influence and champion sustainable growth in the region.

Almost a decade ago (1996) GVRD adopted its strategic plan with a vision of a compact, livable metropolitan region, envisaging 'cities in a sea of green'. The region has a long tradition of protection – agricultural land, mountains, forests and waterways – and the Livable Region Strategic Plan is intended to protect the green zones to achieve a compact metropolitan region with individual, higher density, 'complete' communities concentrating growth in defined urban areas to support increased transport infrastructure. Being able to 'live, work and play' within the community and 'age in place' are the two aims which continue to resonate most strongly with the public.

A key component of this work is the ongoing development of the Metropolitan Core and eight interconnected Regional Town Centres across the region. These major centres are complemented by a number of smaller, local serving Municipal Town Centres. Each Regional Town Centre has a unique character and offers a range of housing types, tenures and prices, with shopping, entertainment activities and jobs nearby or accessible by a short transit or car trip. Safe, attractive streetscapes and public spaces will encourage people to walk and cycle around the centre.

The Sustainable Region Initiative aims to create a framework and action plan for Greater Vancouver based on the concept of sustainability which embraces economic prosperity, community wellbeing and environmental integrity.

In 2002 Vancouver was the focus of the cities^{PLUS} (or cities Planning for Long-term Urban Sustainability) initiative[13] – exploring what cities would look like in 100 years. The initiative developed a sustainability plan for the city in a project that involved 500 experts and participants from 30 cities across Canada and discovered that the longer timescale suggested different choices are required now, with integration across urban systems revealing alternative creative solutions. This two-year-long exercise culminated in Team Canada being awarded the Grand Prix at the international Sustainable Urban Systems Design competition in Tokyo in June 2003. Since the win, the cities^{PLUS} legacies continue to live on through a number of activities and initiatives coordinated by the original partners.

Bridging to the Future, initiated by the International Gas Union (IGU), will develop long-term plans for five urban areas from around the globe[14]. An international project, it is intended to help urban regions manage the difficult transition to sustainable energy systems. A successful transition requires long-term, integrated planning for all urban systems, and making the best use of existing resources. The pathway for each city will integrate urban and energy planning in the context of different scenarios for energy costs. A desirable pathway will use natural gas and other fossil fuels as a bridge to renewable energy and sustainable urban systems. Pathways define the steps and directions to achieve a resilient energy infrastructure over the next 40 years.

In the first stage of the project, The Sheltair Group, based in Vancouver, is adapting its tools for modelling and visualising energy plans to make use of emerging energy technologies and to produce indicators and benchmarks to be used internationally. This study will engage a range of participants from GVRD, Canadian energy utilities, and the IGU. Subsequent stages of the project will be collaborative engagements with international teams from diverse locations. The final result will be a suite of rigorously comparable case studies that demonstrate collaborative development by metropolitan regions to develop energy pathways leading to long-term urban sustainability.

GVRD is attempting to align performance indicators where possible to the internationally recognised sustainability reporting guidelines developed through the Global Reporting Initiative (GRI).

Within the context of the longer term plan for sustainability, GVRD has a series of initiatives to enable action to be taken ‘on the ground’ and these are supported by GVRD’s resource for advice on sustainable building solutions – BuildSmart[15]. Against a background where building codes are ‘life safety’ rather than ‘energy and environment’ focused, this resource offers guides to green construction and best practice, advice on waste recycling, demolition and salvage and sustainable products as well as advice on LEED. GVRD is working to encourage the use of LEED by demonstrating lasting value and developing increased professional and investor understanding.

The concept of ‘smart growth’ envisaged in the strategic plan is not only about design and construction but also encourages more eco-efficient business practices.

13 *www.citiesplus.ca*

14 *www.bridgingtothefuture.com*

15 *www.buildsmart.ca*

For instance, SmartSteps is a programme of tools, technical assistance and information to help businesses become more eco-efficient and more competitive. The goal is to help organisations to find specific, cost-effective actions which can be taken to reduce the amount of materials and energy they use. In turn it is hoped to encourage the development of sustainable products and services. Sustainable energy systems are being encouraged with the use of waste to generate energy for industrial processes or for district heating systems supplemented by geo-heat-exchange systems.

Whether the 'smart growth' and 'livable region' initiatives deliver will remain to be seen. The planned density of 33-55 persons per hectare (pph), increasing to 85 pph in the defined concentrated centres, compares with moderate densities envisaged in the UK[16] of up to 175 dwelling units per hectare in urban locations. This may impact on the urban centres' ability to support improved transport choices. GVRD has recognised problems with the tax regime which does not discourage 'out of town' office developments which therefore continue to rely on individual and often single-occupancy vehicles for access. At the same time, Greater Vancouver has experienced limited investment in alternative forms of transportation and there has been little growth in usage over the last ten years.

Ontario Sustainable Energy Association

Ontario Sustainable Energy Association (OSEA) is an association of groups and individuals working to develop community-scale renewable energy projects across the whole of the Province of Ontario. OSEA's mission is 'to facilitate the transition to a sustainable energy economy in Ontario through the development and support of community-based energy initiatives'. A fundamental concept is that communities are the largest scale at which people feel personally connected and capable of collaborating to achieve meaningful change.

OSEA grew out of the Toronto Renewable Energy Co-operative (TREC). TREC was established in 1997 with the express aim of installing a large urban wind turbine in Toronto. After five years of hard campaigning, TREC managed to secure the legal go-ahead, planning permits, electricity resale contracts

Exhibit 2.9 Wind turbine at Exhibition Place, Toronto

16 LLEWELYN-DAVIES, 2000. *Urban Design Compendium*. English Partnerships

and developer partnership to install the first large urban wind turbine in North America. This turbine is now operating in Exhibition Place (Exhibit 2.9), generating 1,400 MWh of power per year. During the development process, TREC received enquiries from many other communities across Ontario interested in learning from TREC to replicate its success in their own communities or to share their own experiences with TREC. This led to the establishment of OSEA in 1999 to provide an umbrella organisation working to build a network of communities to enable groups to pool efforts.

OSEA now has 16 full members representing communities right across the Province of Ontario. It is able to provide help and advice to these organisations to give them the skills and capacity to effectively design renewable energy systems suitable for their localities. OSEA is an independent non-governmental organisation (NGO), but with the ability to attract charitable and governmental funding to support the development of renewables across the region. It operates on the interface between technical feasibility and social acceptance; and through a strong track record of delivery, OSEA has good links to provincial government and a voice at the federal level.

In order to expand their area of influence, the driving forces behind OSEA secured a C$100,000 grant from the Trillion Foundation to promote the concept of community renewables across Ontario. This generated great excitement and resulted in ten additional communities developing groups to deliver renewable energy projects within their localities. It is this outward looking nature of OSEA's work that enables it to achieve so much. This loose partnership of driven individuals and communities has a wealth of practical experience, a desire to collaborate and share knowledge, and the vision to realise that so much more can be achieved by making that pool of knowledge and inspiration available throughout the province.

University of Toronto at Mississauga

The University of Toronto at Mississauga (UTM) is a campus university occupying a heavily wooded 225 acre (~91 ha) site in the Credit River Valley on the outskirts of Toronto. Thanks to a legacy of careful stewardship, much of the campus remains undeveloped despite great pressure to expand. That sense of stewardship has evolved into a defining value for the UTM community and is one of the guiding principles contained in the campus Master Plan. UTM is determined to prove that rapid expansion and development can be accomplished in an environmentally sensitive and responsible manner. *Grow Smart, Grow Green* is the banner under which UTM's comprehensive, sustainability initiative was launched.

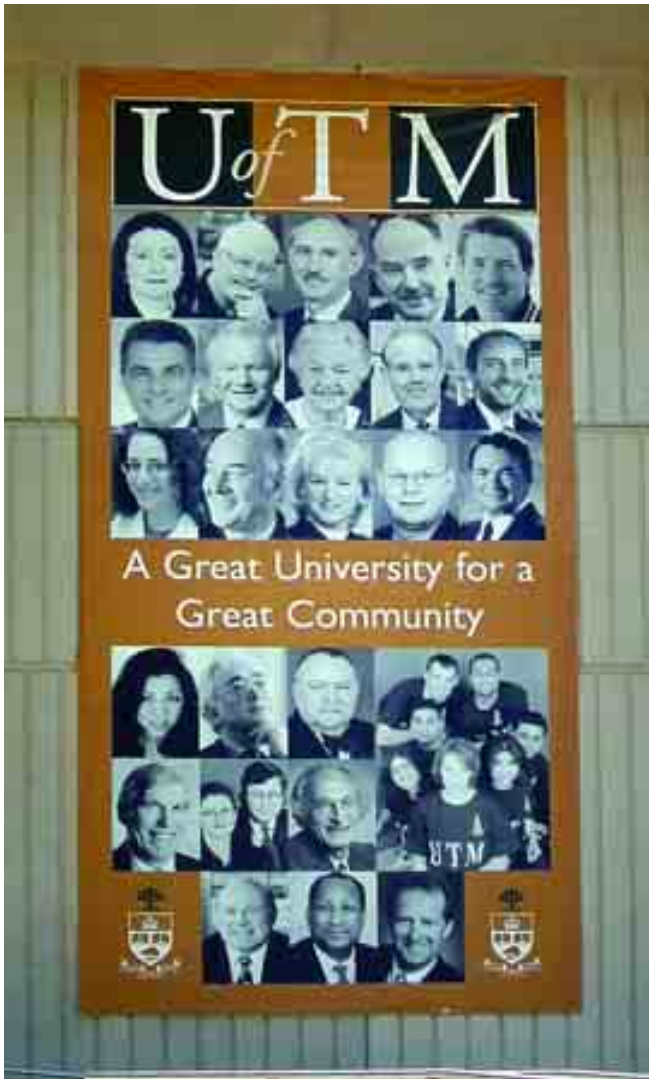

Exhibit 2.10 Welcome banner at UTM

Exhibit 2.11 Photovoltaics at UTM

UTM recently established the Centre for Emerging Energy Technologies (CEET) as a platform upon which research, teaching and public education initiatives may be built. CEET has become actively involved in realising the *Grow Smart, Grow Green* vision and has successfully developed a number of initiatives to promote low-carbon technologies. These include the installation of high efficiency microturbines to provide heating/chilling and electricity, two solar demonstration installations and the establishment of the Hydrogen Village.

The Hydrogen Village – a virtual partnership – is a pioneering collaboration of industry, government and the academy that is determined to accelerate the commercialisation of hydrogen and fuel cell technology in Canada. As a founding member, UTM has played a vital role in developing a framework document that gives substance to the concept, and now has plans to install fuel cells within students' residences and on board a hybrid bus.

One of the most forward-thinking aspects of UTM's work has been the establishment of a corporate programme specifically focusing on student engagement. This is run by the Environmental Affairs Officer, herself a recent Mississauga graduate, and aims both to improve the environmental performance of the University by tapping into the enthusiasm of current students and to provide paid work experience to help students to move into environmental careers upon graduation. The programme is funded partially by the University, but all paid students are funded by the federal government Youth Employment programme that focuses on producing graduates with experience in the workplace. This programme pays students a wage above the minimum wage for up to 14 hours work a week on approved programmes. The UTM programme typically employs ten part-time paid student workers per annum, supplemented by many more unpaid student volunteers. Over the past year this programme has helped UTM to make significant progress towards the goal of a sustainable campus. Examples include:

- The award-winning BikeShare scheme where students can borrow bikes at no cost for both business and pleasure
- A student-led anti-litter campaign focusing on humorous but hard-hitting messages to encourage greater recycling
- Planting projects, focusing on native wildflowers and trees, integrated into student orientation to encourage greater care for the environment

The programme is now in the final stages of agreeing a deal with the Toronto transit provider that will make all local public transport fare-free for all UTM students in return for a small annual subscription.

Exhibit 2.12 BikeShare scheme at UTM

UTM has made a clear statement of intent regarding its approach to a low-carbon future. In addition to the education, demonstration and engagement programmes outlined above, all new developments on campus are to be built to follow LEED principles to ensure that emissions from the University are minimised in the future. The University clearly sees this approach as both a duty to provide local and global environmental stewardship, but also as a way to acquire a unique selling point to attract new staff and students to the institution.

Conclusion

The federal structure in Canada is not ideally suited to achieving emission reductions. The provinces are not bound by legal requirements to achieve emission reductions through Kyoto and therefore have no common motivation to contribute to a national target. The federal government is only now seeking mechanisms to pass this responsibility to provinces – until then the response from Canadian provinces will only slowly make progress.

The Building Codes are a good case in point. The responsibility for setting and implementing energy standards within the Building Codes lies with each individual province. The federal government has established a model Building Code, but it is entirely up to each province as to whether or not to implement this. The result is that many provinces have very low energy efficiency standards for new-build housing with no single standard operating across the country. This complicates matters for large-scale construction firms who need to ensure that they meet 14 different building standards across Canada. The voluntary nature of the codes also makes it difficult for individual provinces to specify codes that would achieve significant carbon reductions above the model code due to a fear that developers may see this as an added cost and simply develop elsewhere.

A strong parallel between Canada and the UK exists here. In the UK, regional assemblies are in the process of developing new Regional Spatial Strategies, many of which contain strong sustainability statements or even emission reduction ambitions. However, many regional assemblies feel that, even though legally they could stipulate higher energy standards than given in the UK Building Regulations, any attempt to do so unilaterally would undermine regeneration activities in the region as developers would choose to develop in neighbouring regions. There is no simple

answer to this, but a strong national lead is clearly required to assist regions or provinces to deliver sustainable developments.

The best examples of positive provincial actions to reduce emissions are provided by non-governmental regional and subregional organisations. These organisations are motivated by many factors, but one that seems to be ever present is care for the global environment stimulated by the love of Canada's natural heritage. Ontario Sustainable Energy Association (OSEA), Toronto and Region Conservation Authority (TRCA) and the University of Toronto at Mississauga (UTM) are all very different organisations but each is determined to connect with the Canadian environmental awareness to deliver a lower carbon future.

2.3 Local authority role – a bottom-up approach

The structure of government in Canada has been described in previous sections. With the majority of Canada's population living in large urban centres it is the large city municipalities that have a significant role to play in climate change. There has been significant restructuring of local government over the last several years, resulting in the creation of 'megacities' with powerful mayors.

There is a growing recognition that municipalities have a key role to play in GHG emissions, both directly in their operations and indirectly through influence. A good example of this is the set of guides and handbooks published by the provincial government of Ontario aimed at communities (municipalities) – *Building Strong Communities: Strategies for Cleaner Air*. These are supported by a set of case studies for cleaner air and are aimed at sharing learning and promoting good practice and change at the municipal level. This demonstrates some recognition that municipal bottom-up approaches are key to success.

The implementation of measures to address climate change at this level is variable and mirrors the picture in most of Europe. Good practice is found in some of the larger municipalities but there is still much scope for rolling this out across to city-wide action. An obvious step forward could be taken by all provincial governments emulating Ontario. The same kind of approach could be translated into the UK context if all RDAs and regional assemblies actively developed regional climate change strategies and encouraged all levels of local government.

Drivers and barriers for carbon reduction actions at a local level

The drivers for CO_2 emission reductions at a local level in Canada appear to arise from several directions:

- As a result of an understanding of the municipal role in achieving the national Kyoto target that the federal government is committed to.
- Local environmental problems, eg smog in Toronto[17].
- Pressure or incentives from an umbrella body or lobby group, eg the Federation of Canadian Municipalities with the Green Municipal Fund (see below).
- One-off local initiatives where CO_2 reductions are as a result of other objectives, eg affordable housing at Regent Park (see Section 3.3.3), animal protection and conservation at the Kortright Centre (see Section 2.2).
- Local political action and leadership, eg the Toronto Clean Air Partnership and Toronto Atmospheric Fun (see below).
- Significant growth in the population of big cities, eg in Toronto a population increase of 4 million is expected over the next 20 years.

The apparent barriers for local action to reduce CO_2 emissions are implicit from a number of findings of the mission team:

- Because of the governing structure of Canada, policies that are developed at federal level cannot be implemented consistently across, nor legislated at, a municipal level. This often means that there is little direction for carbon reduction from provincial or federal government. There is also a lack of integration in thinking and action across all levels of government.
- Municipal government is funded and largely controlled by the provincial level which presents some structural difficulties in implementing integrated climate change policies.
- In some cases there is lack of knowledge – on what needs to be done and how to integrate services effectively to achieve significant carbon reduction – at a level which could influence the actions of the municipalities, eg the Office of Energy Efficiency at a provincial level manages its housing and energy service separately[18].
- There appears to be ‘patchy’ or inconsistent leadership across the municipalities.
- Local authorities have limited powers and resource to regulate, meaning that they have little incentive to develop actions that require policing or monitoring. Most building codes are therefore voluntary.
- Canada has ratified the Kyoto Protocol, but there appears to be no direct translation of the Kyoto targets at the local level. Target setting and climate change strategies are not seen as a priority action by most municipalities, eg only two local authorities have achieved milestone ‘5’ on the Cities for Climate Protection (CCP) model of the International Council for Local Environmental Initiatives (ICLEI)[19].

17 A combination of local climate, use of fossil fuels, vehicle emissions and airborne pollution from the USA has led to a significant increase in the number of extreme smog days declared. Air pollution is a cause of 1,000 early deaths in Toronto.

18 This is a problem commonly experienced in many local authorities in the UK

19 The ICLEI CCP model has five stages: 1 Baseline Study, 2 Adoption of an emissions reduction target, 3 Produce a local action plan, 4 Implement policies and measures, 5 Monitor and evaluate results (see Exhibit 2.13)

ICLEI CCP – how it works

Local governments join the Cities for Climate Protection (CCP) campaign by passing a resolution pledging to reduce GHG emissions from their local government operations and throughout their communities. To help cities achieve their goals, ICLEI then assists the cities undertake the CCP's five milestones.

The five milestones of the CCP and the methodology that underlies them provide a simple, standardised means of calculating GHG emissions, of establishing targets to lower emissions, of reducing emissions and of monitoring, measuring and reporting performance. ICLEI has developed several software tools that help cities comply with the methodology.

The five milestones are:

1 Conduct a baseline emissions inventory and forecast. Based on energy consumption and waste generation, the city calculates GHG emissions for a base year (eg 2000) and for a forecast year (eg 2015). The inventory and forecast provide a benchmark against which the city can measure progress.

2 Adopt an emissions reduction target for the forecast year. The city establishes an emissions reduction target. The target both fosters political will and creates a framework to guide the planning and implementation of measures.

3 Develop a Local Action Plan. Through a multi-stakeholder process, the city develops a Local Action Plan that describes the policies and measures that the local government will take to reduce GHG emissions and achieve its emissions reduction target. Most plans include a timeline, a description of financing mechanisms, and an assignment of responsibility to departments and staff. In addition to direct GHG reduction measures, most plans also incorporate public awareness and education efforts.

4 Implement policies and measures. The city implements the policies and measures contained in its Local Action Plan. Typical policies and measures implemented by CCP participants include energy efficiency improvements to municipal buildings and water treatment facilities, streetlight retrofits, public transit improvements, installation of renewable power applications, and methane recovery from waste management.

5 Monitor and verify results. Monitoring and verifying progress on the implementation of measures to reduce or avoid GHG emissions is an ongoing process. Monitoring begins once measures are implemented and continues for the life of the measures, providing important feedback that can be used to improve the measures over time.

The five milestones provide a flexible framework that can accommodate varying levels of analysis, effort, and availability of data. This element makes the CCP both unique and innovative, by increasing its transferability amongst local governments. It is the breadth of this programme that enables it to cross north/south, developed/developing, metropolis/town boundaries and that has made it successful worldwide.

Exhibit 2.13 ICLEI CCP – how it works

- Partnership working and knowledge transfer is underdeveloped in many municipalities. However, where organisations have demonstrated their commitment to working in collaboration with other bodies, and sharing their learning, significant carbon reduction has been achieved, eg the Better Buildings Partnership at the City of Toronto's Office of Energy Efficiency (see below).

- There is a difficulty in reconciling the need to reduce CO_2 emissions (often perceived as being costly) with the tradition of abundant cheap energy supply in Canada (~50% of UK cost).

This picture is not dissimilar to that in the UK, and while many good examples of local carbon reduction actions can been seen in Canada, in some cases the country is further behind. For instance, municipalities do not have the power to impose energy efficiency measures through building regulations as local authorities can in the UK. There is a voluntary energy code for buildings, but so far only one province has adopted it and this is only in an advisory capacity.

The energy supply context further complicates matters, although energy costs are now rising and concerns of supply security coupled with large growth in city populations are gradually becoming considerations for local politicians.

Particular environmental conditions such as the smog in Toronto have led to high profile interventions at a municipal level (see Toronto Atmospheric Fund below); however, these are city specific, isolated and not fully integrated into other mainstream work. That said, there are local initiatives that are having a Canada-wide impact and are sponsored by the federal government through the Federation of Canadian Municipalities and more is said about this below.

The dynamic between local and regional levels in Canada, and the respective amount of regulatory authority they have, can be highlighted as a significant barrier to the effective implementation of integrated actions to achieve carbon reduction. The New Deal for Cities and Communities (NDCC), however, represents a change that could start to challenge the 'silos' of responsibilities that have so far restricted the two levels of government (see Section 2.1 for an overview of the NDCC).

Glenn Murray from the National Round Table on the Environment and the Economy (NRTEE) stated that 'there has been a revolution in Canada – cities are now able to talk directly to government, which was not the case a few years ago'. This shift was driven by circumstances where federal government had huge revenue surpluses and cities were poor and suffering urban decline. This rapprochement took the form of the NDCC. It followed municipal government reorganisation that created the megacities of Vancouver, Montreal and Toronto, with populations of one to five million through combination of 27 local authorities. This in turn has created very powerful mayors, who speak on behalf of 80% of the population. These factors have the potential to create new forces for change, potentially driving national government policy through vehicles such as the NRTEE.

Local actions for carbon reduction in Canada – case studies

The following case studies are discussed:

- Federation of Canadian Municipalities
- Toronto Atmospheric Fund
- Better Buildings Partnership

Federation of Canadian Municipalities: Canada-wide action

The Federation of Canadian Municipalities (FCM)[20] is the representative voice of Canadian municipalities and plays a similar role to the UK Local Government Association (LGA). Working throughout Canada, the FCM has a membership of 1,100, 10% of which represents 80% of the population. There is a common national climate change policy for members, but its adoption appears to be inconsistent. This may not be surprising given that it took two years for member authorities to support the signing of the Kyoto Protocol.

The FCM has five programmes, the largest of which is the Green Municipal Fund (GMF). Its aim is to:

'… help build sustainable communities by funding innovative environmental projects – projects that meet municipal infrastructure needs, as well as break the single issue or 'silo' approach. This integrated approach encourages municipal governments to connect to several community issues in order to meet longer term sustainable development objectives'.[21]

The FCM was granted C$250 million to grant to local authorities for climate change work under the GMF. This was seen as a way of effectively bypassing the provincial tier of government which does not have a strong track record in supporting climate change – a view confirmed to the mission by government Minister Godfrey who expressed the importance of working with local authorities.

Municipalities can bid into the GMF for a proportion of a project cost, typically 25-40% (this is planned to increase to C$500 million over the next period). The limit is C$20 million for any one project, but typical funding is C$1-2 million. It is intended that the GMF will be used to lever in other sources of funding. So far it has funded 400 projects resulting in 850,000 t of CO_2 reductions. The fund helps authorities to spread the risk of innovative projects. The need to be careful about what was negotiated in the agreement with each local authority was stressed, as well as having a clear dissemination strategy from the beginning.

The other projects are Partners for Climate Protection (PCP) – the Canadian version of Cities for Climate Protection (CCP); a housing programme; an awards programme aimed at promoting leaders and peer-to-peer learning; and energy missions to Europe to facilitate learning.

PCP member cities represent over 70% of the population. 124 local authorities have a climate change strategy. The FCM underlines the need for a political champion at the local authority level to drive forward the agenda.

Toronto Atmospheric Fund: city-level action

The mission team saw, in Ottawa and Toronto, examples of projects and initiatives that reinforced the view that action on climate change was more as a result of local initiatives and leadership. Toronto has developed strategies in response to air quality issues that have worsened over the last few years. The Toronto Atmospheric Fund (TAF) is a prime example of effective local action.

TAF supports the city in its goal to reduce CO_2 emissions by 20% from 1990 levels by 2005, by financing projects aimed at:

- Reducing GHG and smog precursor emissions
- Promoting public understanding of climate change and air pollution

20 *www.fcm.ca/english/main.html*

21 FEDERATION OF CANADIAN MUNICIPALITIES, 2004. *Green Municipal Fund Annual Report 03/04*. Federation of Canadian Municipalities

- Mitigating public health risks associated with extreme weather, especially summer heat waves

The City of Toronto approved the establishment of TAF in 1991 with an endowment of C$23 million from profits gained from the sale of a municipal jail farm. It was supported by key influencers including: local politicians such as Toronto Councillor Jack Layton[22] – now MP and Leader of the New Democratic Party; the mayor; and ICLEI.

Better Buildings Partnership: city-level action

The Better Buildings Partnership (BBP) is a public-private partnership focused on building renewal and energy efficiency that operates in Toronto. It is one of the many initiatives that addresses and supports CO_2 emissions reduction as well as being a job creation scheme.

There are several partners involved including Toronto City, energy suppliers and distributors, property managers and developers.

443 buildings have been involved in the BBP, with 39 million ft^2 (~3.6 million m^2) of floor area retrofitted with an estimated operating cost reduction of C$19 million per year and a CO_2 reduction of 173,600 t/yr. So far the cumulative impact of the project has been 876,118 t of CO_2 reduction.

The partnership aims to recover project costs through energy savings, provide loan finance, and integrate energy efficiency into the overall property management plan.

The BBP operates on the familiar 'spend to save' principle familiar to many local authorities but with the advantage of private-sector engagement and improvements beyond just public buildings.

Examples of projects completed include:

- YMCA Toronto – C$2 million project, C$172,000 annual savings, 12 year payback, 5,755 t of CO_2 reduction
- City Council buildings – C$4 million project, seven buildings, C$570,000 annual savings, seven year payback, 6,600 t of CO_2 reduction
- First Canadian Place (office block) – C$17 million project, C$14 million savings, 12 year payback, 27,000 t of CO_2 reduction

It would be possible for the principle of this initiative to be replicated by UK RDAs. Revolving loan funds could be set up with business to provide the incentive for businesses to engage in energy efficiency retrofitting with the initial payback being used to repay the loan. The longer term savings then accrue to the business as lower overheads, cost reduction and improved competitiveness.

An offshoot of the BBP has been the Better Buildings New Construction Program (BBNCP) which aims to establish higher energy efficiency standards for new developments.

Conclusion

The concept of the Green Municipal Fund (GMF) could easily be replicated given the political will. UK local government is used to bidding regimes and if the incentive is big enough it will drive change. Requiring all councils to develop and implement climate change strategies could be a condition of funding. It also has the advantage of helping local authorities spread the risk of innovative schemes. Administering it through the LGA would be a radical departure. Administering it through RDAs could be done as part of the low-carbon economy improving competitiveness agenda. This approach based on partnership between levels of government is an excellent model of good practice.

22 *www.politicswatch.com/layton-biography.htm*

A key lesson that we have not yet learned in the UK, and that is reinforced from the Canadian experience, is the significance of cultural, management, institutional and political barriers to change. Consequently we continually underestimate the importance of leadership, behaviour change and the need to break down institutional barriers – 'silos' as they are often called. The Canadian experience underlines the need for integration in policy and action. We saw many examples where greater integration would help to minimise impact on climate change. The GMF is a good example, where it is made explicit that it will fund projects 'that break the single issue or 'silo' approach'[23].

It is clearly the case that some of the key federal government initiatives, eg the One Tonne Challenge (see Section 2.4), rely on local delivery mechanisms for their success. These mechanisms are found in Canadian municipalities. The same can be argued for the role of UK local authorities, and this needs to be given greater recognition by UK central government. Through local leadership, change is possible. Effective leadership is what is required, not yet more waited-for improvements in technology, which become an excuse for decision makers to put off doing anything now as we all wait for the technological panacea that is always just around the corner.

The guidance, case studies and encouragement aimed at municipalities that is provided by the Ontario Provincial Government could be fruitfully emulated by RDAs and regional assemblies in the UK. It may be possible to implement this in the UK with, for instance, all regional bodies systematically generating case studies and funding training programmes targeted at local government and businesses.

The Better Buildings Partnership (BBP) provides a very good exemplar of what can be done to promote energy efficiency in public and private buildings through retrofitting. This scheme could be emulated in the UK, and RDAs are in a good position to sponsor and broker arrangements for the setting up of such loan funds.

The BBP has also led to the development of higher standards of energy efficiency for new buildings. These could be adopted as voluntary guidance by all local authorities in the UK, based on what Leicester has done. They could also be used to persuade central government to adopt them as statutory requirements.

23 FEDERATION OF CANADIAN MUNICIPALITIES, 2004. *Green Municipal Fund Annual Report 03/04*. Federation of Canadian Municipalities

2.4 Meeting the challenge: public awareness and understanding

To make progress on carbon reduction measures of any kind there needs to be a high level of support from the public at large. This logic applies not only to voluntary schemes, where without public involvement there is little point in setting up an initiative, but also to regulations introduced by government at municipal, provincial or federal levels.

Therefore, nations need to build up a critical mass of public support if they are to make serious inroads into carbon emissions. This requires a basic public understanding and acceptance of the link between carbon emissions and climate change. Both the Canadian and UK governments have launched a number of fully-funded programmes designed to convince the public that action needs to be taken, and in doing so have attempted to explain the science of climate change, albeit at a fairly basic level. Most of these programmes focus on the practical energy saving measures the public can take to reduce energy use and thus demand.

These efforts have been backed up by scientists, schools, large sections of the media and a range of NGOs. Indeed, in many instances NGOs have sought to go much further and much faster than government in pushing the carbon reduction agenda. However, despite these efforts, GHG emissions are continuing to rise in Canada, and as the carbon reduction impact of the switch from coal to gas generation weakens, emissions are on the up again in the UK too.

The mission attempted to identify what stimulates the Canadian people to get involved in carbon reduction activities in their homes, and in their lives more generally. Perhaps more importantly, the team also set out to discover the barriers, both personal and institutional, to greater public involvement.

One of the important factors in shaping public opinion is the media, which can act as a catalyst for public participation in carbon reduction but can also act as a damper which deters involvement. Therefore this part of the report includes a concise section on the role of the Canadian media in helping or hindering Canada's attempts to meet its Kyoto commitment and go on to further reduce carbon emissions.

Drivers for public engagement

What stimulates the Canadian public to become involved in carbon reduction and just how effective are these drivers? This section sets out some of the factors that motivate the public, and looks at how much impact they are having on people's behaviour.

The mission team were told by many members of the public and many of the professionals they met that 'Canadians like a challenge'. It was therefore logical for the federal government to seek to exploit this national characteristic to good effect. In 2004, using the offices of Environment Canada, the government set up an intensive awareness-raising programme – the One Tonne Challenge – that informs Canadian citizens how each person can reduce their annual GHG emissions by one tonne.

The One Tonne Challenge is cleverly designed to engage large populations from all provinces, and the fact that it transcends regional differences by targeting individuals rather than governmental structures is one of its great strengths. Moreover, the Challenge provides a mechanism for informing the public of the link between their use of energy and impact on the climate. The One Tonne Challenge is a focus for information on climate but more importantly it is a tool which empowers every Canadian citizen.

There are, however, limitations to the initiative. Not least, with Canada looking to

glean a 30% emission saving from the built environment alone, the One Tonne Challenge simply does not go far enough. One tonne represents only a 20% saving, and with most climate scientists recommending a 60% reduction in GHG emissions, the Challenge leaves Canadians with a 40% shortfall.

Backed by celebrities and government at all levels, the One Tonne Challenge has much better brand recognition and is more effective than the diverse campaigns run by a host of UK government-funded organisations, such as the Carbon Trust and the Energy Saving Trust.

Air quality is another major driver in raising the level of public awareness of the threat from man-made emissions, especially in the large municipalities. On most summer days, smog hangs over Toronto and its environs, and last winter the city experienced its first winter smogs. The need to tackle this threat to public health is cited as the first bullet point on the One Tonne Challenge information leaflets, which simply emphasises the importance and public profile of air quality.

As the GHG emissions generated by the combustion of fossil fuels are also the source of the smogs, then the link between man-made emissions and damage to the environment is reinforced in the public psyche. Therefore, rather perversely, the smogs as a visible manifestation of carbon emissions present an excellent opportunity to highlight the importance of carbon reduction.

Increasing energy costs are proving to be a driver in carbon reduction, as people become more aware of the impact on their pockets when using energy. Nevertheless, prices at the pumps in particular are significantly lower than those in the UK, and most of the Canadians interviewed by the mission team did not believe that fuel price hikes alone would persuade people out of their cars, or lead to radical improvements in energy efficiency in the home.

Certainly if Canadians behave as their UK counterparts have, then increasing prices at the pumps is unlikely to have much impact on the level of car use. Indeed, there is much evidence to suggest that devotion to the motor car is probably even stronger in Canada than in the UK, and there is little doubt that reducing emissions from road traffic is an intractable problem in Canada.

Improved competitiveness was put forward as a driver for carbon reduction by personnel at Environment Canada, Toronto's Better Buildings Partnership (BBP) and others working closely with business. Certainly the argument that improved energy efficiency has assisted the economy and enhanced the performance of business has some credence. However, as in the UK, there is a need for much more to be done in the workplace. Moreover, the team found no evidence of any efforts to join up the energy efficiency at work message with a call for employees – or employers for that matter – to take the message home.

Although Canada operates a market economy, it is a far less aggressive and libertarian model than that of its neighbour to the south. There is a great deal of support for strong public services and most Canadians believe that there is a role for government in shaping their economy. There is strong evidence to suggest that this social model assists in engaging the public in community activities, such as the One Tonne Challenge.

This sense of society engenders a broader respect, a respect which is extended to other nations, and the team got the impression that Canada playing its part in the international community plays a part in motivating action on environmental issues. This point is reinforced at government level by the cross-party backing for Canada's involvement in the Kyoto process.

Perhaps conversely, many of the professionals and members of the public the team spoke to believe that there is a healthy

competition with the USA which could be assisting Canadian efforts to motivate people to act on climate change. Certainly, the team found little support for the Bush administration's stance on climate change.

Improved funding by federal government for a range of programmes has helped professionals engage with the public and led to the undertaking of practical carbon reduction measures in existing homes and in new building.

Much of the activity is at the municipal level, where population pressures and local air-quality issues have induced higher levels of participation in energy efficiency measures. This has resulted in greater involvement in the One Tonne Challenge in the municipalities. This municipal involvement and raised awareness in urban populations is supported by the Green Municipal Fund (see Section 2.3) that has, to date, led to 850,000 t of CO_2 being saved by practical carbon reduction measures across all provinces.

Eighty percent of Canadians live in populations of over 10,000 and all of these urban populations qualify for funding under the municipal funding scheme. However, the greatest successes have occurred in the larger conurbations. As it was not in the remit of the mission to examine non-city-scale communities, the team did not go into detailed analysis of carbon reduction in smaller, more rural communities.

It is worth noting, however, that many people believed that there was less carbon reduction activity among rural populations.

The team found some evidence that high profile, low-carbon building developments acting as exemplars had a positive impact on the public's desire to participate in carbon reduction. Even so, most – of the admittedly small number of – people we spoke to could not name an exemplar project. Unsurprisingly, recognition of exemplar projects was much higher among the professionals, and several cited examples of developers adopting higher building standards because of the success of an exemplar low-carbon development in their community. Despite these few examples, most of those we spoke to believed that the public were ahead of developers in wishing for higher environmental standards in all new developments.

Security of supply was cited by many as the emerging issue, and there is some anecdotal evidence to suggest that the public are becoming concerned that the lights might go out unless more renewable energy technologies are added to the energy generation mix.

There is a high level of awareness in metropolitan Canada of the link between GHG emissions and extreme weather events. During the mission's stay in Canada, severe flooding occurred in Alberta, with many residents having to be evacuated from their homes. Despite the fact that the link between carbon emissions and this particular episode could not be proven, many were pointing to this and other recent extreme weather episodes as products of man-made climate change.

The success of recycling campaigns in Canada suggests that Canadians are responsive to positive messages and actions designed to improve the environment. This demonstrates that like their British counterparts the Canadians are capable of behaviour changes which benefit the environment. Indeed, within a decade, marked improvements in recycling rates have been achieved in both countries through a combination of education and the provision of facilities.

Equally, in the 1970s and 1980s, sulphur dioxide (SO_2) emissions were a major problem in Europe, causing significant damage to ecosystems through acid rain. However, since the introduction of stringent limits on sulphur

emissions, much of the environment damaged by acid rain has made a significant recovery. This demonstrates that beneficial changes can be brought about in the space of decades through the introduction of regulations to reduce emissions.

Therefore evidence suggests that a blend of regulation and behavioural changes linked to the provision of basic low-carbon technologies offers a potent combination in meeting the carbon reduction challenge facing both Canada and the UK.

Barriers to public carbon reduction actions

Despite the recent rise in oil prices, fuel costs at the pumps in Canada are about half UK prices. In respect of fuel pricing, the Canadian model is much closer to the USA than the UK, and this low-tax regime encourages greater use of fossil fuel consumption. Despite the fact that there is less evidence of 'gas-guzzling' vehicles in metropolitan Canada than in the USA, the great car economy is alive and well in Canada and contributing in no small part to the nation's GHG emissions.

The provincial system was cited by many as a barrier to speedy and effective action on climate change. Whilst the system works well if there is consensus across all three layers of government, there is evidence to suggest that tensions and lack of joined-up decision making between federal and provincial government have frustrated not just the professionals trying to deliver carbon reduction but also the broader public.

A practical illustration of where the provincial system is not working well is the operation of the electricity grid. Each province has control of the grid within its boundary and there are examples of grid connections finishing abruptly at provincial borders. This is not the most efficient way to deliver energy to Canadians, and does not help convince the public that Canada's thinking is joined-up on energy policy.

Some provinces are suffering from the impact of climate change, whilst others, such as Alberta, have large fossil fuel resources from which they benefit. What works for Ontario might cut across the interest of those living off revenues derived from fossil fuel in Alberta. The Partnership Fund, which is designed to help overcome these differences and to form common strategies beneficial to all provinces, goes some way to enabling a connected federal strategy. Nevertheless, much more needs to be done to prevent counteracting governmental forces splintering Canada's carbon reduction strategy. The Chairman of the National Round Table on the Environment and the Economy (NRTEE, Canada's equivalent of the UK's Sustainability Commission), Glenn Murray, said: 'there is a broader consensus of the need to act on climate change in the UK'. This is in no small part down to the ability in the UK of central government to design and conduct policy across the whole nation.

Unlike the UK, Canada does not have the power to bring fiscal policy and legislative levers to bear at the federal level. Most of the professionals and many members of the public the team spoke to believed that, to make real inroads into carbon emission reduction and energy efficiency, regulation was required. Many felt that regulation would create a level playing field across Canada for building development, and that after some initial resistance, developers would not only conform to the rules but benefit from the knowledge that their competitors had to meet the same high standards. However, with few statutory instruments available to federal government, about the only standards controlled by Ottawa are those in the federal government buildings across Canada.

There is comprehensive evidence, both visual and verbal, that Canadians buy into 'the American dream'. Second homes, second refrigerators, SUVs and extensive air conditioning are commonplace. Whilst Canadian society appears closer to the

European social model, much of its infrastructure and artefacts resembles that of its powerful neighbour. Marrying the American dream to a successful carbon-cutting strategy will present a challenge for all concerned.

There also exists a sense that Canada is only a small nation and that without the USA on board what is the point of Canadians doing their bit? However, the team found this attitude to be in the minority and outweighed by the feeling that Canadians wish to distance themselves from Washington's policy on climate change.

The lack of home-grown low-carbon and renewable technologies was quite apparent, with many items imported from Scandinavian countries. Although the imported technologies are of a very high standard, their transportation creates additional carbon emissions, and more importantly their manufacture does not benefit the Canadian economy. Enhanced support for the low-carbon economy would be achieved if more jobs in carbon reduction products were created for Canadian workers.

Although voluntary building codes have been developed, and are currently being updated, there is strong evidence that building codes without teeth are not helpful. To date, only Quebec has adopted the national Building Code, and without the power of enforcement there is little the federal government can do to apply the code across Canada. Indeed, the team became aware of many voluntary agreements which are not adhered to. This inconsistency does not play well with Canadians and does not help to motivate public participation.

Some of the professionals the team interviewed were concerned that waiting for an emissions trading scheme to come into effect was deterring action at the industrial level in particular. There is a 'wait-and-see' attitude developing, which is holding back early action on carbon reduction. Therefore an early resolution of the details of the scheme should help kick-start a number of actions in the business community.

The role of the media in public awareness on climate change

During the mission to Canada there was a serious storm leading to extensive flooding in parts of Alberta. The severity of the flooding led to homes being evacuated as water levels rose in some urban areas. Coverage of the storm, in both the television and print media, made reference to the possible influence of man-made climate change. In fact the coverage of this severe weather event was very similar to what one would expect from the UK media.

By flagging up man-made climate change in relation to extreme weather events, ecological variations and impacts on agriculture, the Canadian media is reinforcing the link between the use of fossil fuels and climate change in the public's mind. It is important, however, not to argue that every extreme weather event that comes along is down to climate change, but rather to indicate that the upward trend in extreme weather events is related to human activity. This more subtle message is also more complicated and requires a serious and responsible media which is prepared to dedicate more time and go into greater detail on the science of climate change.

Certainly the Canadian media has a real 'public service' feel to it and this orientation makes it an important and accessible vehicle for informing the public on a range of environmental issues. It is also quite noticeable that although there are political differences between journals, the papers are not as polarised as in the UK – this makes for a more consensual press. These factors should make it easier for a consistent message to come across in the print media in particular.

Also impressive is the involvement of the business media in indicating the potential for environmental industries; this is particularly apparent in the business sections of the large journals such as the Toronto Star, as well as in smaller more specialist magazines. Illustrating the commercial opportunities that moving to the low-carbon economy will facilitate is a very important secondary message, because not only does this message promote a public understanding that moving from fossil fuels does not mean the demise of economic prosperity, but it also highlights that a new and more sustainable economy is under development.

The Canadian government has made good use of television and newspaper advertisements, with many of the Canadians we interviewed recalling in some detail the energy saving advice and information on the One Tonne Challenge and other advertising campaigns. The availability of hard copy and on-line data is very good, and without doubt the brand recognition of the One Tonne Challenge is better than any of the numerous rather nebulous adverts put out by the Carbon Trust and the Energy Saving Trust in the UK.

The mission team also asked Canadians to think about role models and famous Canadians who could inspire the broader public to take action on climate change. With some justification, given his contribution to the environment debate over the years, David Suzuki's name was mentioned by many as the guru of environmental action. However, role models and environmental champions among Canada's famous figures are few and far between, and this was an area where the team felt more effort was needed.

Conclusion

Are links with the UK important to Canadian public action on climate change?

During the mission team's visit to Ottawa a meeting was held with the Federal Government Minister of State for Infrastructure and Communities, John Godfrey. The Minister was at pains to stress the importance of UK-Canadian partnership, as both countries sought to meet their Kyoto obligations. With both countries members of the powerful G8 body, there are obvious benefits to cooperation on climate change policy, not least the need for both countries to work together to counterbalance the views of the USA.

However, the benefits of strong UK support for Canada's action on climate change extend beyond proving solidarity with federal government. There is a strong feeling of goodwill toward the UK in Canada, and most English-speaking Canadians have a strong affinity with the 'old country' which extends to a respect for the UK's global policy on climate change.

Therefore, Canada is a perfect partner for the UK to move forward with on carbon reduction. There is very strong evidence that international partnership helps to reinforce the message in both countries. Indeed, more could be made of the common purpose of the two nations in terms of motivating the public, in Canada and perhaps to an even greater extent in the UK.

Members of the mission team were able to establish an agreement from the University of Toronto to unite with UK universities in practical projects designed to raise public and corporate awareness of the need to take action on climate change. This willingness to cooperate was mirrored across the range of professionals the team met with during the week-long mission.

The team was unable to ascertain the impact that close links with the UK on climate issues might have on the francophone element of Canadian society. However, with France also committed to Kyoto, in theory there should be a unity of purpose across both French and English speaking populations.

Canadian innovations could be exported to the UK to engage the public

Although there are many common carbon reduction measures adopted by both the UK and Canada, there are a few approaches which the Canadians have adopted which are not obvious in the UK. Listed below are some ideas which the UK might wish to import from Canada:

- Idle-free zones. These are particularly prevalent in car parks. As well as encouraging motorists to cut down on wasted fuel whilst the car is stationary, idle-free zones could also encourage the uptake of hybrid vehicles, which run on electric motors during urban cycles. These motors do not draw power when the vehicle is stationary.

- Dedicated employees to work on environmental improvements with students at universities. The mission team was impressed with the range of initiatives facilitated by the Environmental Facilitator at the University of Toronto at Mississauga (UTM). This model could work well for UK universities, with savings in resource and energy costs defraying the cost of employing facilitators.

- Free buses for students with costs built into tuition fees. Mississauga has operated this scheme successfully, and has used this, and other environmental initiatives, to market UTM (see following recommendation).

- Market universities on environmental credentials. With Environmental Science taught in many universities it makes sense for establishments to 'practice what they preach', and to use the environmental message to attract potential students.

- Set up a municipal fund along the lines of that managed by the Federation of Canadian Municipalities (FCM) and dedicate the fund to carbon reduction ventures.

- Adopt a National Challenge to householders, businesses and schools. This to be loosely based on the One Tonne Challenge, but in order to reflect the pressing need to make deep cuts in emissions the target should be set at 60%. This would entail a three-stage approach of energy efficiency measures, the introduction of renewable technologies, and offsetting any shortfall.

Recommendations to improve carbon reduction and public understanding of the need for action on climate change in the UK

- The recruitment of high-profile UK champions for carbon reduction in general. These champions to come from a range of sectors (sport, music, film, etc) in order to appeal to the broadest possible cross-section of the UK public.

- More exemplar low-carbon communities should be developed to inform the public of the opportunities and benefits of low-carbon design.

- Introduce schemes which link energy savings in the workplace with savings at home, and incorporate these in the 60% National Challenge framework.

3 PEOPLE AND PLACES – LARGE-SCALE INITIATIVES

3.1 Knowledge transfer

Some of the additional generic questions relating to the overall aim of the mission sought to explore the 'soft' issues of carbon reduction initiatives and their social influence. This included the particular ways in which different agencies utilised the power of information and sought to use it to influence behaviour and decision-making – in effect to turn it from information into knowledge.

In the Canadian context, the approaches to knowledge management at federal, provincial and city level have an implicit role that recognises the significance of the connections between different scales of activity, different thematic professions and the common links with broader mechanisms for change. Knowledge of the environmental and economic implications of carbon emissions, of technical solutions to achieving carbon reductions, and supporting institutional mechanisms had to be placed within the real world and used to influence decision making.

At some level there is bold advocacy being made, to raise awareness and highlight implications of a fast approaching energy crisis. This can be see in the dark predictions of Kunstler (2005)[24] as society fails to collectively respond to the clear lifestyle implications as 'the age of oil comes to an end' and matched by Jane Jacobs' (2005)[25] pessimistic predictions of a new 'dark age' of human society being unwilling to adapt and alter unsustainable lifestyles until it is too late.

Similar to the 'light path' of Ausubel (1991),[26] Heinberg (2004)[27] has described an explicit strategy for a phased carbon reduction as a political and personal choice from a series of possible future scenarios and paths of competition, wishful thinking, preservation or '*Powerdown*: the path of cooperation, conservation, and sharing' … of technology and resources, including information. Beyond this, there is a clear recognition that 'an early warning system' is needed, yet many projections and forecasts are being ignored, due to uncertainties in feedback and gaps in knowledge (Leggett 2001).[28]

The crisis or challenge is not one of 'hard' technical change but of 'soft' socio-economic change where knowledge can have a powerful influence over personal and corporate or municipal behaviour. It is the approach to the sharing, responsive feedback and application of information to create a critical mass of consensus and action that is described in this section.

It broadly addresses issues of knowledge transfer; the role of networks for

24 Kunstler, James Howard (2005) *The Long Emergency: Surviving the Converging Catastrophes of the Twenty First Century* (Atlantic Books, Worthington)

25 Jacobs, Jane (2005) *Dark Age Ahead* (Vintage Canada, Toronto)

26 Ausubel, Jesse H (1991) *Energy and the Environment: The Light Path* (Energy Systems and Policy 15, pp181-188)

27 Heinberg, Richard (2004) *Powerdown: Options and Actions for a Post-Carbon World* (Clairview, Glasgow)

28 Leggett, Jeremy (2001) *The Carbon War: Global Warming and the End of the Oil Era* (Routledge, New York)

dissemination and feedback; the economic underpinning of technical and environmental concerns; the emerging role of transferable models of sustainable communities; and the mechanisms supporting knowledge transfer – drawing a pattern from the broad range of example projects and organisations investigated as part of the mission.

Energy networks

In a Canadian review of energy policy and emerging technologies the clear challenge for achieving large-scale carbon reduction '… was not necessarily to *invent* the solutions to the problems, rather it was to create a link for people who were already there *solving* them' (Heintzman and Solomon 2005 p xix).[29] The role of networking – a mix of organisational and social – and possibly innovation in the way networks are supported, is the means for achieving change in large-scale carbon reduction.

The need to link between different sectors currently working within the discipline of energy as well as different levels of operation was one of the repeating themes cited by all organisations as an aspect for any successful programme aimed at large-scale carbon reduction and seeking to mainstream work that is well known in areas of building research. This is aligned with networks that connect – and in some specific instances, bypass – different layers of decision-making at community, municipality, province and national levels.

Similar to professions in the UK, the energy specialist has the ability and potential to effect the largest change on the basis of early involvement and ongoing dialogue through any design process, be it at regional, city or neighbourhood scale. The open networks developed and promoted have an underlying premise that early and ongoing multidisciplinary working is optimal.

Networks appear to allow for operation between unconnected levels in government. When this is backed up with funding they appear to operate more effectively, and is the beginning of overcoming some of the unspoken interdepartmental rivalry.

Networks allow for a clear passage to transfer knowledge from academic work into practice. For example, a research committee oversees the Canadian Centre for Housing Technology (CCHT) and the organisation promotes the extensive use of its research facilities (including the twin-house research facility) for external bodies, including academic and private-sector organisations. This ensures a level of awareness and opportunities for closer collaboration.

The extension of simple professional networks to touch the world of popular media, and work with wider 'learning networks', is potentially the start of wider collaboration and practical projects. The best examples provide a suitable mechanism for allowing innovation within materials technology and energy systems to be supported at municipality level or other local actions.

One specific and inspiring example was in the support of hydrogen fuel cell and infrastructure at a community and/or municipal level at the H2V Hydrogen Village (based at the University of Toronto at Mississauga's (UTM) Centre for Emerging Technologies[30], perhaps with its closest comparative in the Australian CH2 Village[31]), in itself giving rise to demonstration projects, fostering links between academia, private enterprises and public-sector clients. This was an 'open' network with no professional barrier to entering, and flexible

29 Heintzman, Andrew and Solomon, Evan (2005) *Fueling the Future: How the Battle Over Energy is Changing Everything* (Anansi, Toronto)

30 *www.utm.utoronto.ca*

31 *www.melbourne.vic.gov.au/info.cfm?top=171&pg=1933*

to opportunities (for example: in areas for international cooperation, internships and promoting staff exchange programmes).

Economic underpinning

The Toronto based consultant Bruce Mau has commented that '… initiatives for sustainable energy promise to fundamentally restructure the energy industry itself. To stay in the game, the oil industry is evolving away from fossil fuels, towards renewables. The most massive change will happen here' (Mau and Leonard 2004 p75).[32]

It is evident that there is an economic argument to be clearly and forcefully articulated for the longer term commercial benefits of investing in sustainable technologies and energy sources. Often this argument has been phrased in a negative or commercially threatening way, at least for short-term business implications. Yet the challenge to recognise the links between the environment and the 'bubble' of unsustainable economic growth (Brown 2003)[33] is only the first step in changing the economic perceptions of sustainable energy sources. The common thread throughout the Canadian experiences of moving towards bringing carbon reduction technologies and initiatives into the mainstream is the forcefulness of positive economic arguments and the sharing of economic success stories following the introduction of such initiatives. This is the means to achieve such a 'massive change'.

There is a common usage of the phrase 'a triple bottom line approach' that seeks to reinforce the combined environmental, social and economic benefits of sustainable energy; yet implicit in this phrase is the understanding of the persuasive power of the economic benefits in changing attitudes and behaviour in comparison to the softer social and environmental drivers. Indeed, the economic imperative utilised so successfully in many Canadian initiatives could be argued as a straightforward recognition of the holistic nature of sustainable development and raise questions as to why it appears to be comparatively unusual in approach.

To share the financial knowledge associated with successful initiatives there is the progression of these into bespoke 'turnkey solutions' and 'hassle avoiders'. Examples of this approach are evident at many levels of government and within different sectors.

At a federal and provincial level there have been recent trends in the approach to integrating energy models into a regulatory framework. At present the Building Code is a performance-based code approved by the provincial government that has been supported by 'model' codes (such as the Energy Code) which is an objective-based code. Most provinces have failed to adopt the model Energy Code, citing issues of difficulties over regulation and enforcement as barriers.
The move towards any objective-based code has implications for the market. It is designed to allow the market flexibility and to innovate where possible. This 'market transition' is being supported by voluntary initiatives with linked incentives, such as a training programme for municipal building officials and requirements for professional accreditation.

The updating of the climate change programme (Environment Canada 2004)[34] has embodied this trend towards a similar market-based approach that is partly about regulation and partly about allowing the business community to meet these flexibly and consider their own impacts and trade-offs.

32 Mau, Bruce and Leonard, Jennifer (2004) *Massive Change* (Phaidon, London)

33 Brown, Lester R (2003) *Plan B: Rescuing a Planet Under Stress and a Civilization in Trouble* (Norton, New York)

34 Environment Canada (2004) *Environment Canada's Sustainable Development Strategy 2004-2006* (Environment Canada, Quebec)

The Better Buildings Partnership (BBP) programme promoted by the municipality of Toronto has financial initiatives to promote the uptake in new buildings (specifically upfront fees for additional design costs associated with the incorporation of energy efficiency measures in new buildings at a stage in the life of a building where there is the maximum benefit for the level of investment) which has close parallels to the UK's Commission for Architecture and the Built Environment (CABE) enabling programme that also provides project support through technical time to key projects on a design-time basis. The economic feedback from this exercise proved important, and in response there was incentive to developers in feedback marketing or passing this financial argument onto end consumers. And, importantly at a basic level, there was the need to have evidence that there was an acceptable payback period financially (a period that ranged between one year and seven years depending on different organisations and their experience of working directly with private companies and individuals).

Motivations for community energy planning are described by the Canada Mortgage and Housing Corporation (CMHC 2004)[35] as multiple and causal: 'Initially … the increasing domestic and travel fuel costs … leading to … a raised concern and awareness of climate change, linked to domestic energy security … allowing for … a debate into structural change within urban areas.' This cycle should ultimately and ideally impact upon a reduction in energy demand/ consumption and a financial response to the initial driver of rising fuel costs and the consequential impact of lifestyle.

The barriers and opportunities to change at a community level are largely perceived as economic, partly the level of relatively cheap fossil fuel energy sources available and the cost of non-fossil fuel alternatives. There are also the political difficulties of moving from a model code to proper regulation – so why change if you don't legally have to and can still afford your heating bills? As community-based knowledge increases, working examples of projects become better known, and comparative costs of fossil and non-fossil fuel costs change, this is likely to change and provide a larger number of transferable examples for the UK context.

At a corporate level, there was the common view that volume house builders were not attracted by low-energy incentives but rather were driven to action by increasing consumer demand for energy efficiency. This had the result of the largest house builders seeking some validation of energy standards from federal government agencies (such as the accredited EnergyStar system and its provincial variants) for new-build properties and, as a follow up, a levelling of the 'playing field' regarding mandatory building codes (something requiring political will rather than market acceptance). Volume house builders were prepared to buy-in training for evaluation to be able to provide a better environmental standard that can be externally validated and help their 'product' with differentiation in the mass housing market. The financial motivation according to the CCHT was their 'level of market share and corporate competitiveness' over the long term.

At a household level, the significance of raising fossil-fuel prices was provoking a debate about the differential pricing of power supply, with a varying price throughout the day – something that is fairly radical for a country that does not have individual household meters as standard. Often apartment block residents were still being billed *pro rata* (a simple percentage of the cost for the entire apartment building) rather

35 CMHC (2004) *Practices for Sustainable Communities* (Canada Mortgage and Housing Corporation, Ottawa)

than for their actual energy consumption, a situation that has no clear incentives for energy conservation. In this context, the need for a market transformation does hold very different challenges for new and existing buildings stock, as well as property management and energy regulators, than needs to be followed at different scales and targeting different agents.

Transferable models of sustainable communities

There are strong recognisable comparisons between the UK and Canada in the theoretical underpinning and the approach to promoting a model of sustainable communities. This is partly recognition of the links between urban design and energy use, and awareness of the common body of academic and policy literature.

The influence of the *New Urbanism* movement is significant in the use of phrases such as *smart growth*, *transit oriented development*, and the repeated use of *greenfield*, *brownfield* and *greyfield* for site descriptions (where *greyfield* refers to underutilised commercial areas of shopping malls and surface car parking, what would be described as a subset of *brownfield* but given a technical name of its own in the Canadian context due to the potential relative significance for urban regeneration and intensification). These references and examples often appear within the guidance produced by federal agencies as the main 'justification' (where aspects of *New Urbanism* are taken as positive aspects of sustainable development) for the promotion of specific models of planning and development. Yet the result of this shared quasi-technical language and research – certainly between the UK and Canada, and in some cases even within individual provinces/regions – is a confusion over meanings, and multiple interpretations of key policy terms and, indirectly, policy initiatives.

Despite attempts to present *New Urbanism* as fundamentally about urban restructuring and thinking '… comprehensively about our patterns of growth' (Fishman 2005 p4)[36], rather than being understood in terms of style, this focus has yet to be fully understood within the Canadian context and, as it is, should provide an interesting debate to follow in the coming years.

In the broad advocacy (or self-promotional work of consultants and exponents of *New Urbanism*) undertaken around urban planning and design, recent debates have focused upon the movement impacting on the role and function of the regional city. This key aspect now has some level of political momentum (in part because the spatial scale of thinking negates any stylistic issues) and there are emerging Canadian experiences to share. Most noticeable is the regional planning for the Greater Toronto Area (GTA) being structured towards compact forms and transit oriented development (for example, see Winfield 2003).[37]

At a theoretical level, the re-emergence of the strong city region has made the aspirations of large-scale carbon reduction through urban restructuring (combination of spatial planning tools such as density, mix and variety of development and how they relate to public transit nodes) more achievable. This is exemplified in the response to the restructuring of local municipalities within the Province of Ontario, a move that has created a number of Canadian municipal megacities with powerful city mayors who hold significant statutory powers and political remit. It is now the case that the issue of critical mass that may have hampered the development of

36 Fishman, Robert (Ed) (2005) *New Urbanism: Peter Calthorpe vs Lars Lerup – Michigan Debates on Urbanism, Volume II* (Arts Press, New York)

37 Winfield, Mark (November 2003) *Building Sustainable Communities in Ontario: Overcoming the Barriers* (Pembina Institute, Drayton)

necessary infrastructure, or aspects of the political mandate and power that is required to financially support many new initiatives, can now be addressed by a strong public-sector lead from the municipality.

This challenge of public-sector leadership and urban restructuring was reinforced through a meeting with Glen Murray, the Chair of the National Round Table on the Environment and the Economy (NRTEE). Murray eloquently quoted and referred to the ideas of Toronto resident and social commentator Jane Jacobs (1961 and 2005)[25,38], and agreement with the anti-urban forces described by James Kunstler (1994)[39] amongst others, as the theoretical basis for much of the federal government's approach to sustainable urban policy. Murray has described the 'catalytic' work of the NRTEE: '… we spend a long time silo busting with our government agencies' and producing 'consensus reports' to establish a common agenda. In this respect, the NRTEE and its associated task forces (with strong parallels with the Urban Task Force for England and Wales chaired by Richard Rodgers) provide a strategic function in linking and converging the urban and sustainability agendas.

At this 'city-region' strategic scale of thinking, one of the repeated complaints is the overall lack of enforceable urban policy (as distinct from best practice and guidance, where clarity in urban policy helps to avoid any undue confusion over definitions and interpretations) and, in a similar vein, the lack of autonomy, power and financial support to pursue these models of sustainable communities. This highlights one of the most significant challenges at a federal level in diverting spending towards the larger conurbations or megacities.

Together with the rise of the city-region is the networking of the representatives from these cities as an advocacy and lobbying group to influence federal government to prioritise and empower the cities. The Canadian 'hub' cities of Calgary, Montreal, Toronto, Vancouver and Winnipeg, collectively known as C5, are following the well trodden path of England's Core Cities Group (Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham, Sheffield), and the Netherlands G4 city network (Amsterdam, Hague, Rotterdam, Utrecht). Behind this is a subtle political shift away from party-based politics and towards collaborative working on an agreed agenda (for example, see Rowe 2001).[40] Often this is about bringing technology and processes into mainstream thinking rather than seeking innovation and risk.

Murray contends that '… things are happening through enlightened local action rather than any specific financial incentives' but that this is about to radically change. Emerging successes of the urban lobbying are the symbolic transfer of the cost of suburban sprawl to the larger cities in the form of the federal 'gas tax' as part of the New Deal for Cities and Communities (NDCC), and the development of the Green Municipal Fund (GMF) that effectively assists municipalities bypass provincial government and bid directly for targeted environment funds from the federal government.

This is a powerful example of knowledge transfer involving political representatives. The C5 network and the work of the NRTEE have constantly stressed that 'one size does not fit all' and have raised wider discussions on the need for dissemination mechanisms, capacity building, and analytical skills to adapt models of sustainable communities to any specific urban context.

38 Jacobs, Jane (1961) *The Death and Life of Great American Cities* (Random House, New York)

39 Kunstler, James Howard (1994) *The Geography of Nowhere: Rise and Decline of America's Man-made Landscape* (Simon and Schuster, New Jersey)

40 Rowe, Mary (Ed) (2001) *C5: Historic First Meeting of Canadian Mayors with Jane Jacobs* (Ideas that Matter 2(1) pp3-27): *www.ideasthatmatter.com/cities/itmv2n1.pdf*

Supporting mechanisms

One of the aspects resulting from wider issues of Canadian leadership and governance – particularly the legislative and financial relationships and tensions between the three layers of federal, provincial and municipal organisations – is an apparent fall-back or default response to the production of supporting mechanisms, publications, guidance, tools and toolkits. There is a plethora of models and an avoidable duplication of evaluation and predictive tools aimed at supporting operational staff in the disciplines of energy planning, town planning and public policy at all levels of government.

Some of these are aimed at raising awareness by setting personal challenges and relying on an element of healthy competition; some are learning tools, some predictive, and others tend towards technical models.[41]

A cross-section of relevant work at a city or community/neighbourhood level has been collated by Natural Resources Canada (NRCan, March 2003)[42], drawing attention to a number of on-line and ICT-based tools for testing feasibility, modelling different scenarios for energy savings as well as providing contacts. Interestingly, NRCan is not afraid to point to international sources where these provide the most useful technical resource for the agent interested in community-based alternative or renewable energy systems. This extensive approach to a portfolio of notes and tools based on '… interviews and correspondence with (federal government) energy specialists and researchers and from contacts in other federal departments, academic institutions and private sector firms' is suggestive of the limitations of the remit of NRCan as a federal agency and the unspoken (or spoken but non-attributable) strategy to directly resource local communities and municipalities in deference to the role of provincial government.

On top of this are a multitude of sustainability indicators (for example, Ditor et al 2001[43]; IndEco Strategic Consulting Inc 2002)[44] that have little common references and potentially contrasting objectives because they are not fully grounded in policy at federal and provincial levels. Again, NRCan (undated)[45] is making attempts to address any inconsistencies by promoting evaluation and assessment tools that are broadly consistent with federal policy or, more accurately, federal processes. What this work does provide is an interesting lesson in subsidiarity, with federal agencies recommending process tools and references to best practice (largely best practice at municipal and community levels) that are at a non-technical and accessible level for empowering and resourcing communities. In effect the process tools draw on wider aspects of community planning (including the use of 'visioning', workshops and 'charettes') that aim to establish a level of popular consensus and support, making direct links with public awareness.

These tools being promoted can be understood as an 'entry point' for many different groups/agents to begin to address aspects of sustainable lifestyles. The initial emphasis on renewable energy is set alongside changes to behaviour in food production, personal travel and 'soft' aspects of community enterprise and development.

41 A range of examples and links to examples available for institutional and personal use can be found at *www.climatechangesolutions.com*

42 Natural Resources Canada (March 2003) *Alternative Energy Sources for Potential Community Use* (Community Energy Systems Group, CANMET Energy Technology Centre, Ottawa)

43 Ditor, Michael; O'Farrell, Dennis; Bond, Wayne and Engeland, John (August 2001) *Guidelines for the Development of Sustainability Indicators* (Canada Mortgage and Housing Corporation and Environment Canada, Ottawa): *www.ec.gc.ca/soerree/English/scip/guidelines.cfm#scenario*

44 IndEco Strategic Consulting Inc (April 2002) *A Sustainable Energy Business Plan* for the City of Toronto's Energy Efficiency Office, Ontario

45 Natural Resources Canada (undated pre-publication draft) *Community Energy Planning: Sustainable Energy Indicators* (CANMET Energy Technology Centre, Ottawa)

For example, from conversations with Mark Holzman at the CMHC (which has a specific interest and remit at the federal level for initiating research and dealing with information transfer from/between national institutions and practitioners), it entered the energy debate at the level of sustainable communities and urban form/structure, and he drew specific attention to its recent publication *Practices for Sustainable Communities* (CMHC 2004)[35] that has a theoretical basis in *New Urbanism*. It was keen to promote place-specific successful examples of urban intensification and infill, conversion, underutilised shopping malls and adaptive reuse.

To complement these are a range of procedural tools that have been developed in connected disciplines but principally in the area of urban policy and planning. CMHC provides evaluation tools that focus on this scale of intervention and make explicit links between GHG emissions and urban form. Examples include the GHG Urban Travel Calculator (a PC-based spreadsheet) and a series of web-based tools that allow for community-based comparison and evaluation between different models of future development growth. This is supplemented by infrastructure costing tools (one example is the HeatMap software used to help determine capital costs for energy distribution networks) for different neighbourhood typologies that stress the good economic basis as well as environmental and social benefits (another example of the 'triple bottom line' approach to sustainable development) of promoting a compact and mixed urbanism.

There is a similar range of statutory spatial planning tools in Canada and the UK available to individual municipalities (property mix, mixed uses, density, car parking standards, etc) as well as financial incentives being made available at the point of decision-making with which to operationalise recommendations from these evaluation tools. Yet these 'tools' are almost entirely based on existing knowledge (that links actions/activities with energy use and carbon emissions) and in part are always going to be limited and limiting, particularly when considering unpredictable externalities.

In this context, not only is there duplication of tools but a disconnectedness of tools. Some are focused on technical and qualitative scenario modelling while others are empirical and predictive. Some are community focused and overlap with work on raising awareness, marketing and promotional tasks; others are decidedly expert-based, arising out of the research and academic community but clearly not operational within their target audiences.

There is potential to improve the approach to supporting practitioners, politicians and communities at various scales by aiming at integrated tools that recognise the connections between scales, sectors and the complications of linking physical and social concerns. It is also critical to ensure the robustness of these models through a combination of academic review and regulation or endorsement by federal government. In practice, it is more likely and achievable to provide a broader and fully referenced 'toolkit' rather than a fully integrated model.

Barriers to mainstreaming

In meeting with representatives from the CCHT with a range of professional backgrounds – in materials and product evaluation (particularly with engineered wood products/membranes and building envelopes); R&D in energy technology (including links to the academic sector); community energy planning (emphasis on district heating systems); and wider links to sustainable communities planning – there was a lot of frustration at the barriers to bringing what they understood as 'common sense' environmental products into more widespread use.

The barriers to a wide take-up of many of the modern construction methods and technologies being developed and tested within the CCHT were expressed as a mix of cultural, sector-based working within the construction and energy industries; government structures and processes; promotional and outreach limitations; and the most significant: economic implications. Yet there was one concern above all of these social barriers.

The recognisable trend in working processes was in moving from a performance-based code towards the adoption of an objective-based code. This is intended to encourage innovation within the construction industry to find different technological and/or financial means of meeting measurable code outputs. The Building Code has retained the core concerns of access, structural integrity, fire safety and public health. While some energy aspects are included as an indirect result of these core concerns (for example, in the reduction of internal levels of condensation) they are largely excluded from the national Building Code and remain the concern of the 'model' Energy Code – a voluntary code that to date has remained largely unadopted by the Canadian provinces. However, the new approach to the flexible meeting of objectives rather than a prescriptive performance code allows for the addition of energy issues (potentially through the integration of the 'model code') as an additional core objective through a review mechanism.

Yet there was a frustration that this is not explicit in any governmental policy objectives due to the statutory limitations of federal government agencies and the lack of resources to comply and enforce the 'model code' within provincial government structures and local municipalities. Indeed, there was a consensus within the representatives from CCHT that regulation and enforcement remain the key barrier to adopting the 'model code' for energy rather than the substantive implications from the 'model code'. The buck still appears to stop with the government – in this case at all levels.

Knowledge-based exports

In some key areas this appears to be already implicit in the working between municipalities, provincial and federal governmental structures. This appears to be due to a set of common, explicit political drivers underlying and motivating the various levels of governmental responses to energy issues and climate change. These are interconnected and arise out of:

- A growing public concern over environmental impacts that initiates actions and direction, particularly in response to urban air quality and the impacts on public health (grassroots pressure demanding action from listening and responsive political leaders).

- The development of civic responsibility to socially and morally lead by example as well as impose codes and standards (in part, an element understood as wishing to make a difference and create a political legacy – the desire for key political or organisational leaders to make a mark for history; and partly an extension of individual/personal morality into areas of social conscience and community responsibility).

- A level of 'healthy' intercity/regional rivalry (reinforced by the underlying economic aspects of increasing city competitiveness and differentiation over the longer term).

But beyond these varied motivations that stimulate and promote aspects of knowledge management are the attributes of successful Canadian energy networks. They are hard to describe, partly because they are subtle (to do with an attitude of collaboration) and partly due to a different culture ranging from an inherited provincial government culture and more sophisticated populace when in comes to environmental awareness. The next step for the successful networks is the formalisation of relationships – even where this begins to threaten the political *status quo*; and an agreed protocol between partners with responsibility over, and interest in, aspects of climate change.

Further reading

Coupland, Douglas (2002) *Souvenir of Canada* (Douglas and McIntrye, Vancouver)

Crombie, David (1992) *Regeneration: Toronto's Waterfront and the Sustainable City – Final Report* (Ministry of Supply and Services, Ontario)

Federation of Canadian Municipalities (2004) *Green Municipal Funds: Annual Report 2003-2004* (Federation of Canadian Municipalities, Ottawa)

Malbert, Björn (1998) *Participatory Approaches to Sustainable Urban Development: Reflections on Practice in Seattle, Vancouver and Waitakere* (Planning Practice and Research 13(2) pp183-189)

3.2 Financing green projects – VanCity: a case study

Founded in 1946 to provide financial services to people from all walks of life, VanCity Credit Union has grown to become a major financial institution serving the people of British Columbia. VanCity is a democratic, ethical and innovative provider of financial services to its members and is Canada's largest credit union, with C$8.2 billion in assets, 297,000 members, and 41 branches throughout Greater Vancouver, the Fraser Valley and Victoria.

In the mid 1990s, VanCity Credit Union saw how integrating corporate and social responsibility into the business operations was a natural and logical direction for a democratic, member-focused credit union. Corporate and social responsibility was recognised as one of its strategic business goals. Having offered financial services to its members for over half a decade, VanCity is now committed to doing business in a way that strengthens its long-term success while contributing to the social, economic and environmental wellbeing of the community. Not only do the members have a say in the future of the credit union, but they also have a share in its earnings and benefit from a series of initiatives to respond to climate change.

Climate change solutions

In reducing its impact on the environment, VanCity is committed to being carbon neutral by 2010. This means reducing GHG emissions from its own operations. Alternatively, it plans to neutralise or offset emissions by investing in community projects that cut down on carbon use so that the net impact is zero. The company focuses on reducing GHG emissions in energy use, paper use, employee commuting and business travel as well as in its own premises.

For personal and business members VanCity provides innovative financing solutions to

encourage action, support activities that reduce home energy consumption, use cleaner energy or lead to more sustainable transportation choices, buildings, businesses and neighbourhoods. Programmes include:

- Financing for green-energy alternatives, such as the Furry Creek small-scale hydro project (see Exhibit 3.2)
- Green business loans and green mortgage pilot projects
- Home financing incentives to support energy-saving home renovations
- Financing for hybrid and natural gas vehicles

Supporting community action

VanCity also supports community organisations which are working to find solutions to climate change. Through grants and innovative financial solutions it invests in activities that address climate change in areas like alternative transportation, green buildings and sustainable community development and planning.

VanCity's Lynn Creek Community Branch

VanCity's Lynn Creek Community Branch in North Vancouver opened in June 2003. The building has reduced water consumption by 30% and improved energy efficiency by 40% over the industry norm. VanCity also made a commitment to recycle close to 100% of its construction waste. The inside of the building is also extremely 'green' with everything from rigorously monitored indoor air quality to the use of low emitting materials, including paints, carpets and composite wood.

The building is aiming for LEED 'Gold' certification.

Exhibit 3.1 VanCity's Lynn Creek Community Branch

A variety of social enterprises are supported, including 'not for profit' organisations, co-operatives and businesses with significant social or environmental objectives and with a

Financing green energy: Furry Creek Hydroelectric Power Project

The Furry Creek Hydroelectric Power Project is a run-of-the-river power development, located on Furry Creek, which flows into Howe Sound about 13 km south of Squamish, BC. With a capacity of 10.458 MW, the Furry Creek Generating Station is expected to generate approximately 44 GWh/yr, sufficient to supply the needs of ~4,400 homes.

The Squamish Nation, on whose traditional lands the project was built, were consulted extensively during the early stages of the project, and have benefited from the project through their ownership, revenue sharing and job opportunities during construction.

Furry Creek provides spawning habitat to five species of salmon so compensation measures are being implemented, such as placement of gravel in two locations in the creek and the establishment of a supplemental water supply for fry migration during the dry summer months. Professional biologists will monitor the conditions of the stream, including Harlequin Ducks, over the next five years to ensure that impact on the environment is minimised.

The scheme is expected to serve the needs of many of BC Hydro's customers with a superior, sustainable and environmentally respectful source of electricity for generations to come.

Exhibit 3.2 Financing green energy: Furry Creek Hydroelectric Power Project

'triple bottom line' of performance measured in financial, social and environmental terms. A growing number of organisations are measuring their success not only through financial results, but by the impacts they have on their community and the environment and they are beginning to represent a significant part of the economy. VanCity provides capital solutions to help achieve a range of goals assisting businesses to identify other resources which can be built into a viable financing plan.

For example, a number of non-profits and co-ops can receive significant revenues or in-kind contributions from government, foundations, community members or volunteers and, from a financial perspective, they represent pure equity for the organisation concerned. For-profit businesses may also be eligible to receive grants or allowances from different sources for achieving significant social or environmental impacts. Sometimes, achieving non-financially measured results can also help to improve financial performance, as with the marketing benefits and highly motivated staff associated with many socially responsible organisations.

VanCity is committed to using its skills and expertise to support individuals, businesses, co-operatives and non-profits working to find positive solutions to these environmental concerns. VanCity supports eligible non-profits and co-operatives to achieve their environmental goals through both EnviroFund (Exhibit 3.3) and Community Partnership (Exhibit 3.4) grants.

Supporting climate change solutions in the community

The Green Building Grant Program was established by the Real Estate Foundation of British Columbia and VanCity. The vision is to minimise the impacts of climate change and improve sustainable land-use practices by supporting green building initiatives in British Columbia. The goal of the programme is to reduce CO_2 emissions resulting from settlement activity.

Each year, the programme provides one or more grants up to C$50,000 each to qualified recipients to fund projects that focus on innovative building renovations, retrofits or regulatory changes that advance green building

VanCity EnviroFund

Established in 1990, the VanCity EnviroFund was conceived as a way to support community initiatives that address local environmental concerns in a positive, constructive and creative manner. The EnviroFund grows through donations made by VanCity based on a minimum of 5% of VanCity VISA card profits. It also grows through individual donations.

Each year, VanCity EnviroFund VISA cardholders vote on which issue areas the EnviroFund will support. The votes are tabulated and the top three issue areas are determined. Community groups are then asked to submit EnviroFund applications that address these issues. A selection committee reviews the applications once a year and selects projects to be funded.

The purpose of the EnviroFund is to encourage positive, actionable solutions to local environmental concerns. To date, over C$1.2 million have been awarded to local groups addressing environmental concerns in sustainable agriculture, water quality and consumption and in wildlife preservation and habitat restoration.

Exhibit 3.3 VanCity EnviroFund

development and practice and reduce the environmental impacts associated with the construction and operation of non-industrial buildings. Projects must include an educational component that aims to encourage green building initiatives by sharing benefits with the public and other practitioners.

In 2001, VanCity and Ecotrust Canada launched a joint Conservation Financing Program. The aim is to strengthen the growth of the conservation economy in British Columbia through this partnership by financing enterprises that help to bring it to life.

Together, VanCity Credit Union, VanCity Capital Corporation, and Ecotrust Canada provide a full range of financing solutions, including small and large conventional loans and growth capital. Financing through a tailored Conservation Loan Fund is available for eligible businesses with strong business plans but unable to access conventional credit.

In addition, the partnership is finding innovative ways to provide technical assistance to individual enterprises and emerging conservation sectors. The Canadian Eco-Lumber Co-op (see Exhibit 3.5) is one such organisation.

Environmental borrowing options

For the individual home owner, VanCity offers renovation financing – Bright Idea Loans – to enable energy-saving improvements to be made.

This personal loan is at prime rate for up to seven years, with a low interest rate compared to a conventional loan. To qualify, householders need to make renovations recommended by an EnerGuide for Houses evaluation of their home. These renovations must achieve at least a five-point improvement in the EnerGuide efficiency rating. Developed by the Office of Energy

Community Partnership grants

For over fifty years, VanCity has been committed to supporting community-building activities in the neighbourhoods in which it operates. A portion of the credit union's annual consolidated net earnings, after taxes and distributions to members, is reinvested in the community through funding programmes.

The grants operate under three principles – social justice, economic self reliance and environmental responsibility. Each project must satisfy at least two of these criteria to qualify. In environmental terms, VanCity considers funding projects and programmes that create awareness and solutions that help to:

- Protect and restore indigenous species and habitats
- Prevent the release of substances that damage air, water, earth or its inhabitants
- Improve air quality, including the promotion of alternative modes of transportation such as public transit, cycling and car co-operatives
- Conserve energy and promote environmentally safe and sustainable energy sources

Projects, undertaken by a not-for-profit, co-operative or charitable community organisation, begin with a community decision-making process. Public participation in the planning and organising process is critical. They are locally focused and have educational value that extends beyond the project or event.

Exhibit 3.4 Community Partnership grants

Efficiency of NRCan in cooperation with CMHC, the programme has a pool of qualified energy advisers who undertake an independent assessment of the home and analyse how it uses energy and where energy is being wasted.

The evaluation includes a 'blower door' test to identify air-leakage points, a comprehensive walk-through of the house to collect data for modelling energy use, an EnerGuide for Houses report, with customised energy upgrade recommendations for the home and an estimate of annual energy consumption, along with an EnerGuide for Houses rating and label. This is a home-energy rating system developed by NRCan and gives a breakdown of energy consumption and a rating of the home's energy efficiency on a scale of 0 to 100.

In addition to the funding packages made available by VanCity, renovations can also be eligible for a home energy grant offered by NRCan.

It is currently estimated that 17% of all energy use in Canada goes toward running homes. So far, more than 130,000 homeowners have used EnerGuide for Houses to help identify and solve home comfort problems and plan their energy efficiency retrofits. NRCan data shows that if these homeowners undertook all the retrofits recommended, they would reduce their GHG emissions by almost 4.6 t per year, per house, more than meeting Canada's 'One Tonne Challenge' (see Section 2.4).

In addition to supporting home improvements, VanCity offers loans for the purchase of petrol-electric hybrid or natural gas powered vehicles. The Clean Air Auto Loan is a prime rate personal loan for a term of up to five years which reduces interest and cuts the cost of motoring as well as claiming reduced emissions of CO_2 by as much as 6 t over five years.

Canadian Eco-Lumber Co-op

The Canadian Eco-Lumber Co-op is supplied by just four forests within British Columbia and offers sustainable solutions to the requirements of the construction industry.

The Co-op members are practitioners – community forests, woodland managers, small-scale sawmills, furniture and cabinet makers, and other value-added wood processors and advocates including many of the best-known and most effective environmental organisations.

All the wood products sold by the Co-op are either eco-certified by the Forest Stewardship Council (FSC) or are reclaimed from old structures slated for demolition. They have been chain-of-custody certified by the FSC which allows the Co-op to sell products bearing the FSC logo. The Co-op is audited annually by the Soil Association, an FSC-accredited certification body, to ensure that it can verify that its wood products come from an FSC-certified source.

Exhibit 3.5 Canadian Eco-Lumber Co-op

3.3 Sustainable communities

3.3.1 Introduction

Many cities and communities around the world are addressing the same issue faced by the UK, namely rundown and redundant industrial lands blighting existing communities. Yet, this is recognised as a great opportunity: the opportunity to create new, vibrant and prosperous neighbourhoods that link back into, and rejuvenate, existing communities. Whereas, in the recent past, new developments have concentrated on generating prosperity, there is a growing awareness that this is insufficient and short sighted. The desire is to make them more rounded sustainable communities, and with this, address issues of energy use and climate change.

The principles of sustainable urban development that are being adopted in both Canada and the USA are referred to as 'Smart Growth'. In the UK the same basic principles – of increased density, mixed use, public transport integration, etc – have been incorporated by the Urban Task Force in their report *Towards an Urban Renaissance* and, partially, in the subsequent Urban White Paper. In all cases the emphasis is on improving the urban environment by redeveloping redundant and brownfield sites in cities – knitting the urban social and physical fabric together. The implications of such development, particularly on infrastructure (transport, energy, open space, ecology, water, etc) as well as on the economic aspects, are rarely fully explored.

In isolated, ring-fenced communities, such as the Simon Fraser University (SFU) and University of British Columbia (UBC) campuses in Vancouver, it has been possible to produce local incentives and monitor progress. For example, the mixed-use developments in combination with transport pricing strategies have had a significant impact on reducing single-occupancy vehicle use of the sites.

However, in Vancouver overall, the Smart Growth policies seem to have been accompanied by unwanted consequences, such as the dispersal of industry to the peripheries (one suspects as a result of increased land value due to densification as well as finding attractive, accessible environments). This in turn has meant that planned public transport is less likely to be as effective or commercially successful as planned because diffuse employment locations have resulted in some increased private car use.

The case studies discussed below warrant detailed observation to monitor actual progress as they are likely to reveal important lessons in sustainable community development.

A number of key aspects are raised:

- Need to address issues of infrastructure provision given plot developer inability to lead this
- Statutory energy standards tend to reflect lowest common denominator over a wider geographic area, and so do not help in moving energy performance significantly forward towards long-term goals
- Lack of take-up of voluntary advanced standards like residential R-2000
- False sense of limited environmental impact of electricity due to historic low-carbon sourcing
- Locally applying enhanced standards to act as catalyst for change
- Local authority acting as enabler for infrastructure and services that go beyond individual development plots
- Taking advantage of high public awareness of 'quality of life' issues to sell sustainability issues

The following community-scale projects are reviewed below:

- Dockside Green, Vancouver, Canada
- Regent Park, Toronto, Canada
- Southeast False Creek, Vancouver

3.3.2 Dockside Green, Vancouver

Introduction

This community-scale project is currently also at the design proposal stage and thus this description is about principles rather than achievements. It is a project to redevelop 12 acres (~5 ha) of abandoned industrial land into mixed use accommodation and public spaces. The design principles are based on the 'triple bottom line' of sustainability, with interactive benefits for environment, society and economics.

Description

The proposal is to develop this large brownfield site based on sustainable design principles. The vision statement for the development is as follows:

'Dockside Green will be a socially vibrant, ecologically restorative, economically sound and just community. It will be a distinct collection of beautifully designed live, work, play and rest spaces designed to enhance the health and wellbeing of both people and ecosystems, both now and in the future.'

The planned mix of uses is approximately as follows:

- 77% residential
- 8% hotel
- 6% office
- 5% industry
- 4% commercial

The overall floor area ratio (FAR) is 2.

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Exhibit 3.6 Dockside Green, Vancouver: conceptual design

© Busby Perkins & Will Architects

Exhibit 3.7 Dockside Green: conceptual masterplan

The development focus is on 'Dockside Plaza' at the southern end of the development, and stretches northwards via the 'Greenway' – a linear park with pedestrian routes and water features. The design approach is to create pedestrian and cycle streets, with limited vehicular access, integrate public art, and exploit green roofs.

Along the eastern edge the development is low-rise, three-storey mixed industrial accommodation, whereas along the western side it is stepped residential towers, rising to seven or eight storeys. This massing is accentuated by the rise in topography from the east dockside to the west and exploited to accommodate underground parking. The massing is manipulated to enable a view from the west of the site to the east, in between the residential towers to the dockside. The low-rise buildings to the east and the dispersed higher development to the west aims to ensure solar access to the centre of the site. This is reinforced by the wide spacing between buildings.

Green roofs, urban agriculture and habitat enhancement are an integral part of the strategy. Green spaces are, furthermore, an integral part of the water management for the site.

All buildings will need to achieve LEED 'Platinum' accreditation.

Other intentions and targets include:

- Development to be GHG neutral
- Biomass energy cogeneration
- Geothermal energy
- Biodiesel facility
- Sewage treatment
- Renewable energy strategies
- Energy efficiency in building design
- No potable water use in irrigation
- Potable water reduction in buildings (60% in residential, 75% in commercial)
- Composting of organic waste
- Integrated transport strategy
- Mixed income and age profile of population (including affordable housing)
- Fly ash use in cement
- Construction waste management
- 'LEED for neighbourhood' rating system
- Job creation training during/after construction
- Demonstrating local products
- Partnering with local educational institutions
- Economic spin-offs

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Exhibit 3.8 Dockside Green: conceptual design for Harbour Road Industrial Area

Performance

The performance targets are exhaustive, but largely qualitative at this stage. The structure and nature of the economic strategy – ie how the ambitions will translate, be implemented and support in practice – is not as clear as the 'green' intentions. However, the ambitions for this project are very high and the enthusiasm and expertise is to a large extent to hand. Lessons learnt from smaller local developments – such as those described in this report – suggest that this project will build on the successes.

Conclusion

This project represents a significant challenge in terms of the change of scale and breadth of issues being tackled compared to previous projects, both regionally and internationally. It is hoped that the intentions will mature into measurable criteria and that the final result can truly function as a pilot test case and exemplar of large-scale sustainable urban development.

An open and honest assessment of the project criteria, strengths and weaknesses as it develops and when it is completed will be a significant and extremely valuable contribution to knowledge. In order to succeed in this respect the criteria need to become explicit, and the monitoring of progress should be published. It is hoped that this project will succeed in every respect and will be of international acclaim. It is certainly one that should be followed closely.[46]

3.3.3 Regent Park, Toronto

The 69 acre (~28 ha) downtown area of Regent Park in Toronto is one of the oldest publicly funded housing communities in Canada, having been home to 7,500 people for over 50 years.[47] Today, although the neighbourhood is culturally vibrant, with a diverse range of residents, the area suffers from crime and poverty, and is in desperate need of regeneration. Serious problems such as deteriorating buildings, a lack of community facilities and services, and poorly planned public spaces blight the area.

It is within this context and following many unsuccessful attempts to improve the area that, in 2001, site managers Toronto Community Housing Corporation (TCHC)[48] took the decision to make the revitalisation of Regent Park a priority. It was decided that sustainability would be a key component of the improvements, leading the way to social as well as environmental and economic sustainability.

TCHC set the vision to make Regent Park a community of:

'… vibrancy, diversity and sustainability – in building types, designs and heights, incomes, uses, community services, recreation spaces, learning facilities and activities. In short a healthy community shaped by the residents of this community. The vision sees the community infrastructure renewed alongside the housing infrastructure. Redevelopment offers a unique opportunity to take a new and inclusive approach to building a vibrant, healthy community and to creating a place where poverty can be reduced through community effort.'

46 *www.docksidegreen.ca*

47 TORONTO COMMUNITY HOUSING, 2005. *Regent Park – A Place to Call Home*. Toronto Community Housing

48 TCHC is the social housing corporation owned by the City of Toronto. As Canada's largest landlord and social housing provider, it houses more than 160,000 residents in 65,000 households across Toronto

Exhibit 3.9 Regent Park, Toronto: view of existing buildings

Now, having received almost unanimous approval by the City of Toronto's planning officials in early 2005, work at Regent Park is due to start at the end of the year, following four years of planning and preparation. The project is due to be completed in six phases, over 12 years, and while some of the existing housing will remain and be upgraded, most of the Regent Park site will be demolished and cleared.

The plan is for a mixed-use community with a range of building types, sizes and tenures, with an increased neighbourhood density from 2,000 units to over 5,000 units for 12,500 people, of which around 3,000 will be market housing and 2,000 social housing. Buildings will be three or four storey townhouses, mid-rise buildings and higher-rise apartment buildings, and streets, green areas, and public and private spaces will be introduced.

Project development

Regent Park was originally constructed in two phases between 1947 and 1958. The aim of the community development was to create a 'garden city' set apart from the fabric of the rest of the city in a park-like setting. Ironically, it is this idyllic concept that has probably caused most discussion and debate amongst the project team during the planning of the revitalisation of the area. Unhappy with the fact that the area stands apart from the rest of the city, residents have asked that the new community looks like any other neighbourhood in Toronto and that it be reintegrated into the city – a point that Regent Park planners have taken seriously. Residents have also requested that the neighbourhood be a 'green community', so TCHC has set ambitious environmental targets for the regeneration project.

© Toronto Community Housing Corporation

Exhibit 3.10 Regent Park, Toronto: proposed masterplan

Community consultation and opinion has been an important aspect of the project development phase. For example, a Community Plan has been developed in consultation with more than 2,000 residents, other agencies, local schools and employers, the City of Toronto, and key stakeholders. This plan focuses on areas that are of importance to the local community: employment and economic development, health and safety, diversity and settlement, education, youth.

More widely, there appears to be a genuine sense of optimism amongst citizens of Toronto that the regeneration of Regent Park will help revitalise a much larger area of the city than the neighbourhood itself, bringing new business and activity to the whole of the east downtown. Evidence of this optimism was seen during the mission week, with positive reports of the project appearing in the local media almost daily. This is especially encouraging given that Canada, like the UK, is undergoing an urban renaissance with a drive to re-urbanise and encourage people back into the cities.

The Regent Park project is predicted to cost ~C$1 billion[49]. TCHC will provide over C$400 million of this, but the major proportion (~C$500 million) will be invested by residential developers and commercial service providers. The remaining required funds are expected to come from the three levels of government (for infrastructure and enhanced community services) and from federal-provincial housing funding programmes.

49 This figure does not include the costs of the significant up-front resource that has gone into the planning and development stage of the project. At the time of the mission, TCHC was unable to ascertain this cost.

© Toronto Community Housing Corporation

Exhibit 3.11 Regent Park, Toronto: community consultation

Environmental strategy

Sustainability has been an integral part of the development phase of Regent Park, and in order to ensure that the scheme will be at the fore of best practice and will meet the need of the local community, TCHC has conducted a significant amount of research at the outset of the project. Alongside extensive consultation with residents through meetings and workshops, TCHC has also undertaken investigations on best practices, developed roadmaps of possible options and solutions, and conducted studies into the targets and recommendations that should be made.

As a result of this work, environmental targets have been set for Regent Park that together address energy, air quality, water quality and quantity, waste reduction and natural environment enhancement, as well as aesthetic appeal and the comfort of residents (see Exhibit 3.12). These targets and standards have been informed by the LEED rating scheme, but given its current limitation as a 'community-scale design tool' (being more geared towards individual buildings),[50] it was not the only driving force in optimising sustainable solutions for the neighbourhood.

The key to achieving the 75% energy reduction target, and therefore delivering a reduction in carbon emissions at Regent Park, is seen as the planned community energy system. The proposed system covers all the thermal energy requirements for the site and will incorporate radiant heating and cooling, a central ventilation system for

50 To help develop a LEED system that is relevant to community-scale development, TCHC is feeding back information on the issues it faces at Regent Park

Regent Park, Toronto: sustainability targets

- 35% reduction in water use per person
- 20% reduction in storm-water runoff
- 84% removal of solids in storm water
- 35-60% solid waste diversion rates in all buildings
- 90% diversion of demolition and construction waste
- Reduced environmental impact in building products
- Improved modal split and support for non-automobile transportation
- Improved natural environment and water use through low maintenance landscape strategies
- Up to 75% reduced energy consumption
- Up to 80% reduction of GHG emissions (35,000 t per year)

Exhibit 3.12 Regent Park, Toronto: sustainability targets[51]

humidity control, and centrally heated hot water. Alongside this, the buildings themselves will have design requirements for enhanced thermal envelopes, and high performance glazing and lighting.

To set up the community energy infrastructure across Regent Park, TCHC has partnered with a community energy company. This engagement in the early stages of the project has meant that TCHC has been able to explore options to exploit resources such as solar and ground water cooling in the future, and integrate feasible concepts into the plans for the scheme at the outset.

In many ways, the use of community energy is seen as a pioneering step by TCHC. During the visit, a representative of the energy company reported that there is still some hostility and apprehension towards its use across Canada, with many claiming that the systems are too costly. It is clear that, as in the UK, a lack of knowledge and understanding is still a considerable barrier to the widespread uptake of such systems.

Conclusion

If, in 10-12 years' time, Regent Park delivers the vision it has set out to achieve, it will surely be regarded as a huge success and an example for other cities in Canada to follow. Although no tangible evidence of the success of the scheme exists yet, the ambitious targets that have been established should drive the ambition for higher standards of sustainability at a community scale of development in Canada and raise the level attained by other community schemes.

From discussions held with TCHC during the mission, it is evident that the success of the scheme to date can be attributed to two key factors:

- Significant up-front resource – although TCHC is unable to ascertain the financial resource that has been utilised during the initial phase (2001-2005) of Regent Park, the work that has been undertaken to date is clear evidence that the Corporation is fully committed to ensuring the development meets the needs and expectations of all stakeholders. Significant staff resource and time has been given over to the regeneration scheme; residents have been consulted extensively; local businesses have had the opportunity to express their views; and consultants have been employed from the outset of the project to provide advice and help identify and avoid potential longer-term problems. This will surely contribute to the success of the project in the longer term.

51 The targets for sustainability at Regent Park were presented to the mission team by TCHC during the mission week

- Strong leadership – the revitalisation of Regent Park has received wide support from a large number of individuals and organisations around Toronto, including the City of Toronto, the Toronto Mayor David Miller[52], residents and community champions. This support is considered to be one of the key factors in driving the project forward and in ensuring widespread acceptance of the plans for the site. The Mayor, in particular, has been a strong advocate of the project and has provided leadership in seeking additional funding from the provincial and federal governments, and in linking the project to other initiatives such as the NDCC. He is cited by TCHC as being critical to the success of the scheme to date.

Throughout the development phase of Regent Park, TCHC has faced several challenges that it has overcome with tenacity and sensitivity. If it continues to take this approach over the next 10-12 years, it should deliver a scheme that socially meets the expectations of the city, the residents and all that have been consulted; that economically attracts new business, provides employment opportunities, and supports the growth of surrounding communities; and that environmentally delivers a sustainable development with a quantifiable reduction in carbon emissions.

3.3.4 Southeast False Creek, Vancouver

Southeast False Creek (SEFC) is an area of some 200 hectares of former industrial area ringing False Creek waterfront, southeast of Vancouver city centre. North False Creek has already been developer built-out with high-rise residential blocks and waterfront facilities. South False Creek is predominately lower density residential type accommodation.

While there are some isolated sustainability related features, the standards are largely set by the developers based on Building Code minimums. There have been some unquantified indications of potential occupier interest in sustainability-related issues, probably where developers mention it as part of their market discrimination, given the high number of units on the market at any one time. Interestingly there appears to be more public interest where sustainability is presented in the form of 'quality of life' issues.

Southeast False Creek is the next phase of some 36 ha, and the last of the undeveloped waterfront (see Exhibits 3.13, 3.14 and 3.15). For this, Vancouver City has put in place an Official Development Plan (ODP) (Exhibit 3.16) to make it a model sustainable community. It will also be the location for the 2010 Winter Olympics Village. The base development plan envisages ~500,000 m^2 of residential accommodation and 115,000 m^2 of commercial floor area.

The City's aspirations for Southeast False Creek are high, and it is aware that without considerable City involvement the development market would be unwilling to deliver on these. Backed by ownership of about 80% of the land, the City is taking a proactive approach to infrastructure and common services, as well as establishing hard-edged sustainability standards. Having set out its aspirations in the ODP (similar to UK Supplementary Planning Guidance) and mindful that much of the funding will come from private sources, it is seeking joint venture agreements with developers, joint municipal utility / private ESCo for services infrastructure, and planning agreement commitments on amenity provision and development standards. The ODP describes the basic principles for urban design and

52 TORONTO COMMUNITY HOUSING, 2005. *Toronto Community Housing – Partners in Communities. Annual Review 2004.* Toronto Community Housing

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Exhibit 3.13

Southeast False Creek (outlined in yellow) showing its context to the rest of Vancouver

Exhibit 3.14

Southeast False Creek: reclaimed industrial land alongside a flyover (on the right of the image) indicates the environmental challenges for the new development

Exhibit 3.15

Southeast False Creek: the waterfront is the last available for development in the area, and is a particularly attractive aspect of the site

Southeast False Creek: Official Development Plan Preamble

Vision for a sustainable urban neighbourhood in Southeast False Creek

The objects of the Official Development Plan for Southeast False Creek (SEFC) are to:

- Embrace the vision for SEFC set out in the Southeast False Creek Policy Statement adopted by Council on October 19, 1999, and amended on July 26, 2004.
- Establish a foundation of urban design principles, sustainable principles, and environmental, social, and economic sustainability strategies to enable the development of SEFC as a complete community, and to serve as a learning experience for application of such principles and strategies on a broader scale.
- Develop a mixed-use neighbourhood focusing on the diversity of residential uses to accommodate all incomes, with family housing as a priority, where people live, work, play, and learn in a neighbourhood designed to maintain and balance the highest possible levels of social equity, 'liveability,' ecological health, and economic prosperity so as to support their choices to live in a sustainable manner.
- Provide a framework for the creation of policies, zoning and other bylaws, housing programmes, public facilities agreements, subdivision plans, servicing agreements, design guidelines, forms of development, development conditions, restrictive covenants shoreline treatment and configuration, and other instruments, consistent with this Official Development Plan, to regulate development.

Exhibit 3.16 Southeast False Creek: Official Development Plan Preamble

sustainability and then goes into more detail with strategies for each. It deals with massing and town planning guidelines and sets targets for environmental standards.

Typical of the environmental impact aspect of the ODP is the reference to LEED as the benchmark standard. While the current market might be prepared to offer LEED 'Certified', the City is setting the standard at 'Silver', and it expects 'Gold' to be achieved by civic buildings, with various potential additional 'Platinum' standard demonstration buildings. More specifically on energy use, the expectations significantly exceed the statutory requirements with targets of ASHRAE 90.1 (1999) standard less 50% for commercial property and less 15-20% for residential property. Issues of 'affordable housing' also address energy because it is defined as needing no more than 30% of gross income on rent and utilities.

With regard to energy supply there are various references to 'carbon neutrality' and there is considerable interest in UK and European examples. To what degree this might be achieved in Vancouver is less certain. The supporting Energy Options study document is distinctly downbeat about the level of innovation to be expected, and vague on where the real benefits are to be gained compared with European leading-edge thinking. Various studies are continuing, including carbon-neutral heating using energy from waste, ground source heat pumps, and heat recovery from sewer lines. Solar hot water technology is also being seriously considered although it has market hurdles related to sun availability perceptions.

The impression gained is that some of these higher aspirations are being diluted by the lack of local experience of delivering them. The consequence of this is likely to be reflected in reduced political confidence and expectations, and thereafter diluted planning policy enforcement. Unless this situation is retrieved, more than a few of these aspirations may well become subject to a classic situation of defaulting to conventional solutions that are simply easier and more predictably delivered.

Given the extensive forests surrounding Vancouver there is an interesting negative attitude to biomass as an energy source, either for electrical generation via CHP or simply for heat generation. The beautiful local scenery is dominated by woodland and has a close association with the local high quality of life, consequently there is apparently little thought of using this natural resource for energy. This is in spite of the fact that there are vast forested areas remote from the built-up areas that potentially could be husbanded as a significant sustainable energy resource.

On the other hand there is an apparent automatic assumption that electricity use in new-build development is sustainable because such a large proportion is historically sourced from hydroelectric power. However, recent expanding electrical demand is being met by building new gas-fired power stations, so effectively any new-build added to the building stock is using all fossil-fuel sourced electricity. While electricity is so cheap, this attitude is likely to continue.

While the majority of the completed development cost will come from private capital, there is expected to be a significant public-funded component. As well as applying a Re-zoning Levy that aims to capture a community contribution from the development capital gains, Vancouver operates a city-wide Development Cost Levy (DCL) at a rate of C$6/ft^2 (~C$65/m^2). This is intended to help fund infrastructure initiatives alongside replacement housing, childcare, parks and other public services.

Preliminary list of sustainability indicators and targets for SEFC

The following extracts outline typical hard-edged indicators and targets for ongoing monitoring and evaluation of the performance of the SEFC community. These indicators and targets were developed as a baseline for the SEFC ODP.

ENERGY

Indicator – Total annual building energy consumption (residential and commercial), GJ/m^2 gross floor area.

Target – 0.79 GJ/m^2 average for commercial and institutional buildings; 0.44 GJ/m^2 for townhouses; 0.31 GJ/m^2 for multi-unit residential buildings. This is based on the assumption that privately developed residential and commercial buildings achieve LEED 'Silver' performance and all civic buildings achieve LEED 'Gold' performance. All wood-frame low-rise (four storey and below) buildings are assumed to be built to R-2000 standards, and concrete construction – including high-rise apartments and commercial buildings – are assumed to be built to Commercial Building Incentive Program (CBIP) standards.

TRANSPORTATION

Indicator – Transportation – by residents' % trips non-automobile. This is an initial indicator, which captures most sustainable transportation modes, such as walking, cycling, and all forms of transit. Although less useful for estimating environmental impacts than specific data such as automobile km/person/yr, mode split data is available for the City and some specific neighbourhoods, whereas automobile usage is not.

Target – 60% of all daily trips by non-automobile modes based on reduced parking requirements, greater support for car-sharing and co-op vehicles, and increased support for alternative transportation modes such as cycling and public transit.

GREEN BUILDINGS

Indicator – Overall Environmental Performance of Buildings (LEED points). LEED points represent a cumulative total of credits for building performance with regard to site impacts, energy efficiency, transportation and parking management, water management (drinking water and storm water) and indoor air quality.

Target – 33 points per building or better, based on Council's policy direction that all non-municipal buildings in SEFC should achieve at least LEED 'Silver'. LEED 'Gold' status is required for all civic buildings.

OTHER ENVIRONMENTAL INDICATORS ARE PROVIDED FOR:

Water consumption
Solid waste and recycling
Storm-water runoff
Urban agriculture

LIKEWISE SOCIAL INDICATORS AND ECONOMIC INDICATORS ARE PROVIDED

Exhibit 3.17 Preliminary list of sustainability indicators and targets for SEFC

4 SUSTAINABLE BUILDING PROJECTS

4.1 Non-domestic buildings

4.1.1 Introduction

In order to understand the application of low-carbon strategies and design approaches within the non-domestic sector the mission team visited a range of projects currently being showcased as best practice in Vancouver and Seattle.

The team was keen to understand the main drivers for the development of low-carbon buildings, the decision-making processes during design, and as-built performance. The expertise and disciplines represented within the team enabled these issues to be related back to the UK situation during site visits and subsequent discussion with US and Canadian counterparts.

A cross-section of projects was considered, covering the commercial, education, recreation, public and retail sectors. Many of the buildings could be described as demonstration schemes as opposed to examples of standard practice. The team was particularly interested to learn if the 'grass roots' environmental agenda was forcing change and how lessons learned from each project were being taken forward into wider application.

At an early stage in the mission it became apparent that, at the design stage, energy conservation was given a lower priority than in the UK due to availability of low-price electricity available from hydroelectric plants in the region. Coming from a renewable source this meant that the carbon impact of buildings in Vancouver and Seattle were relatively low compared with most other areas of North America. This resulted in higher emphasis being given to the wider issues of sustainability and many of the projects had actively used the LEED certification scheme as part of the design process.

LEED stands for Leadership in Energy and Environmental Design and is one of the several building environmental performance assessment and certification schemes currently available in the world today. The BRE's Environmental Assessment Methodology (BREEAM) is the UK's equivalent.

4.1.2 Leadership in Energy and Environmental Design (LEED)

This section provides a brief overview of the LEED scheme as it is operated in Canada and comments on some of the differences with the BREEAM scheme.

LEED was developed by the US Green Building Council (USGBC) and is licensed by them for use in other countries and regions. LEED in the USA offers a range of schemes covering new commercial construction, existing offices, core and shell schemes, commercial interiors, homes and neighbourhood schemes. In Canada the Canada Green Building Council (CaGBC) adapted the new construction methodology to better reflect Canadian construction practices, climate and regulations. The amended scheme became operational in 2000 with CaGBC being responsible for its promotion, management and development. In the five years since the introduction of the scheme, 109 projects have been registered and 16 have been certified (May 2005 figures). Alongside this rapid uptake is an equally rapid growth in the number of LEED accredited professionals, some 1,683 by March 2005.

LEED was created with a number of objectives to help transform the marketplace for green buildings by providing a measurable 'green' standard and preventing 'greenwash'.[53] The assessment criteria are based on existing codes, standards and guidance. The assessment process is performance-based, self-evaluating, self-documenting but not self-certifying. Certification and quality assurance is carried out by CaGBC. The assessment process covers six main areas:

1 Sustainable sites: the intent of this section is to: encourage the reuse of existing buildings and sites; improve storm-water management; reduce external light pollution; and encourage alternative methods of transport. Some of the credits are similar to credits in the BREEAM scheme under the categories of land use, transport and pollution.

2 Water efficiency: aimed at reducing water consumption within the building and increasing the uptake of waste water technologies. These credits are similar to those awarded under the BREEAM water category.

3 Energy and atmosphere: energy efficiency, renewable energy systems and ozone protection are the main goals of this category.

4 Materials and resources: encourages reuse of materials, collection and storage of recyclable materials, and reducing the impact of the materials used in construction.

5 Indoor environmental quality: encourages an improvement in the indoor visual, acoustic and thermal environment. Such credits are similar to those in the health and wellbeing section of BREEAM.

6 Innovation and the design process: this sixth and final section was added by CaGBC and rewards design teams incorporating novel features not covered elsewhere in the assessment process. There is no equivalent in the BREEAM scheme.

Exhibit 4.1 summarises the number of credits available for each LEED category.

Unlike BREEAM, most categories have a number of prerequisite credits that must be achieved before certification can be achieved. These prerequisites must be met to qualify for certification, but do not provide any credits towards the final score. Once the prerequisites are achieved, credits can be sought under any category to achieve a final rating. This offers design teams greater choice and flexibility to meet a target rating within a cost plan. For example, a design can be focused on energy efficiency and indoor

53 Greenwash: '… a term that environmentalists and other critics give to the activity of giving a positive public image to putatively environmentally unsound practices' *(http://en.wikipedia.org/wiki/Greenwash)*

No	LEED category	Number of prerequisites	Number of credits	Maximum number of points
1	Sustainable sites	1	8	14
2	Water efficiency	-	3	5
3	Energy and atmosphere	3	6	17
4	Materials and resources	1	7	14
5	Indoor environmental quality	2	8	15
6	Innovation and design process	-	2	5
	TOTALS	7	34	70

Exhibit 4.1 LEED categories

environmental quality and a rating achieved. This, however, does not fully achieve one of the aims of LEED which is to promote an holistic approach to building design.

Ratings are awarded from 26 points upwards (see Exhibit 4.2).

LEED rating	Points range
'Certified'	26 – 32
'Silver'	33 – 38
'Gold'	39 – 51
'Platinum'	52 - 70

Exhibit 4.2 LEED ratings

Credits are all of equal weighting, unlike the BREEAM scheme where an environmental weighting factor is applied to each section score before the final score is calculated. As with BREEAM, credits are awarded by meeting specific performance criteria that outperform minimum typical specifications. The criteria required to confirm the award of a credit are described in published guidance available via CaGBC's website and accredited LEED professionals.

The LEED professional's role in the design team is to provide advice on the development of a design that achieves the credit criteria, assist with documentation and calculations, and register and submit the project for certification with CaGBC. The rating process requires the submission of a 'scorecard' and the required supporting documentation. Documentation requirements have been changed to reduce certification timescales. Instead of the submission of detailed drawings and performance calculations, letter templates with which the designer certifies meeting the requirements for claiming a credit are supplied. Random audits are carried out by CaGBC to verify credit claims.

The BREEAM scheme does not have an equivalent for the LEED accredited professional. With BREEAM, a BRE-registered assessor is appointed by a project team or client from a licensed organisation. The assessment is made by the assessor based on evidence (detail drawings, specifications, calculations) provided by the design team. A certification report is prepared, based on the assessed evidence, recommending a rating. On satisfactory completion of the quality assurance checks made by the BRE, a certificate is issued direct to the client.

The assessment process (LEED or BREEAM) provides a design checklist for environmental issues which a design team may wish, or be required, to address through the design process. Both schemes address the same broad issues and themes of GHG emissions, pollution, quality of internal environment, efficient use of resources, be that energy,

Exhibit 4.3 City of Vancouver Works Yard

water or materials. Performance criteria vary but both schemes reward designs for achieving over and above the minimum legislative requirements. Both schemes encourage an integrated, whole-building design approach to reduce the overall impact of buildings on the environment.

LEED has adopted a market-led approach and has achieved very rapid market penetration in Canada. This has been assisted by the creation and use of the accreditation process for professionals. The accredited professionals are well supported with guidance documentation and web resources from the CaGBC. No equivalent exists in the UK, and the BRE should review the BREEAM scheme to determine whether greater value could be obtained from better recognition of BREEAM assessors.

LEED in Canada has become a recognisable, trusted brand with a growing group of accredited professionals supporting and extending the network.

The following non-domestic building projects are reviewed below:

- City of Vancouver Works Yard, Canada
- University of British Columbia, Campus Sustainability Office, Vancouver, Canada
- Gleneagles Community Centre, Vancouver
- Omicron office refurbishment, Vancouver
- Semiahmoo Library, Surrey, Canada
- City of White Rock, 'Green' Operations Building, Canada
- Seattle Public Library, USA
- REI flagship store, Seattle, USA

4.1.3 City of Vancouver Works Yard

The mission visited the City of Vancouver's National Works Yard and toured the Administration Centre, one of a number of new buildings on five hectares of reused industrial land to the southwest of Vancouver's city centre. The Works Yard provides city facilities, not dissimilar to a city council depot in the UK, for activities such as

engineering, parking and infrastructure maintenance. Omicron, the architectural and engineering design consultants for the project, led the tour of the centre.

The centre was the first building in Canada to receive LEED 'Gold' certification from the CaGBC under the LEED BC criteria. With 44 credits (refer to Exhibit 4.6), the scheme clearly addresses individual LEED criteria in order to achieve this high score. The result is a broad-based approach to sustainability making it a good pilot project from which the city and its designers can learn and develop.

This two-storey building structure is a composition of 'tilt-up' concrete, structural steel and engineered 'paralam' timber roof trusses. The striking large steel 'V's and tree structures are reminiscent of the industrial heritage (the site used to be a rail yard) and act to provide lateral stability to the building against earthquakes which are a significant design criterion in Vancouver.

The building design presents good passive opportunities, being oriented south with a monopitch roof. The ground floor is a double-loaded corridor with support spaces to either side. At the upper level, circulation and technical spaces are positioned to the north, and office accommodation is generally to the south behind a glazed façade. The deep roof overhang provides solar protection to the generous amount of glazing, which in turn allows 90% of occupants to have year-round direct views to outside – one of the criteria for a LEED credit.

The built fabric consists of aluminium, thermally broken windows with low-E coated glazing and a 0.79 transmission coefficient and 0.49 shading coefficient. The overall fabric U-values are: wall 0.5 W/m^{2}K, roof 0.4 W/m^{2}K and window 2.6 W/m^{2}K; which are significantly higher, therefore less insulating, than current Building Regulations in the UK.

The building has a number of mechanical systems to control the indoor environment. A closed-loop (water/glycol mix), ground-source heat pump rated at 176 kW provides thermal exchange between the building and the ground beneath the external car park. The ground-loop boreholes, some 24 in number and each 120 m deep, are sized to provide 50% of the peak heating demand, with natural gas boilers providing the peak duty during extreme winter conditions. Detailed hourly load analysis by the engineers shows that, in this configuration, the peak load boiler only runs about 10% of the time. The annual heat demand is calculated to be ~343,000 kWh.

Every second borehole is installed at 12º from vertical to allow greater separation of the holes at depth. This is a clever strategy that reduces thermal interference between adjacent boreholes and also reduces the amount of header piping connecting the boreholes since the bore heads can be closer together.

A 'two-pipe' hydronic network distributes water through high-level radiant panels (Exhibit 4.4) in the accommodation areas and fan convectors adjacent to doors. The system therefore works in cooling or heating mode at radiant panel temperatures of 60ºF (15.5ºC) and 130ºF (54.5ºC) respectively.

Exhibit 4.4 Works Yard: suspended radiant panels

Indoor air quality is a significant design factor in Canada and, not withstanding the considerable effort put into reducing applied finishes and using low-VOC materials, occupied spaces are also provided with a full fresh air mechanical displacement ventilation system with mechanical cooling. The building also incorporates manually controlled opening windows to perimeter areas. The two strategies are not specifically integrated, however mechanical ventilation fan speed is reduced when CO_2 sensors detect low-CO_2 concentrations (ie when the windows are opened). This goes some way to reduce fan energy consumption when natural ventilation alone can provide satisfactory conditions.

The artificial lighting installed at ~10 W/m^2 incorporates occupancy controls but no daylight sensing/dimming or local manual override. One result of this is that all the lights were switched on during a bright sunny day in spaces that could have been easily daylit. In Canada at present, dimmable electronic ballasts are not considered cost effective due to the high component cost (twice that of traditional switch-start ballasts) and the low cost of electrical energy. T8 fluorescent lamps, in up/down suspended luminaires, are generally specified in the building.

Exhibit 4.5 Works Yard: photovoltaic rooflight

A small photovoltaic (PV) rooflight (Exhibit 4.5) is included primarily as a demonstration exercise and is estimated to offset ~1% of the building's electrical demand.

The designers purport an energy reduction of 60% below MNECB (Canadian Model National Energy Code for Buildings), and ~40-50% below ASHRAE 90.1-1999.

Water demand has been reduced by 75% through the inclusion of dual-flush WCs, waterless urinals and rainwater harvesting from the roof to flush the WCs via a buried 5,000 litre tank. Waterless urinals proved less popular with the occupants due to smells and blockages; however, making people aware of the purpose of the technology and improving the maintenance regime has successfully overcome this.

As a demonstration project, a small area of roof is planted with drought-resistant sedum. Albeit small in overall roof area terms, this is used to demonstrate possibilities for storm-water attenuation, and reduction in the 'heat island' effect. The city intends to increase the area of sedum roof in the future to further enhance the benefit to the site.

The mission team felt that, in comparison with building practice in the UK, the biggest technological advances had been made in materials specification. Particular examples are: the extensive use of fly ash as a cement substitute in concrete, reducing cement volume by up to 50%; 80% of the structural steel is fabricated from recycled steel and over half of the construction materials are sourced locally. Monitoring during the construction period revealed that over three quarters of construction waste was recycled.

The building clearly plays an important role as a pilot project in Vancouver, increasing the profile of the city's green building programme and promoting the Canadian LEED programme.

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

City of Vancouver Works Yard
LEED Project #1
LEED BC Version 2.1 Certification Level: Gold
Monday, June 14, 2004

44 Points Achieved — **Possible Points: 69**

Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 or more points

8	**Sustainable Sites**	Possible Points:	**14**
Y	Prereq 1	**Erosion & Sedimentation Control**	
Y	Prereq 2	**Riparian-wetland protection**	
1	Credit 1	**Site Selection**	
	Credit 2	**Development Density**	
1	Credit 3	**Redevelopment of Contaminated Site**	
1	Credit 4.1	**Alternative Transportation,** Public Transporation Access	
1	Credit 4.2	**Alternative Transportation,** Bicycle Storage & Changing Rooms	
1	Credit 4.3	**Alternative Transportation,** Alternative Fuel Vehicles	
	Credit 4.4	**Alternative Transportation,** Parking Capacity	
	Credit 5.1	**Reduced Site Disturbance,** Protect or Resore Open Space	
	Credit 5.2	**Reduced Site Disturbance,** Development Footprint	
	Credit 6.1	**Stormwater Management,** Rate and Quantity	
	Credit 6.2	**Stormwater Management,** Treatment	
	Credit 7.1	**Heat Island Effect,** Non-Roof	
1	Credit 7.2	**Heat Island Effect,** Roof	
1	Credit 8	**Light Pollution Reduction**	

5	**Water Efficiency**	Possible Points:	**5**
1	Credit 1.1	**Water Efficient Landscaping,** Reduce by 50 %	
1	Credit 1.2	**Water Efficient Landscaping,** No Potable Use or No Irrigation	
1	Credit 2	**Innovative Wastewater Technologies**	
1	Credit 3.1	**Water Use Reduction,** 20% Reduction	
1	Credit 3.2	**Water Use Reduction,** 30% Reduction	

10	**Energy & Atmosphere**	Possible Points:	**17**
Y	Prereq 1	**Fundamental Building Systems Commissioning**	
Y	Prereq 2	**Minimum Energy Performance**	
Y	Prereq 3	**CFC Reduction in HVAC & R Equipment**	
2	Credit 1.1	**Optimize Energy Performance,** 20% New / 10% Existing	
2	Credit 1.2	**Optimize Energy Performance,** 30% New / 20% Existing	
2	Credit 1.3	**Optimize Energy Performance,** 40% New / 30% Existing	
2	Credit 1.4	**Optimize Energy Performance,** 50% New / 40% Existing	
1	Credit 1.5	**Optimize Energy Performance,** 60% New / 50% Existing	
	Credit 2.1	**Renewable Energy,** 5% Contribution	
	Credit 2.2	**Renewable Energy,** 10% Contribution	
	Credit 2.3	**Renewable Energy,** 20% Contribution	
1	Credit 3	**Additional Commissioning**	
	Credit 4	**Elimination of HCFCs and Halons**	
	Credit 5	**Measurement & Verification**	
	Credit 6	**Green Power**	

6	**Materials & Resources**	Possible Points:	**13**
Y	Prereq 1	**Storage & Collection of Recyclables**	
	Credit 1.1	**Building Reuse,** Maintain 75% of Existing Shell	
	Credit 1.2	**Building Reuse,** Maintain 95% of Existing Shell	
	Credit 1.3	**Building Reuse,** Maintain 95% Shell & 50% Non-Shell	
1	Credit 2.1	**Construction Waste Management,** Divert 50%	
1	Credit 2.2	**Construction Waste Management,** Divert 75%	
	Credit 3.1	**Resource Reuse,** Specify 5%	
	Credit 3.2	**Resource Reuse,** Specify 10%	
1	Credit 4.1	**Recycled Content,** Specify 5%	
1	Credit 4.2	**Recycled Content,** Specify 10%	
1	Credit 5.1	**Regional Materials,** 20% Manufactured Regionally	
1	Credit 5.2	**Regional Materials,** 10% Extracted Regionally	
	Credit 6	**Rapidly Renewacble Materials**	
	Credit 7	**Certified Wood**	

10	**Indoor Environmental Quality**	Possible Points:	**15**
Y	Prereq 1	**Minimum IAQ Performance**	
Y	Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	
	Credit 1	**Carbon Dioxide (CO2) Monitoring**	
1	Credit 2	**Increase Ventilation Effectiveness**	
	Credit 3.1	**Constuction IAQ Management Plan,** During Construction	
	Credit 3.2	**Constuction IAQ Management Plan,** After Construction	
1	Credit 4.1	**Low-Emitting Materials,** Adhesives & Sealants	
1	Credit 4.2	**Low-Emitting Materials,** Paints & Coatings	
1	Credit 4.3	**Low-Emitting Materials,** Carpet	
1	Credit 4.4	**Low-Emitting Materials,** Composite Wood	
1	Credit 5	**Indoor Chemical and Pollutant Source Control**	
1	Credit 6.1	**Controllability of Systems,** Perimeter	
	Credit 6.2	**Controllability of Systems,** Non-Perimeter	
1	Credit 7.1	**Thermal Comfort,** Comply with ASHRAE Standard 55-1992	
1	Credit 7.2	**Thermal Comfort,** Permanent Monitoring System	
	Credit 8.1	**Daylight and Views,** Daylight 75% of Spaces	
1	Credit 8.2	**Daylight and Views,** Daylight 90% of Spaces	

5	**Innovation & Design Process**	Possible Points:	**5**
1	Credit 1.1	**Innovation in Design:** Exemplary Water Use Reduction	
1	Credit 1.2	**Innovation in Design:** Exemplary Recycled Content	
1	Credit 1.3	**Innovation in Design:** Exemplary Local Materials	
1	Credit 1.4	**Innovation in Design:** Pilot Project Education	
1	Credit 2	**LEED™ Accredited Professional**	

Exhibit 4.6 Works Yard: CaGBC LEED scorecard

Key findings

- Pilot projects are invaluable to promote and trial new technologies and should be encouraged by clients.
- Significant advances can be made to increase recycled content in concrete, particularly by substituting cement that is CO_2 intensive in manufacture.

4.1.4 University of British Columbia, Campus Sustainability Office

The mission visited the Campus Sustainability Office (CSO) at the University of British Columbia (UBC). The Mission Statement guiding the CSO is:

'To earn respect of the future generations for the social and economic legacy we create'.

As the Statement attests, the CSO's aim is primarily one of promoting the importance of an environmentally responsible campus and developing sustainable means of development for the University community. This vision is guided by the Talloires Declaration, which the University has signed up to and was summed up by Jorge Marque of the CSO as the concept of 'living off the interest, rather than the capital'.

The CSO, set up in 1998 following the University's implementation of its Sustainable Development Policy, is funded entirely on the value of energy savings achieved by the deployment of its various initiatives.

In practice, the CSO is responsible for the payment of all energy bills for UBC, and using the pre-1997 baseline costs, funds itself with the balance of those cost savings.

The CSO is made up of just three full-time members, three part-time members and three part-time students. Their message is spread via numerous programmes targeting energy and resources reduction, the endorsement of low-energy and more environmentally benign buildings.

As well as encouraging the green development of new buildings, the CSO has launched two retrofit projects projected to save 20% of energy use within the building stock and 30% of water use.

These programmes have succeeded in reducing electrical energy via a university-wide light fitting upgrade; replacement of the inefficient T12 fluorescent lamps with T8 technology was undertaken with the expectation of a five-year payback on the investment. Similar programmes target paper usage, water consumption and the recycling of biodegradable waste via campus-located compost sites.

Parallel with the more tangible goals of energy saving set by the CSO, it is also committed to the promotion of sustainable values within UBC's community. Many of the programmes rely on student and faculty volunteers to carry out the various initiatives emanating from within the CSO; conversely, by harnessing the imagination and commitment of 125 volunteer members of UBC, useful ideas and tools can be directly injected into departments, halls of residence and faculty housing. One of the most far-reaching components of this strategy is the embedding of a sustainable attitude towards consumption within the community members who then take these attitudes and tools with them out into the wider community.

C K Choi Building for the Institute of Asian Research

Of the two campus buildings visited, the C K Choi Building for the Institute of Asian Research is the older, opened in 1996.

Exhibit 4.7 C K Choi Building, UBC

The CSO grew out of the development of this project, which was originally proposed as a demonstration project for sustainable development within the campus. The procurement of the building and its initial setting up as a demonstration project appear to be significant factors in the success of the project, and the emergence of the CSO as an effective agency capable of steering the sustainable development of UBC.

The basis of the design process was founded upon a workshop attended by senior members of UBC including the Dean of the Faculty, representatives of all the users, the Estates Department, architect, design consultants and a researcher into green

buildings from UBC's architecture faculty. This group, initially led by Bob Berkebile (founding chair of American Institute of Architects Environment Committee), established a vision for the project from which a set of design principles was developed. Crucially the setting up of the procurement methods for the building and contractor permitted the vision to be shared throughout the entire team.

The sustainability design principles agreed at the initial workshop were collected under the following headings:

- Site development issues: tree protection
- Materials: recycling / waste management
- Energy: defined targets, see below
- Environmental quality: natural ventilation / low VOCs
- Facility character: architectural spaces / finishes
- Construction: site set-up / waste
- Operation: energy saving targets / training

Specific targets included:

- 50% less water use
- No sewer connection
- 50% reused or recycled materials
- Reduction of energy use below ASHRAE 90.1 levels by 35%
- Lighting energy <0.5 W/ft^2 (<5 W/m^2)

Set alongside this vision was UBC's instruction that the building budget and programme should not be affected by any 'greening' of the scheme.

The 3,000 m^2 building is composed of a long thin three-storey structure with larger and more public spaces on the ground floor and smaller and more private offices and meeting rooms on the upper levels.

The perception of the building from the main entrance is of a well-mannered deeply modelled brick form separated from the road by a footpath and a green planted swath of reeds and trees. The cornice line is broken by five towers each symbolically representing a different region of Asia, each of which is terminated by a dramatic curved roof.

The building's western flank has been constructed right up to the edge of a mature range of trees which has an immediate impact on one's perception of the ground-floor spaces. The retention of such large trees immediately adjacent to the building is impressive, as is the nature of the micro-climate they produce by modifying the direct sunlight which would otherwise enter the building and 'conditioning' the air prior to its passage through the building. This modifying effect is made more apparent by the unhindered sunlight entering from the road side through large unshaded windows.

The entire building is naturally ventilated. Air entering through the large manually operable windows (PVC-framed) on the tree-shaded elevation at ground level passes up through

Exhibit 4.8 C K Choi Building: atrium on western flank

open vents and the atrium to exit at high level through the towers. Within the offices, intake air enters through air grilles below operable windows at a designed rate of 9.4 litres per second per person (l/s/p). The mission team's visit to the building coincided with a relatively hot (23ºC) and windless day and small fans located at high level in the towers were at work helping the air find its way out of the top of the building.

On the upper levels, the separate needs for ventilation and the acoustic requirements come into direct conflict where the routes forming the ventilation paths from private office to public spaces also compromise the acoustic privacy of the adjacent offices.

Of the various design and energy targets, the most obvious aspects of the building's design which differ from British examples are the extent of reused or recycled material expressed in the construction, and the use of composting toilets.

The superstructure is a heavy timber post and beam supporting a concrete slab above profiled steel sheeting. The soffits are left exposed to capitalise on the thermal exchange between it and the passing incoming air. 65% of the structural timber was salvaged from an adjacent demolished building. Other reused materials included internal timber doors and frames, the external brick cladding, originally used as paving in the city, electrical conduit, sinks and all toilet accessories and the entire stair and atrium balustrade.

The extent of visible materials bearing the scars from a previous life is reminiscent of 18th Century wharf buildings constructed from old ship timbers. Unlike the historic example, the additional effort in coordination, checking, grading and the attendant issues of design liability had a considerable effect on the design team's workload, and all parties involved understand the extent of unpaid design work invested in the building.

Exhibit 4.9 C K Choi Building: recycled timber bearing scars

A significant contractual requirement was included for the contractor to separate and recycle building materials, with certified documentation requirement for payment. Following the contractor's initial reluctance based on concerns of cost, limited site area and programme constraints, the haulage reductions and reuse of timber for small framing work actually produced cost benefits. The local government agency responsible for waste collection carried out analysis showing ~95% of construction waste was diverted from landfill.

The composting toilets are perceived by the users as a major lifestyle shift, providing as they do a direct link between human activity and the natural process of recycling. The toilets (first commercial use in North America) are connected to a tank in the basement from where the liquid content (curiously referred to as 'tea') is pumped to the wetland trench at the front of the

Exhibit 4.10 C K Choi Building: sign on composting toilet door

building where the natural process of purification occurs. The water emerging from either end of the 50 m trench, which when tested by the City met the standards for bathing water, is then used for irrigation during the summer. The use of these toilets has saved an estimated 1,000 litres of water per day.

Liu Centre (for the study of global issues)

The Liu Centre, opened in 2000, has many similarities to the nearby C K Choi Building. While its appearance testifies to a change in architect and aesthetic approach, common ties include the client's relationship with the design team, the environmental engineers, the agreed documentation of performance targets and the common approach of all disciplines implemented throughout all stages of the contract.

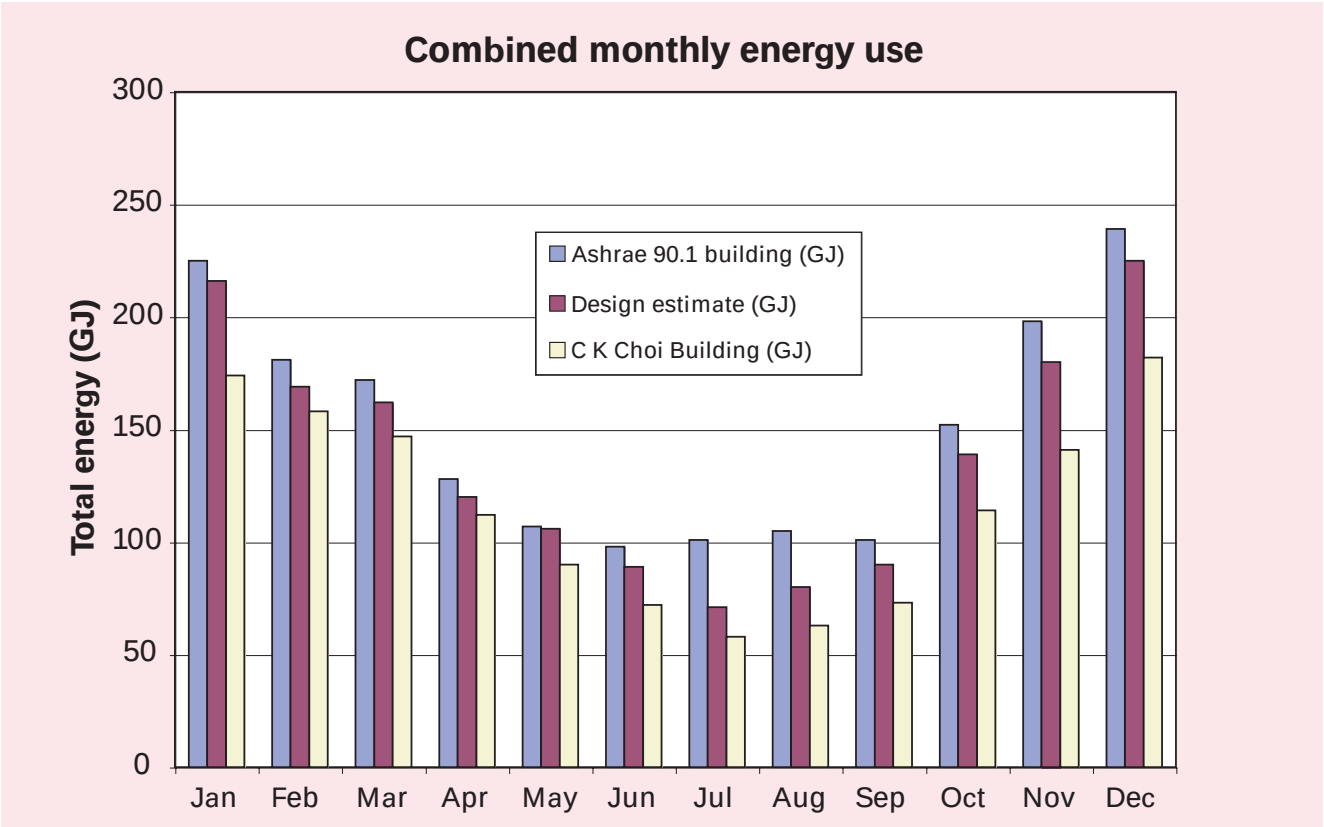

Exhibit 4.11 C K Choi Building: monthly energy use

The 1,750 m^2 building reuses the site of a former UBC building and is surrounded on three sides by tall mature coniferous trees, which were protected during the deconstruction of the original and construction of the new building. The six-week deconstruction process resulted in just 6% of the 1,263 yd^3 (~966 m^3) going to landfill.

Exhibit 4.12 Liu Centre, UBC: external view

The building is composed of two blocks oriented nominally north-south, enclosing a landscaped space between. The eastern block, a three-storey structure containing the main entrance, reception area and the more cellular private spaces above is linked to the western wing via a glazed extension which interconnects all the public facilities at ground floor, including the exterior spaces which function as external 'breakout' spaces.

The micro environment produced by the shaded wooded surroundings is used as the source of incoming air for the western single-storey block. The building form is shaped by the requirement to be naturally ventilated and well daylit, hence the narrow block width. The design of the two blocks responds to the different patterns of use by employing separate environmental systems for each block.

Within the three-storey office block, a similar ventilation strategy to that used in the C K Choi Building is employed. The narrow building width of 12 m provides the environment for natural cross-ventilation to the perimeter offices through operable aluminium-framed windows. The windows throughout have well-sealed trickle vents positioned below the opening vent. The trickle vents are used during the night to provide secure, insect free, passive cooling via the exposed concrete floor slabs; cooler night time air is drawn across the face of the concrete slab where a thermal exchange between air and the concrete mass takes place thereby reducing the air temperature within the structure. The cooler structure temperature militates against daytime heating loads by reversing the exchange throughout the day.

Exhibit 4.13 Liu Centre: operable windows

The consequences of this strategy include the loss of acoustic privacy between offices as experienced in the C K Choi Building; the exposure of the soffit-mounted building services leading to the visual requirement to coordinate high-level services to a higher standard than those concealed within a suspended ceiling; the need to finish the concrete to an acceptable visual standard; and the saving in cost of an entire suspended ceiling.

The layout of the concrete floor slabs between timber separators provides the footprint of the office plan, with the timber insert providing an accessible route for cabling to the office partitions above and the ceiling-mounted fittings below. In the non-office locations, suspended plywood soffit panels are used to partially reduce the visual clutter of electrical cables and sprinklers.

The concrete structure is a further location of carbon reduction technology – the introduction of fly ash, a waste product of coal burning, into the concrete mix displaces 50% of the cement content, the production of which in GVRD produces 80% as much GHG as car traffic. The slower curing times incurred need to be accommodated within the construction programme, but this does provide longer handling time for the mix.

The single-storey western wing relies on a displacement ventilation system and contains a ground-floor air plenum connected to a low-level air intake adjacent to the shaded area of trees. Air is exhausted via vents through the first-floor roof. No mechanical air system or air cooling is provided.

The building does not possess a building management system to control the opening of vents at specific times or temperature ranges and hence relies on the knowledge of the environmental controls by the users to ensure the optimum running of the cooling system.

The use of recycled timber for the internal roof finish of the public spaces provides a beautiful, warm coloured richness to the spaces which resonates with the enclosure of surrounding trees growing immediately outside the glazed envelope; visually the space can be perceived as a clearing in the forest.

The integration of the building into the wooded site is remarkable, and the benefits – both visual and environmental – are palpable. The trees provide solar control, reduced temperature for intake air as well as the less easily defined benefits such as smells and sounds of the forest.

Exhibit 4.14 Liu Centre: integration into wooded site

The embodied energy of the structure contributes only a fraction of the total energy footprint of the building over its lifetime; however, the reuse of timber within these two buildings has had a significant effect on the perception of the spaces.

The building has recorded a 34% energy saving over the National Energy Code.

The aluminium-framed cladding system provides a crisp, finely detailed envelope for the building with the built-in facility to accommodate the retrofitting of PV cells. There appears to have been an aesthetic decision to reveal the concrete structure behind the external cladding. While this adds an interesting complexity to the façade it also increases the ratio of fenestration thereby

decreasing the thermal performance and increasing the impact of solar gains.

In conclusion, many of the design strategies and details of both these buildings will appear familiar and, for the most part, sensible to a British audience. However, the drivers for the projects differ to those in Britain, as they appear to be founded in the palpable appreciation of the local natural environment, the need for its protection and its relationship to a healthy lifestyle.

Key findings

- The Talloires Declaration, to which UBC is a signatory, provides a complete agenda for the sustainable development of an educational institution. However, awareness of the Declaration in Britain is limited, and if it were to have a higher profile it would not in itself be the driving force for campus sustainability, but could be a useful tool for advocates and become an indicator of commitment.

- Without the devotion of advocates dedicated to the principles of sustainable development, the Declaration becomes nothing more than a well-meaning list. Only changes in legislative building and development codes can provide the authoritative benchmark against which buildings can be measured.

- The initial setting up of a project with the establishment of clear, achievable and measurable goals against which all of the design and construction team can be measured has provided these projects with the controls to navigate new and complex problems. The adoption of similar methods in Britain could be assisted with similar procurement strategies, such as the recently developed 'Softlandings' appointment, which provide a baseline of mutually agreed targets for the building design.

- Monitoring and measurement are essential components of energy-conscious building design, without which learning and progress in design will be limited and potentially misdirected.

- The recycling of materials within new projects adds a number of interesting aspects to the sustainability debate; the 'bottom line' on carbon reduction is not significant in comparison with a building's operational contribution, and as the contractual and cultural mechanisms are not established in the industry, the move towards further building material recycling is currently resisted. The creation of new databases and establishment of specialist consultants could increase the potential of this underused resource.

4.1.5 Gleneagles Community Centre

The mission team visited the Gleneagles Community Centre, guided by a representative of Patkau Architects and a representative of Cobalt Engineering who was formerly with EarthTech during project development.

Situated in West Vancouver, the 24,000 ft^2 (~2,230 m^2), C$6.5 million Centre provides a large gymnasium, multipurpose room, community living room, fitness studio, childcare, café and administrative facilities.

Exhibit 4.15 Gleneagles Community Centre, Vancouver

The design team's main objective was to create a facility that delivered a healthy and comfortable environment for its visitors and staff while minimising its impact on the environment. The team was assisted by a public steering committee and took direct community feedback during open-house events.

To further these ambitions, a fully integrated environmental control strategy was proposed linking the building design, structural elements and mechanical services. This centres around the application of the Swiss BATISO (Batiment Isotherm) concept. This requires plastic tubing embedded in the building's concrete structure to enable radiant heating and cooling. Coupled with displacement ventilation to remove most of the heat from lights and equipment, this concept results in a very stable internal environment.

To limit direct solar gain while maintaining good levels of daylight penetration, large roof overhangs have been provided along the main building elevations. As well as giving a particular aesthetic, these covered spaces are available for public use and 'breakout' for internal facilities.

Heating and cooling is provided by a low intensity radiant temperature control system using tubing incorporated into the concrete slab walls and floors of the building. The concrete slabs are maintained at a virtually constant temperature (ranging between 19 and 25°C depending on the season) by circulating heated or cooled water through 6,800 m of plastic tubing. As air is not being used for the heating and cooling medium, opening windows and doors do not significantly affect the performance of the overall system. Two gas-fired boilers provide hot water; however, these can supplement space heating during winter, and temper ventilation air if required.

Displacement ventilation is provided to all the main spaces within the building with no air recirculation. Air is extracted through ducting concealed above permeable ceilings of the main gymnasium areas. The distribution system is fed by three air handling units, one of which provides heat recovery in the upper level ceiling space.

The main heating and cooling plant of the building is supplied by a ground-source heat pump. The heat exchanger for this system is located under the main car park where 3,000 m of polyethylene pipe was laid under site overburden.

The environmental control strategy for the Gleneagles Community Centre is summarised in Exhibit 4.16.

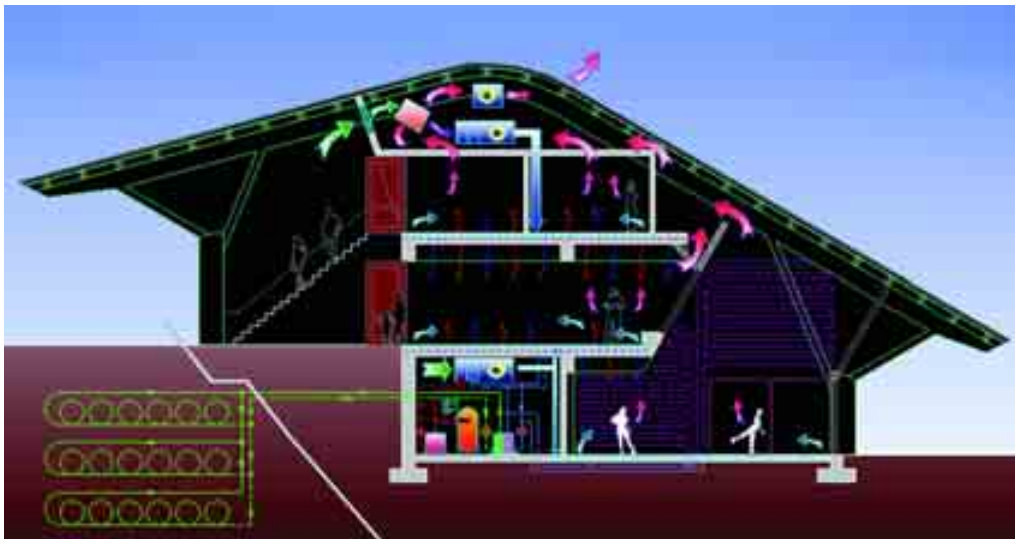

Exhibit 4.16

Gleneagles Community Centre: environmental control strategy

The team was impressed by the low visual impact of the applied building services. All ductwork and air handling units were hidden, and – for a building designed with large areas of exposed structure – very little electrical trunking could be seen.

On materials selection, the main tilt-up concrete slabs were constructed with 26% fly ash. This application resulted in a reduction of 1,157 t of CO_2 emissions as calculated by off-set concrete use. The polyethylene piping used for the radiant panels was also specified with a high recycled content.

The energy use of the building is currently being monitored. Early estimates suggest that at least 60% savings are being made over a conventional serviced building of this function in British Columbia.

Exhibit 4.17 Gleneagles Community Centre: main gymnasium

Water management was given high priority at design. Low water use fixtures and appliances were specified within the building and an elaborate sustainable urban drainage system applied. This involved roof and hard surface drainage directed towards a water feature by the main building entrance. Overflow from this feature is directed to a bioswale before flowing to wetland areas in a neighbouring golf course and eventually feeding a local salmon-bearing stream.

This project was not LEED certified due to costs associated with the certification process and additional energy modelling. Given the budget constraints, the mission team was impressed with the low-energy strategies applied at Gleneagles along with the overall approach to sustainability.

Key findings

- Successful application of the BATISO concept and clever integration with ground-source heat exchanger.
- Linked architecture and environmental control strategy.
- For a heavily serviced building, limited visual intrusion was apparent.

4.1.6 Omicron office refurbishment

It is generally recognised that the existing building stock represents a significant challenge in terms of reducing carbon emissions. This is for two reasons:

1 The replacement rate of the existing building stock is only ~1-2% annually.

2 The performance of existing buildings is significantly lower than new buildings.

In commercial office buildings, the rate of interior fit-out is relatively fast – in the order of every three to seven years – and is driven

by fashion or prestige, with rarely any interest in improving the environmental performance. At the Omicron offices in Vancouver the mission team had the opportunity to discuss this issue and view the case-study office refit.

Omicron is a design consultancy housed in a typical 1970s high-rise commercial office tower in downtown Vancouver. The accommodation is on the whole of the fifth floor and, where possible (excluding shell and core), has been completely refitted.

The strategy can be broadly described in terms of the following three aspects, although all are interrelated:

- Spatial arrangements
- Finishes and furnishings
- Environmental services

Exhibit 4.18 Omicron: interior view of main office space

Exhibit 4.19 Omicron: view from the core towards the open plan office with wooden 'hub'

The main spatial strategy is to remove existing suspended ceilings (except in and around the core) and expose the concrete ceiling (Exhibit 4.18). This has two benefits: (1) more exposed thermal mass, and (2) taller spaces which, when used in conjunction with displacement ventilation, provide a valuable reservoir of warm air before being extracted. Taller spaces furthermore present a more spacious feel, which may be of psychological benefit: the taller spaces make open plan office space feel less crowded. Open plan spaces also have the potential for improved daylight penetration from the perimeter windows, as well as potential views out for more people (shelving and partitions are kept below eye level).

To complement the exposed ceiling and open plan approach, and in order to provide a degree of privacy for meeting and social spaces, four enclosed 'hubs' are provided. Each is identifiable by its distinct construction material (eg timber, fibre board, glass, etc). Thus despite the open plan 'landscape', and a resultant monotonous work environment, each office area has a particular and identifiable location between hubs. The hubs each provide localised environmental conditions appropriate to the specific needs (Exhibit 4.19).

The finishes and furniture have been carefully specified to minimise 'off-gassing' (and thus improve air quality and health) and maximise the content of recycled or renewable materials. For example, much of the furniture is made from 'agriboard' which uses the discarded waste from the grain industry. Another example is the use of recycled materials for the floor finishes, such as the use of tyres and recycled natural fibres in carpets.

The environmental systems complement the above strategies. Displacement ventilation is used – although based on the existing air conditioning system provided in the building overall – by intruding air at low levels and extracting at high levels. Additional cooling has also been provided where necessary using chilled ceiling panels.

The taller ceilings are painted white to reflect light from the artificial lighting system. This accentuates the spaciousness and provides even background lighting throughout. Localised task lighting ensures individual control and local higher light levels as necessary. Light sensors ensure that intermittently occupied areas are not unnecessarily lit when not in use.

Finally, toilets are fitted out with waterless urinals, dual-flush WCs and low-volume taps. The waterless urinals require regular and informed maintenance to ensure proper performance.

Although no explicit performance data are available, the impression is that the office is well-liked, feels spacious and is comfortable.

With the increased amount of exposed thermal mass (as a result of the removal of acoustically absorbent ceilings) there is the risk that the acoustic conditions would suffer due to the increased reverberation and reflection of noise. This has been addressed, in spaces such as the main meeting room, by suspending an acoustic absorbent panel in the centre of the space which also incorporates light fittings (Exhibit 4.20).

Despite a lack of performance data, this building provides some interesting and valuable insights into strategies for more sustainable office refit. It is also a valuable test case for 'LEED for Commercial Interiors' (LEED-CI) in the Canadian context.

The exposure of concrete ceilings and resulting increase in space height brings a number of benefits, as outlined above. This approach has been observed in a number of other new-build projects visited too. This strategy relies on achieving an acceptable finish and being able to deal with any remaining electrical or HVAC runs. It may have implications for the perception of sustainable refits as less refined if such aspects are not carefully considered.

Exhibit 4.20

Omicron: main meeting room

Significant daylighting improvements might be achieved if the black Venetian blinds on the inside of the perimeter windows were replaced with lighter blinds, and were controllable in relation to orientation and daylight availability. Automated controls might then be an effective way of reducing the electrical demand and internal gains associated with lighting. It may have been that the blinds installed were considered to be part of the 'shell' and therefore not changeable because they might alter the external appearance of the building.

This project highlighted some interesting insights and products with respect to sustainable refurbishment of commercial offices. Continued monitoring (of energy and water use, occupant comfort and health, etc) and further life-cycle environmental analysis will be an important next step for this particular sector of the industry.

Key finding

- Valuable test case for LEED-CI standard

4.1.7 Semiahmoo Library

This public library building in the City of Surrey, BC, completed in 2003, also accommodates Royal Canadian Mounted Police (RCMP) facilities and underground parking. The 3,000 m^2 building is located next to a busy, urban road junction, with the RCMP accommodated on the ground floor and the library on the upper floor (Exhibit 4.21). Of particular note is the library's reduced energy consumption and high perceived air quality for this setting. Furthermore it specifically aims to reduce the consumption of potable water, and overall is the first library building in Canada to have achieved a LEED 'Silver' certification. This description focuses principally on the 2,000 m^2 library accommodation.

The motivation for developing a 'green' building approach came initially from the City of Surrey after visiting a LEED 'Gold' certified building. In particular, the interest was in the potential for energy savings and reduced water consumption. The City was willing to pay for the additional fees associated with the LEED certification and to use the building as a pilot project. Thus, an enlightened client was the driver for the 'green' credentials of the project.

The approach to developing the brief was reported as being straightforward: a largely conventional brief for the library's needs was defined, and the design team that was appointed included LEED certified personnel. Some key decisions in response to attaining LEED credits that would have an implication for the users included the use of low-water toilet fixtures (such as the waterless urinals) and the selection of low-VOC-emitting furniture.

Exhibit 4.21

Semiahmoo Library, Surrey, BC: exterior view (main entrance on the right via the glazed atrium space)

The close collaboration between design and construction team members was seen as essential to ensure that the 'green' aims of the project were met and all achievable LEED credits were achieved. This involved not only building design decisions – including for example the use of natural light to offset the need for electric light – but also details of construction waste management and materials specification.

Exhibit 4.22 Semiahmoo Library: entrance (under canopy and via tall glazed space)

The building design strategy was to provide a robust yet welcoming external façade, consisting primarily of concrete and a glazed atrium entrance space (Exhibit 4.22). This envelope protects the deep plan first floor library from the external climate and urban microclimate. The sealed, well-insulated (U-values of walls are reported to be 0.21 W/m^{2}K) library space is conditioned using displacement ventilation via a 300 mm raised floor plenum, incorporating CO_2 sensors and heat recovery.

No supplementary perimeter heating is required. Daylight enters high up through triple-glazed clerestory windows (the triple glazing has a solar transmittance of 0.17 and daylight transmittance of 0.47) on three sides and general artificial lighting provided by an array of fluorescent lights (artificial lighting provides 35-45 cd/ft^2 (~380-480 cd/m^2) for a lighting load of 0.8 W/ft^2 (~9 W/m^2)).

Exhibit 4.23 Semiahmoo Library: daylighting via high-level glazing (larger view windows to the north and towards the green landscaping)

Other constructional aspects of the project include:

- 88% of the construction waste was diverted
- 41% locally manufactured materials
- 54% materials contained recycled content
- Use of low-emitting materials including paint, carpet and composite wood

The success of the building's energy performance was measured in terms of comparing the energy cost with another more conventional library design in Surrey. For 2004, the actual energy costs for this building showed an overall per square metre reduction of 28%, consisting of 17% in electricity and 55% in gas cost reduction (based on figures provided by the Library). A target energy figure for the design showed a potential 45% reduction in

expected energy use compared to a similar building constructed to the Model National Energy Code for Buildings (MNECB).

The water-efficient fixtures result in 41% water use reduction compared to similar buildings constructed to 1992 fixture standards.

Other aspects of the building's performance include:

- Improved perceived air quality due to low-emission materials and finishes (eg no 'new building smell')
- Quiet interior due to envelope design and displacement ventilation (reduced noise from outside or from ventilation fans)
- Reduced water use due to washroom fixtures
- Reduced parking

Of these, the waterless urinals and the reduced parking availability needed explanation to the users to gain their understanding if not their approval. Plaques in the bathroom show how much water is saved annually. A brochure explaining why reduced parking has been provided, and indicating alternatives, was produced.

The low-energy HVAC performance initially resulted in slightly cool or warm conditions, as a result of which increased air flow and number of diffusers has been implemented to improve the controllability of temperatures throughout the library.

The building represents a sound environmental response to its context – a noisy urban junction – by employing a deep plan form; with high-level, sealed windows for deep daylight penetration; and using energy-efficient displacement ventilation.
A well-designed envelope and the use of relatively low-energy lights reinforce this strategy further.

As a result of the strategy a number of opportunities have not been possible to exploit for practical or cost reasons:

- No opportunities for natural ventilation have been created through design (eg green, quiet, protected garden or courtyard space)
- Clerestory windows face north, east and south with no substantial change in strategy and no shading to control glare (ie sun patches are allowed to enter) (Exhibit 4.24)
- The unheated east-facing atrium is an effective buffer space to the road but passively preheated air from it is not used to supplement the heating and ventilation strategy
- Rooflights were considered too expensive but could have improved daylight distribution and availability through the plan
- Artificial lighting is apparently not controlled in relation to daylight availability, partly due to the relatively deep plan (ie permanent artificial lighting is required here)

Exhibit 4.24 Semiahmoo Library: high-level glazing presents potential glare problems

On a more positive note, the relative energy efficiency is very good; the use of low-water fixtures in this public building is courageous and effective; the specification of low-emission materials, furniture and finishes is laudable; the sourcing of recycled and local

materials, as well as the management of construction waste, is excellent. The design quality, particularly the exterior (which presents an appropriately robust façade to the urban context), is commendable (Exhibit 4.25).

Exhibit 4.25 Semiahmoo Library: exterior façade

The above achievements are perhaps all the more surprising as they have been made using a 'design-build' contract, and thus this project represents a valuable lesson for cost effective, green design in the UK.

Key findings

- Good use of entrance space to buffer traffic noise and provide ventilation pre-heat.
- Opportunities missed to reduce lighting electrical demand through optimised daylight.

4.1.8 City of White Rock, 'Green' Operations Building

The mission visited the Green Operations Centre guided by Busby Perkins & Will architects. The new building, which serves as a technical and administration hub for the City's facilities and maintenance operations, was completed in May 2003. It is located on the site of an abandoned wastewater treatment plant and embodies the city's policy to lead by example; pursuing 'green' strategies for their new buildings and planning initiatives.

At the outset of the project, the client and design team agreed to gauge the success of the building using the LEED rating system. A key element of the brief was that the building should achieve LEED-NC v2 certification to the 'Gold' standard. This was ultimately achieved, being Canada's first building to reach this standard, with 44 points (Exhibit 4.33)

At 661 m^2, this small structure reuses several buried concrete treatment tanks, relics from the past use of the site, for its massive foundations. This was one of a number of significant initiatives to reduce waste and reuse materials. Others, such as the recycling of 98% (by weight) of the existing demolished buildings and the use of recycled timber joists (sourced, evaluated and purchased a year in advance of the construction) are examples rarely seen in the UK, and are a lesson on what could be achieved. What impressed the mission team was the driver for this approach being equally to do with responsible use of resource and avoidance of landfill than the avoided energy and carbon emissions from the manufacture, transport and construction of the displaced materials. This is a theme repeated in a number of the mission case studies.

The building consists of two pavilions clad in locally harvested west-coast cedar, and

Exhibit 4.26 City of White Rock, BC, Green Operations Building

interconnected by a glazed entrance link (Exhibit 4.26). The design cleverly responds to the site and its orientation; no mean feat given the constraints of using existing structure on which to found the building. Shallow-plan office spaces are located to the south where generously proportioned glazing provides good daylighting to most workspaces. Here, a projected roof line and 'brise-soleil' work to reduce heat gain through the windows while judicious use of planting is said to shade the walls, all resulting in the avoidance of a need for mechanical cooling. The northern pavilion accommodates service spaces, crew changing rooms and meeting rooms and is generally less glazed to reduce heat loss.

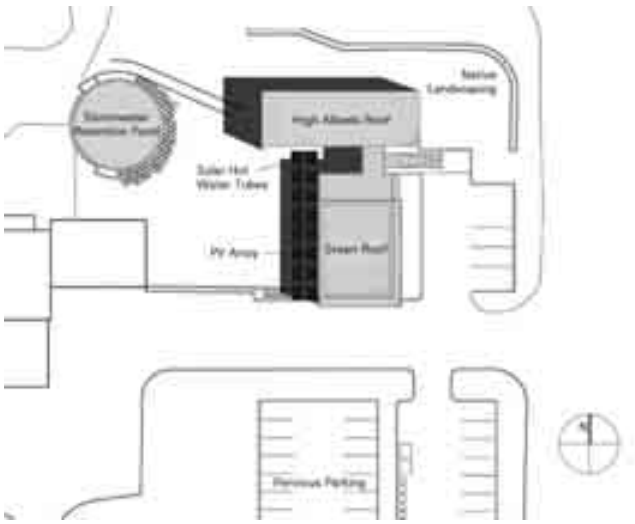

Exhibit 4.27 Green Operations Building: site plan

The sensible approach to passive design together with good levels of insulation (wall 0.3 W/m^{2}K, roof 0.18 W/m^{2}K) and manually openable windows for natural ventilation set the groundwork for a simple, low-energy building. As with many of the projects visited during the mission, however, the low-carbon agenda does not dominate the brief given the currently low carbon intensity of delivered electrical energy.

Nevertheless, carbon savings are implicit in the holistic approach and there are still lessons that can be learnt. One example on this project is the selection of the north pavilion roof finish, which has a high 'albedo' (a measure of reflectivity). Increased reflection reduces heat absorption through the roof fabric. This is a desirable feature, particularly for a lightweight roof but, in the wider context, contributes to the urban 'heat island' effect. A green roof as seen on the lower roofs also reduces heat absorption but, instead of re-radiating heat, loses it by evapotranspiration.

A particularly successful trick is the subtle exploitation of the relationship between the site's existing location and its new use. Located at the bottom of a storm-water catchment area, one of the site's existing sewage settlement tanks is rehabilitated to detain about 108,000 gallons (~491 m^3) of storm water (Exhibit 4.28). The harvested water is used by maintenance vehicles for street cleaning (260,000 gal/yr ≈ 1,180 m^3/yr) and washing city vehicles (150,000 gal/yr ≈ 680 m^3/yr). The tank provides roughly 100 days of storage, even without rainfall.
The same tank also provides irrigation water (Exhibit 4.29) and WC flushing water, a practice not often seen in the UK since surface water from roads etc is typically quite contaminated. One less vaunted but equally successful feature is the magnificent amenity the pond offers the site.

Exhibit 4.28 Green Operations Building: reclaimed water irrigation outlet

Exhibit 4.29 Green Operations Building: surface water pond

Overall, the design energy demand is 84 kWh/m^2 which is 55% less than the ASHRAE 90.1-1999 standard. The demand is met from a variety of renewable and non-renewable sources.

A number of heat sources supply heat to the building via a low temperature, hydronic underfloor radiant heating circuit. Heat energy is extracted from the storm-water collection tank through a pipework loop at the bottom of the tank connected to a water-source heat pump. This heat source is supplemented with an evacuated tube solar thermal collector at roof level. The latter is particularly interesting since the greater heat demand in the winter is poorly matched by solar energy supply, which is greatest in summer. British Columbia's

Seymour-Capilano Filtration Plant

The importance of saving water in order to reduce carbon emissions is not particularly intuitive.

While in Vancouver, the mission team visited the works for the new Seymour-Capilano water filtration plant, a huge civil engineering project involving the tunnelling of two, 3 m diameter pipes over 7.5 km, pumping, etc.

The main purpose of the plant is to satisfy the increasing demand for water in the Vancouver region. The embodied energy and pump energy, not to mention treatment energy in sewage works, all have a carbon burden.

Exhibit 4.30 Seymour-Capilano Filtration Plant

Exhibit 4.31 Green Operations Building: photovoltaic array

climate is not dissimilar to that in the UK yet solar thermal space heating is rarely used in Britain. With improved evacuated tube technology and reduced heat demands, solar thermal space heating would be worth looking at again in the UK. Backup heating is provided by a high-efficiency gas boiler.

Renewable electricity is generated on site with monocrystalline PV modules that are simply fixed to the roof of the building, at

Exhibit 4.32 Green Operations Building: lights off in office

optimum tilt and orientation, without particular effort at building integration (Exhibit 4.31). They do not appear out of place, however, and serve to articulate the environmental credentials of an otherwise modest building while also offsetting daytime electrical demand. The panels provide ~5% of the building's annual electricity requirements.

What stands the design of the Operations Centre apart is that it is one of the only buildings visited by the mission team in which the electrical lighting was switched off during the day. This is credit both to the good daylighting design and the use of daylight/ occupancy sensors on the artificial lighting.

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

Green Operations Building, LEED Project # 0225
LEED Version 2 Certification Level: GOLD
July 28, 2003

44 Points Achieved — Possible Points: **69**

Certified 26 to 32 points **Silver** 33 to 38 points **Gold** 39 to 51 points **Platinum** 52 or more points

8 Sustainable Sites — Possible Points: **14**

Y			
Y	Prereq 1	**Erosion & Sedimentation Control**	
1	Credit 1	**Site Selection**	1
	Credit 2	**Urban Redevelopment**	1
	Credit 3	**Brownfield Redevelopment**	1
1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
1	Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
	Credit 4.3	**Alternative Transportation**, Alternative Fuel Refueling Stations	1
1	Credit 4.4	**Alternative Transportation**, Parking Capacity	1
	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1
	Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1
1	Credit 6.1	**Stormwater Management**, Rate and Quantity	1
	Credit 6.2	**Stormwater Management**, Treatment	1
1	Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands**, Non-Roof	1
1	Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands**, Roof	1
1	Credit 8	**Light Pollution Reduction**	1

5 Water Efficiency — Possible Points: **5**

Y			
1	Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1	Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
1	Credit 2	**Innovative Wastewater Technologies**	1
1	Credit 3.1	**Water Use Reduction**, 20% Reduction	1
1	Credit 3.2	**Water Use Reduction**, 30% Reduction	1

11 Energy & Atmosphere — Possible Points: **17**

Y			
Y	Prereq 1	**Fundamental Building Systems Commissioning**	
Y	Prereq 2	**Minimum Energy Performance**	
Y	Prereq 3	**CFC Reduction in HVAC&R Equipment**	
2	Credit 1.1	**Optimize Energy Performance**, 20% New / 10% Existing	2
2	Credit 1.2	**Optimize Energy Performance**, 30% New / 20% Existing	2
2	Credit 1.3	**Optimize Energy Performance**, 40% New / 30% Existing	2
2	Credit 1.4	**Optimize Energy Performance**, 50% New / 40% Existing	2
	Credit 1.5	**Optimize Energy Performance**, 60% New / 50% Existing	2
1	Credit 2.1	**Renewable Energy**, 5%	1
	Credit 2.2	**Renewable Energy**, 10%	1
	Credit 2.3	**Renewable Energy**, 20%	1
	Credit 3	**Additional Commissioning**	1
1	Credit 4	**Ozone Depletion**	1
	Credit 5	**Measurement & Verification**	1
1	Credit 6	**Green Power**	1

6 Materials & Resources — Possible Points: **13**

Y			
Y	Prereq 1	**Storage & Collection of Recyclables**	
	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Shell	1
	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Shell	1
	Credit 1.3	**Building Reuse**, Maintain 100% Shell & 50% Non-Shell	1
1	Credit 2.1	**Construction Waste Management**, Divert 50%	1
1	Credit 2.2	**Construction Waste Management**, Divert 75%	1
1	Credit 3.1	**Resource Reuse**, Specify 5%	1
	Credit 3.2	**Resource Reuse**, Specify 10%	1
1	Credit 4.1	**Recycled Content**	1
	Credit 4.2	**Recycled Content**	1
1	Credit 5.1	**Local/Regional Materials**, 20% Manufactured Locally	1
1	Credit 5.2	**Local/Regional Materials**, of 20% Above, 50% Harvested Locally	1
	Credit 6	**Rapidly Renewable Materials**	1
	Credit 7	**Certified Wood**	1

11 Indoor Environmental Quality — Possible Points: **15**

Y			
Y	Prereq 1	**Minimum IAQ Performance**	
Y	Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	
1	Credit 1	**Carbon Dioxide** (CO_2) **Monitoring**	1
	Credit 2	**Increase Ventilation Effectiveness**	1
	Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
1	Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1	Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1	Credit 4.2	**Low-Emitting Materials**, Paints	1
1	Credit 4.3	**Low-Emitting Materials**, Carpet	1
1	Credit 4.4	**Low-Emitting Materials**, Composite Wood	1
1	Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1	Credit 6.1	**Controllability of Systems**, Perimeter	1
	Credit 6.2	**Controllability of Systems**, Non-Perimeter	1
1	Credit 7.1	**Thermal Comfort**, Comply with ASHRAE 55-1992	1
	Credit 7.2	**Thermal Comfort**, Permanent Monitoring System	1
1	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
1	Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

3 Innovation & Design Process — Possible Points: **5**

Y			
1	Credit 1.1	**Innovation in Design**: Exemplary Performance in 98% CWM	1
1	Credit 1.2	**Innovation in Design**: Exemplary Reduction of Water Use	1
	Credit 1.3	**Innovation in Design**:	1
	Credit 1.4	**Innovation in Design:**	1
1	Credit 2	**LEED™ Accredited Professional**	1

Exhibit 4.33 Green Operations Building: USGBC LEED scorecard

The provision of individual task lights allows general lighting to be kept off for longer periods and ambient lighting levels to be reduced. This is a design strategy seldom seen in the UK but is one that has the potential to considerably reduce lighting energy use, particularly in offices. Low-energy lamps give an installed lighting load of 10.7 W/m^2. The overall peak electrical demand is equivalent to 60 W/m^2.

This is all the more impressive given that the low cost and low carbon intensity of delivered electricity give no incentive to reduce electrical lighting demand.

At C$12 million in 2003, the construction cost equates to ~£1,120/m^2 in today's prices and is estimated by the client to be 8% more expensive than a traditional building. An anticipated 40% reduction in energy costs is expected to pay back the extra investment in 11 years assuming a 5% annual increase in energy costs.

Key findings

- Sustainability targets were set at the outset of design, and an assessment method to measure success has been used.
- Recycled building materials can be successfully integrated into new building design and can reduce embodied energy carbon emissions.
- Strategic decisions about site location can foster symbiotic relationships that improve sustainability (eg high demand for recycled water located at bottom of surface water catchments).
- Simple passive design measures could easily reduce, if not prevent, the need for air conditioning in the UK climate.
- Task lighting can give occupants greater control of their environment and may allow the overall ambient lighting level to be reduced.

4.1.9 Seattle Public Library

The design for the new Seattle Public Library was selected by international competition. It was won by an international team led by Rem Koolhaas' Office for Metropolitan Architecture (OMA) based in the Netherlands.

The impressive visual form consists of five staggered floors suspended within a transparent envelope forming an iconic sculptural form within the urban setting. The contained voluminous spaces open to a full-height atrium and benefit from vast quantities of natural light and expansive external views of the centre of Seattle.

The design seeks to *'reinvent the library as an institution that is no longer exclusively dedicated to the book, but functions as an information store, where all media, new and old, could be presented under a regime of new standards'.*

The eleven-storey building contains some 37,000 m^2 floor area, housing 1.4 million volumes and a staff of ~300. It cost in the region of C$165 million and was completed in late 2003. At its time it was one of the largest projects to be considered for LEED 'Silver' rating.

The fully glazed façade consists of interstitial expanded metal mesh, computer-analysis optimised for each orientation to allow views out, but limit solar gain. Natural daylight is the dominant feature of the interior, with the glazing mesh shading reducing undue glare. This is coupled with an efficient lighting system on daylight automatic control and extra long-life induction lamps to reduce maintenance and access requirements.

Exhibit 4.34

Seattle Public Library: exterior view

Exhibit 4.35 Seattle Public Library: interior view 1

The air conditioning is predominantly based on a European type floor supply displacement system, allowing air to pick up heat gains and lift them up out of the occupied zones and thereby improve ventilation effectiveness. The chillers have zero ozone-depleting refrigerant and a full load COP in excess of 7, coupled to cooling towers and variable speed pumping and fans. Steam is provided by the local utility for heating and hot water generation.

Satisfying the local energy codes was a challenge. Two separate computer models had to be used to demonstrate Seattle code compliance and for the LEED assessment. Seattle has its own energy codes that are more stringent than most across the USA. As an illustration of its approach, it is a code requirement that buildings first fully use free outside air cooling mode before using chillers for a climate similar to the UK. This effectively discourages fan-coil minimum fresh air type solutions. Food for thought when it comes to setting UK statutory benchmarks. However, this more prescriptive code approach makes for considerable design work when it comes to demonstrating compliance by way of non-conventional building fabric and systems.

The design energy targets for the building exceed the standard design building in LEED energy performance by ~40%. In due course it will be interesting to see how the actual energy consumption compares with the prescribed energy code modelling. There appears to be less building in-use monitored feedback than is available in the UK, so how code-defined energy assessments relate to in-use, given occupant influence, remains to be seen.

The LEED 'Silver' rating was not a specific requirement at time of brief, but was introduced part way through the design process. It achieved just short of 'Gold' rating and may well have achieved higher had this been an initial design objective. A significant challenge is the prescriptive nature of many of the third-party codes.

LEED is used to define the credits. Thus, the floor supply air-conditioning system loses potential credits under ASHRAE definitions because it does not hold a constant temperature throughout the space – whether this makes for worse indoor comfort levels is highly questionable. As a public building the Seattle Public Library is an outstanding success, with annual visitor numbers well above expectations. As a piece of urban architecture it is also regarded as a success. The fact that it also achieves a high standard of sustainability illustrates that high-profiled architecture is compatible with reduced resource use.

Key findings

- Seattle Public Library illustrates the importance of using industry-recognised sustainability assessment methods. It allowed the project team clearly defined design targets, the client a benchmark for selling the building concept, and the users a means of identifying what sustainability means for their built environment, all backed by a third-party design verification process.

- It showed the considerable scope for producing successful high-quality public buildings, complete with generous glazed architectural form, in a cost-conscious way, yet still meeting what is locally regarded as very challenging energy targets. Key to this was using innovative thinking within an integrated multidisciplined project team.

- It will be interesting to see how the actual energy performance compares with the design calculations, given that elsewhere locally there are the beginnings of the realisation that building actual energy consumption is also dependent on operational factors.

Exhibit 4.36 Seattle Public Library: interior view 2

Exhibit 4.37

Seattle Public Library: air flow distribution

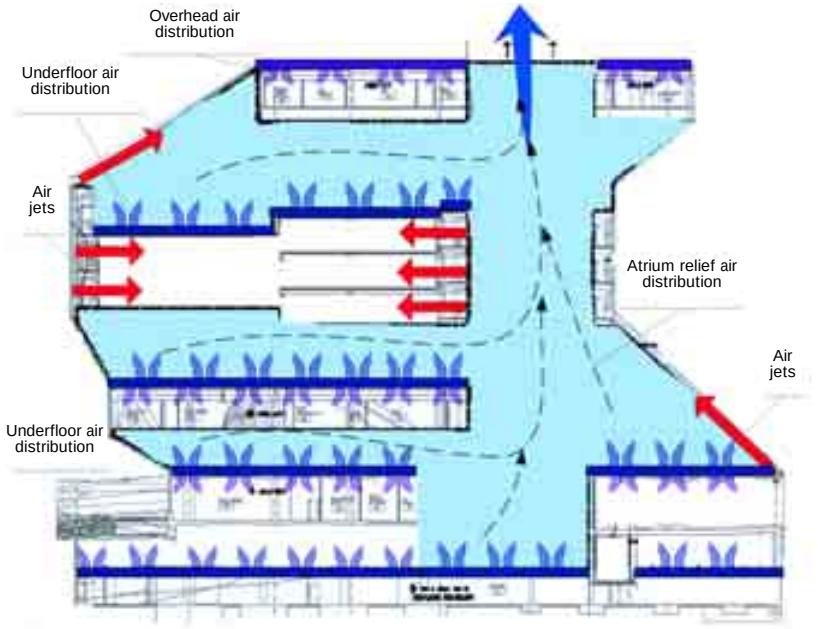

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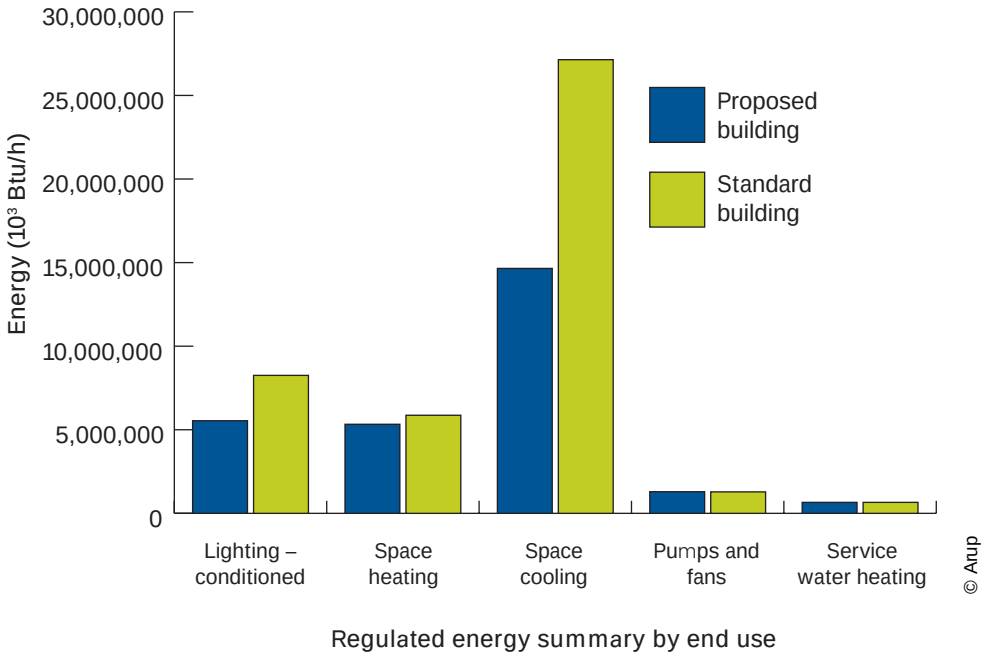
Exhibit 4.38

Seattle Public Library: annual system energy use comparison



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Regulated energy summary by end use

4.1.10 REI flagship store

Recreational Equipment Incorporated, better known as REI, was founded in Seattle in 1938 to provide for the needs of outdoor enthusiasts. Developed as a co-operative, the company now has 2.5 million members and 80 stores nationwide with an international mail order business. The growth in the business in the founding store demanded increased floor space, and in the early 1990s the concept of a ‘flagship’ store in Seattle was born.

At the outset the company set out to develop a store which minimised environmental impact, and the brief sought resource efficiency in the use of materials, energy and water, with a reduction in waste. A survey commissioned by the co-operative confirmed this approach. Architects Mithun, whose philosophy embraced the importance of green building, were selected in a national competition in 1992.

The site selected for the project was just north of downtown Seattle, with a major

Exhibit 4.39

REI flagship store, Seattle: entrance

highway to the immediate east and with a fall in levels towards the west. The 100,000 ft^2 (~9,550 m^2) store with its supporting car parking, offices and 250-seat multi-function room occupies a whole city block. The existing buildings on the site were demolished but 76% of the site materials were recycled, reused or salvaged (the accuracy of this recycled figure itself begins to suggest a serious commitment to the green strategy). Whilst not ideally sited for access by public transportation – the site accommodates parking at the lowest level for 275 cars – the development of the South Lakes area to the north of the city core, within which this development is located, will in time lead to improved linkages.

The building is of L-shaped configuration; the store in one wing is set alongside the highway and acts as an acoustic barrier for the site, with a second wing of largely support accommodation towards the west. Access to the building is through a landscaped space formed by the two wings, facing southwest, a man-made wilderness of rocks, boulders, streams, a waterfall – which itself helps to mask the highway noise – and

Exhibit 4.40 REI flagship store: building and nature

Exhibit 4.41 REI flagship store: climbing wall

woods through which the shopper must pass to reach the store, the entrance to which is above street level. This outside space also incorporates boot and bike test trails!

The main entrance leads to the store's landmark feature – a 65 ft (~20 m) climbing wall. This is enclosed in glazed construction and rises above the general roof level of the store.

The architectural challenge of the building was to establish character appropriate for an outdoor gear retailer within cost parameters whilst meeting the resource efficiency goals. In meeting this challenge, Mithun determined a design which defines the two separate functions of retail and support areas, the shop itself being largely of timber construction with steelwork primary columns and beams – typically 65% scrap content – with the other wing and the lower level parking areas having a primary structure of concrete. This was one of the first projects in

Exhibit 4.42

REI flagship store: steel and timber construction

Exhibit 4.43

REI flagship store: extensive use of timber

Seattle to use fly-ash content, a practice now widely adopted, often using greater than the 10% utilised at REI over a decade ago.

The extensive use of timber is immediately apparent on approaching and entering the store. No timber of a greater dimension than 3 x 8 inches (75 x 200 mm) was used unless salvaged, and this principle led to the extensive use of glued, laminated timber (glulam). This was selected as the most resource-efficient use of wood in a structural application and also for the inherent character of the wood for the store's environment. Plywood is also used in some areas for both floor and wall sheathing, with other wall finishes and merchandising fixtures using oriented strand board (OSB) made from post-production timber waste materials.

Covering the entire structure is a panellised roof system of steel trusses, douglas fir glulam trusses and solid sawn timber purlins. The roof was sheathed using plywood exposed to the store beneath. This in turn contributes to the diaphragm design which can resist high short-duration loads which may be encountered in this earthquake zone.

Exhibit 4.44 REI flagship store: automatic dampers control natural ventilation paths

Generally, no finishes are applied to the timber or steel. Where necessary, low-VOC finishes were utilised in accordance with the then higher California standards at a cost premium but to which all products now conform.

The building is gas heated and air conditioned – although the later generation of REI buildings, for which Mithun are still the architects, are working towards its elimination. The building is divided into a series of zones with different levels of control on the internal environment. The office areas are tightly controlled whereas the store itself is allowed to vary by +/-5ºF (+/-3ºC) from its design temperature, the front 'porch' or reception area, which is the immediate transition from the outdoors, and climbing wall enclosure varying between 50 and 90ºF (10 and 32ºC) depending on the time of year. Where possible, outside air is used for purging, particularly pre-opening, to limit the use of air conditioning.

The retail store space is partly daylit from the east face although otherwise relies on artificial lighting utilising high-efficiency metal halide and fluorescent sources. This glazing, facing the highway, has no opening lights and no solar protection which gives an element of winter pre-heat. The glazed enclosure for the climbing wall also acts as a solar collector to assist in winter pre-heating. REI regards the daylit environment as important – it believes it results in higher customer satisfaction, with average 15 to 2 hour stays. All stores now being developed, which tend to be of 25,000-30,000 ft^2 (~2.300-2,800 m^2), adopt daylighting as a standard strategy.

Mithun recognises that there are improvements which could be made to the scheme but given that it was developed in 1993 – prior to the establishment of the Green Building Council and the Cascadia Region (which embraces Oregon, Washington, and British Columbia), one of two original chapters incorporated in December 1999, and predates the LEED assessment system – this building displays advances in design thinking which would be regarded as leading edge at that time. The building nevertheless achieved its objective to minimise resource impact and, with the exception of additional cost to meet unforeseen site contamination issues, was on target budget.

In continuing to work with REI on subsequent stores, Mithun has continued to evolve this concept, most recently achieving a LEED-CI 'Gold' rating for the Portland Store, the first retail store in the USA to achieve this standard.

Key findings

- REI's flagship store is a novel retail development with high environmental credentials.
- Strong links exist between the building and its site, offering dramatic improvements to inner city biodiversity and air quality.
- A two-tier specification system was used which set a standard description against preferred recycled or low impact alternatives.

4.2 Domestic buildings

4.2.1 Introduction

This section covers the mission's visits to the Hanvey residence, an energy efficient extension and refurbishment project, and Koo's Corner, a 'high density' development of six dwellings (four new-build and two alterations) in an 'historic' area of Vancouver. A brief comparison of the Canadian housing sector with Great Britain (GB; many housing statistics are GB based rather than UK based) is also presented:

- The Canadian housing stock in 2001 was ~12.5 million houses with a total population of 30.7 million, giving a typical household size of 2.48 persons. By comparison, the GB stock was 24.3 million houses with a population of 58 million, a typical household size of 2.38. Both countries are experiencing a similar downward trend in household size, but a growth in the number of households. The total stock of housing in Canada has grown more rapidly since 1990 than in GB with a 23% increase in Canada compared with 10% in GB.

- Residential energy use in both countries has been increasing since 1990, despite improvements in the energy efficiency of both stocks. Canada has experienced an 8% increase, with total energy use up by 102 PJ to 1,391 PJ. Similarly, GB has seen a 15% increase, with total energy use up to 1,960 PJ.

- The GB energy trend has been driven partly by the increase in the number of households and partly by the increasing demands for electrical appliances and the growth in the total number of heating systems. Improved standards of energy efficiency have helped to control this increase but the trend is still upward. Similar drivers have been experienced in Canada, while improvements in energy efficiency standards (both fabric insulation standards and efficiency of appliances) have resulted in a 17% saving in energy use and associated GHG emissions.

- The residential sector in Canada includes four major types of dwellings: single detached houses, single attached houses, apartments and mobile homes. The average size of housing unit is 119 m^2. Household energy uses are primarily for space and water heating, the operation of appliances, lighting and space cooling.

- Space heating energy consumption is estimated to be ~60% of the total consumption in both countries. In Canada, space heating energy use was 845 PJ in 2000 and in GB 1,163 PJ. As with GB the dominant fuel for heating is natural gas, with just over half the demand met from gas. Exhibits 4.45 and 4.46 show the breakdown of energy use by end use for each country since 1990[54].

- GHG emissions in the residential sector for Canada in 2000 were 75.8 Mt, with UK emissions being 38.2 Mt.

The following domestic building projects are reviewed below:

- Hanvey residence
- Koo's Corner townhouses

54 Statistics for Canada from Natural Resources Canada (NRCan) and for GB from the BRE Energy Fact File 2003

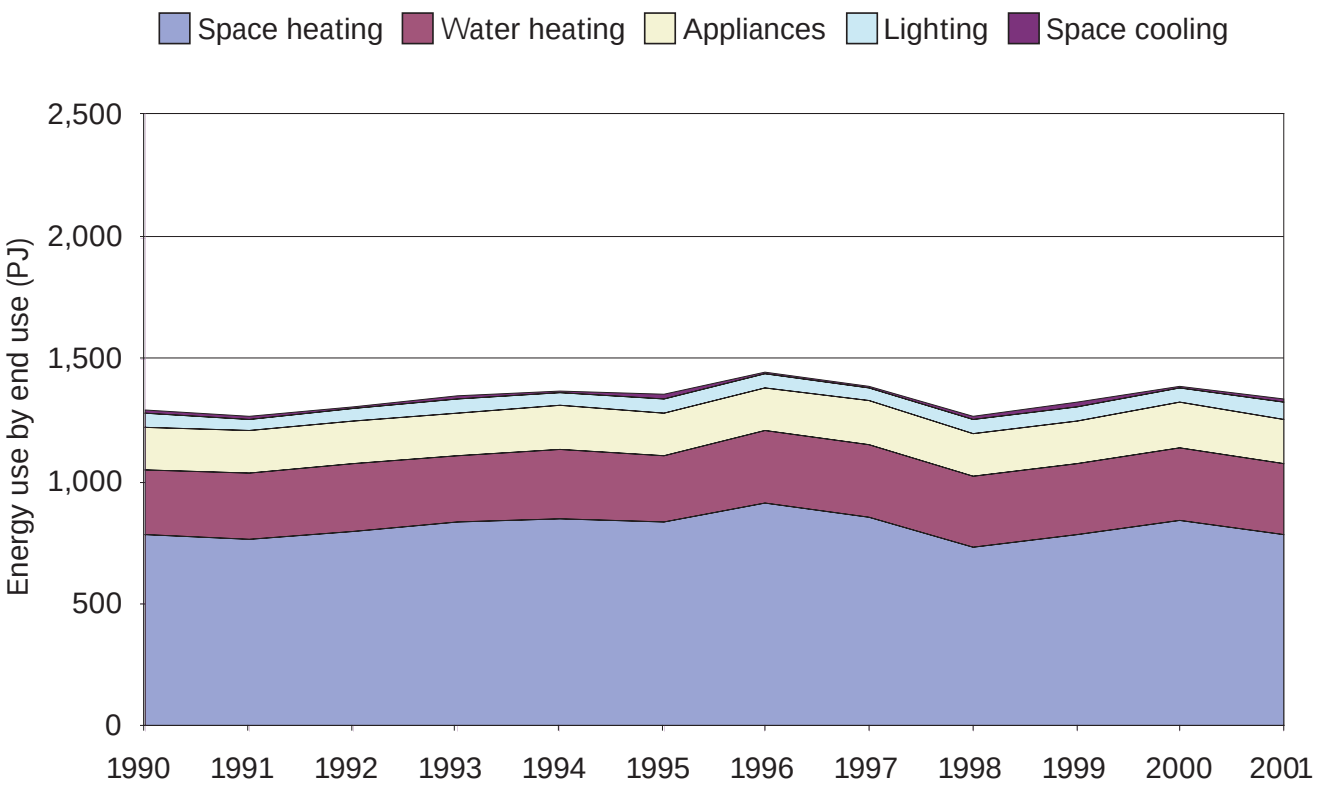

Exhibit 4.45 Energy use by end use, Canada

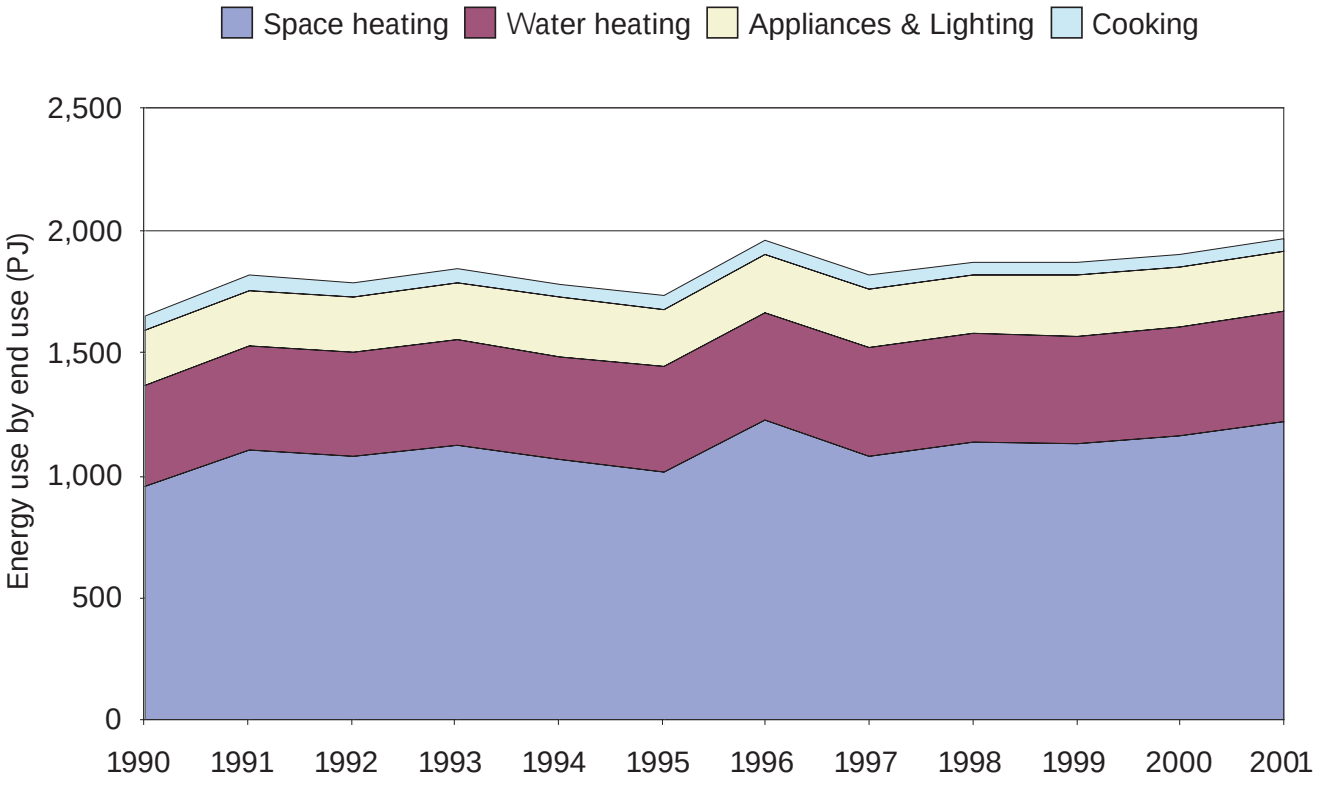

Exhibit 4.46 Energy use by end use, GB

Exhibit 4.47

Hanvey residence, Vancouver

4.2.2 Hanvey residence

Key features

- Single-storey extension to original dwelling
- Improved overall energy efficiency standards
- Use of highly efficient gas-fired heating
- Specification of water-efficient appliances
- Design aimed for materials efficiency through reduction in specification, reuse of existing materials and use of recycled materials

Introduction

The Hanvey residence project is an extension and refurbishment of an existing single-family house in Vancouver. The project is unusual in Canadian terms as the general approach would have been to knock down the original dwelling and construct a new one.

However, Kevin and Helen (an informed pair of architects) took the view that a more environmentally sound approach was to renovate and extend their existing house to meet their space needs.

Reducing the environmental impact of the project was a major issue for the pair. This objective was to inform the design process, with particular emphasis on the five areas identified in LEED: energy, water, materials, land use, health. An integrated design approach was adopted to ensure that the environmental impacts were minimised and that all aspects of sustainability were addressed during design.

Sustainable design

The initial stages of the project have been completed: the original dwelling has been extended to give an increased floor area providing an open plan living area and kitchen. A design assessment of providing the additional floor space by a second storey was rejected in favour of retaining all the accommodation on a single floor level. Similarly, increasing the floor area beyond the immediate space requirements was rejected to reduce the environmental impact of the building and cost.

The existing house is a timber frame construction with aluminium framed,

single-glazed windows. Heating was provided by an inefficient furnace in the crawl space with heat distribution via a warm air system of ductwork. A log burning stove provided additional heat to the living area. A blower door measurement (a fan pressurisation test) of the house indicated a very leaky standard with an equivalent leakage area of 279 in^2 (~1,800 cm^2).

The design incorporates good standards of thermal insulation to the walls and roof of the extension, new double-glazed windows in the extension area and extensive air tightness works to significantly reduce the air leakage of the property (before and after blower door tests have been carried out to inform the improvements and confirm the effect, a 20% reduction). In addition to the improvements to the airtightness standard, careful attention to detailing to reduce the impact of thermal bridging was given. The design resulted in significant improvements in the design standards compared with the local building code requirements.

The use of natural light has been maximised in the living area and this has been complemented by the use of energy efficient artificial lighting. (A significant number of downlighters have been used in the open-plan space which may well reduce the overall energy savings over time.)

The existing space-heating furnace has been replaced with a 93% efficient gas-fired furnace, but the original ductwork retained and extended. The furnace has been relocated out of the unheated crawl space to within the heated and insulated envelope. Controls have been improved through the use of programmable room thermostats on both the furnace and the focal gas fire. The water heating system has been retained with the aim of replacing the existing system in the near future with a gas-fired direct heater. The estimated impact of the improvements to the building fabric and the heating system are to reduce fuel use by some 35%.

The ventilation strategy is typical of the UK approach to housing with mechanical extract from kitchens and bathrooms. The old poorly performing extract fans have been replaced with 'EnergyStar' rated units, which are not only more energy efficient, but are also quieter in operation.

Water efficiency was taken account of in the design as well. To reduce the consumption of water within the dwelling, water-efficient appliances have been installed including a dual flush (6/3 litre) toilet, taps with reduced flow rates, and plumbing the fridge to dispense cold, filtered water. Externally a rainwater barrel has been fitted to harvest rainwater and for watering the garden. Planting has been carefully selected to be of low water demand.

A significant number of measures were taken to reduce and where practical recycle materials in the project. Initially, a reduction in the quantities of materials used for the project was achieved by only providing an area of extension that was required to meet the space needs of the family. The design concentrated on specifying locally sourced materials and where possible selecting materials with longer life cycles to help reduce maintenance costs over the life of the component. Wherever possible, specifications required the use of existing materials – a good example of this was the reuse of masonry from the original chimney as the patio. All the timber used for the extension was locally sourced and FSC certified (75%).

To reduce the amount of new material used in the project, steps were taken to limit the quantity of waste generated by the project. Subcontractors were encouraged to participate fully in recycling efforts including recycling cardboard, packaging, metal scraps,

Exhibit 4.48

Hanvey residence: interior

wood scraps and broken pallets. The impact of these measures was to reduce by over 50% the quantity of construction waste materials, a significant achievement for a project of this scale. The recycling theme is maintained within the kitchen as well, with a kitchen bin for compostable material and bins for recyclable materials, glass, paper, etc.

Conclusion

The use of an integrated design approach and a strong focus on environmental impacts has resulted in the project achieving good standards of energy efficiency and excellent consideration of materials issues. A two-storey option would have provided more floor area, but would have required almost double the amount of material. The single-storey extension added only 300 ft^2 (~28 m^2) to the front of the house, meeting the space needs of the family. The layout did not add circulation space to the original dwelling and was planned so that the original heating ducts could be simply extended – again reducing materials use and keeping the design efficient. Only the exterior walls were upgraded, meaning that a very cost-effective and resource-efficient solution could be achieved.

4.2.3 Koo's Corner townhouses

Key features

- Reuse of brownfield site
- Reuse of existing building structure
- Improved standards of energy efficiency (~15% better than Regional Code requirements)
- Trial of solar thermal hot water system
- Use of heat recovery ventilation system
- Extensive use of reclaimed and/or recycled materials
- Improved indoor air quality through use of low-VOC finishes

Introduction

Koo's Corner is unusual in Canadian housing for two reasons: it is a high density infill development, and it was designed to be a sustainable development constructed within a private developer's budget.

Koo's Corner is located in the Strathcona district in downtown Vancouver, one of Vancouver's oldest neighbourhoods. As an older district it includes a mix of single-family housing and multi-family housing in a variety of architectural styles. The development is on

a former garage and parking area across from an urban park. When the developer, Chesterman Property Group, acquired the site in 2000 it decided to retain the original garage building. It was keen to maintain the building within the development proposals as a visual link to the history of the site and as part of their environmental brief.

The development that Chesterman designed included an extensive refurbishment (and relocation to the northeast end of the site) of the original garage building to create two loft units and the construction of four new townhouses. The development proposals had to overcome a sceptical local community, and a detailed set of design requirements from the city, before it was completed in August 2002. Total development costs were C$1.43 million (~£650,000), equivalent to C$234/ft^2 (~£1,146/m^2).

Sustainable design

The corner site occupies a space of 6,100 ft^2 (567 m^2). The zoning permitted by Vancouver City allows for 0.75 FSR (floor space ratio = total built living area / total site area) for additions to multi-family dwellings and 0.95 FSR for infill projects. Typical new-build projects for housing would be about 0.45 FSR. The project was considered to be part infill and part addition, but the developer required the higher density to meet the financial goals and to achieve the sustainability targets for the development. The project team developed a scheme in which the original garage structure was moved to the northeast end of the site and three (three-storey) terraced homes were built at the southwest end. A linking, two-storey unit, with terraced roof was constructed to complete the terrace. The dwellings range in size from 720 to 1,170 ft^2 (67 to 109 m^2) and provide two or three bedrooms. With the exception of the smallest dwelling, each has a single parking space.

The buildings make excellent use of the compact site, but with the penalty of leaving only a very small space to the rear of the dwellings for gardens. The design incorporated a usable front deck to partially compensate for the small yards and provide a link to some of the surrounding architecture. The decks are popular with the residents giving a pleasant space to interact with neighbours.

Energy-efficient design

The dwelling designs were carefully configured to take advantage of natural light; this partly aided the designs to 'feel' larger and help to reduce energy demands for heating and lighting. Consideration was given to minimising the risk of summertime overheating during the design process by incorporating low emissivity glazing and providing high-level opening windows to provide improved ventilation. To further reduce heat losses associated with the larger

Exhibit 4.49

Koo's Corner townhouses, Vancouver

glazed areas, double glazing with argon gas fill was installed.

The structure is predominantly timber frame. One of the design team's aims in achieving a sustainable design was to reduce the amount of new material used within the development. Reusing the original structure of the garage helped substantially in achieving this aim, but also high-quality reclaimed timber was sourced for over 50% of the timber framing for the development. This was seen to reduce unnecessary harvesting of old growth forests in British Columbia, a particular local issue. Insulation to the building fabric was installed to greater thicknesses than required by the local building code requirements. In addition, the insulation has 60 to 80% recycled content.

A number of different approaches were tried for the heating and hot water systems in the dwellings. Two of the homes have gas-fired, high-efficiency combination boilers supplying heating to an underfloor circuit and direct hot water. Other dwellings have more typical electric baseboard heating and hot water. One dwelling has a solar thermal system installed to pre-heat domestic hot water. All units have been pre-plumbed for solar thermal systems, but only one occupant was initially prepared to have a system installed. A further trial has been carried out on a coil device that recovers heat from water in the shower drain, the recovered heat being used to pre-heat water going to the water heater. The performance of this unit had been monitored by the occupant but had not delivered significant savings, partly due to there only being a small demand for hot water.

Ventilation requirements are met in the three-storey townhouses by the use of a mechanical, whole-house heat recovery system. The heat exchanger recovers heat from air extracted from kitchens and bathrooms and uses this to warm incoming outside air that is delivered to the living rooms and bedrooms.

Exhibit 4.50 Koo's Corner townhouse: elevation

Energy use by lights and appliances was also considered during design, with compact fluorescent bulbs and fixtures, and 'EnergyStar' rated dishwashers, being installed.

Water efficiency

In addition to aiming to reduce energy use within the dwellings, attention was also paid to reducing water consumption both within the dwellings and on the landscaping. Water-efficient appliances were specified, using front-loader washing machines in preference to top loaders; and dual flush, low-volume cisterns were specified for the toilets. A standard toilet flush would use between 6 and 18 litres of water, whereas the dual flush systems allow either a 6 or 3 litre flush. The soft landscaping included plants that are low maintenance and drought tolerant, and rainwater barrels (Exhibit 4.51) are

Exhibit 4.51 Koo's Corner townhouse: water butt

provided to collect rainwater runoff from the roof for use in watering the landscaping. To reduce surface water runoff, semipermeable pavers and finishes were used.

Materials

A strong theme for the project was to maximise the reuse of existing materials and limit the quantity of construction waste. The project successfully achieved over 80% of the waste from construction going for recycling. The construction made extensive use of reclaimed materials. As mentioned above, the structure of the dwellings used high-quality reclaimed timber, and reclaimed glulam beams were used to provide timber for the flooring. Further reductions in timber were achieved by the use of a composite cement material and wood waste for the exterior cladding.

Kitchen cupboards are made from fibreboard (urea-formaldehyde free) and the doors are solid fir, reclaimed from old beams.

In common with many of the projects visited by the mission, all of the poured concrete within the project consisted of at least 50% fly ash, a cement replacement. Also, to help reduce materials consumption, minimal finishes were specified to concrete surfaces, which were largely left exposed and simply sealed with a waterborne acrylic sealer.

Exhibit 4.52

Koo's Corner townhouse: kitchen

Tiling finishes used in the bathrooms were made from recycled porcelain in the USA, rather than imported from Europe. Other finishes were specified to reduce off-gassing to improve indoor air quality.

Finally, to encourage recycling in the households, bins have been provided to allow wastes that are recyclable to be sorted and stored for collection and suitable material for composting to be collected.

Conclusion

Using the local vernacular for inspiration, the townhouses fit neatly into their context. The developer and design team had a strong vision for the energy and environmental performance of the development and succeeded in delivering designs that are both attractive and incorporate strong sustainability features.

The commitment to reduce the quantity of materials used in the design led to the reuse of the garage building structure and a significant reduction in new, raw materials. This was a common feature of the projects visited by the mission, that an objective was to reduce and wherever possible reuse materials. For commercial buildings, one driver for this is the use of the LEED assessment process. In the UK, ~420 million tonnes of materials per year is used in the construction sector, equivalent to seven tonnes per person. The environmental impacts of extracting, processing and transporting these materials are a major contributor to GHG emissions. Whilst flagship projects in the UK such as BedZED have set targets for reducing materials impacts within housing developments, there are still opportunities to be learnt from the Canadian experiences of setting up systems to allow the reclaiming and recycling of construction materials.

The designs adopted similar standards to UK good practice in terms of energy and water efficiency, and further improvements similar to the UK's could be achieved by moving towards best practice standards. The LEED standard for low-rise residential developments has not been adopted yet in Canada, and use of this standard would help to reward developments achieving standards beyond minimum regulation requirements; the UK experience with EcoHomes may be beneficial here.

Appendix A

KEY FACTS AND FIGURES

A.1 Kyoto Protocol and greenhouse gas emissions – the 2005 Climate Change Plan

The Kyoto Protocol was developed as a direct response to the emerging threat of climate change and was negotiated at the 3rd Conference of the Parties (COP3) to the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, Japan in December 1997. The Protocol stipulates that industrialised countries, plus a number of economies in transition (EIT) should, in aggregate, cut their carbon dioxide (CO_2) and the other five main greenhouse gas (GHG) emissions to around 5% below 1990 levels by 2008-2012 (the 'First Commitment Period').

Before the agreement could become legally binding, it had to be ratified by at least 55 of the nations that signed it – a condition met in May 2002 when Iceland ratified – and by countries accounting for at least 55% of the GHG emissions produced by industrialised and EIT nations in 1990. This second condition was achieved when Russia ratified the Protocol in November 2004, with the protocol coming into effect on 16 February 2005.

The Kyoto Protocol sets mandatory targets on GHG emissions for 30 industrialised and EIT countries ('Annex I Parties') of the 128 Parties to the Protocol. These targets range from -8% to +10% of the countries' individual 1990 emission levels, although in almost all cases, the targets call for significant reductions in currently projected emission levels.

With a rise in average global temperatures of between 1.4ºC and 5.8ºC projected between 1990 and 2100, the estimated 0.1ºC cut in temperatures that could result from achieving the Kyoto target may seem small, but as an initial demonstration of the role international cooperation can play in reducing GHG emissions and producing long-term environmental benefits, the Kyoto Protocol is widely recognised as an important first step.

As part of the Kyoto agreement, the EU15 (the European Union's 15 pre-2004 member states – including the UK) accepted an overall emissions reduction target of 8% from the 1990 'baseline'. Each member state then agreed to contribute to this target according to its own particular circumstances. The UK, responsible for around 2.3% of global CO_2 emissions, agreed a 12.5% reduction in GHG emissions from the 1990 level, although the UK government effectively increased this voluntarily and unilaterally by setting itself a more stringent target of a 20% reduction in CO_2 emissions by 2010, as a clear statement of its commitment to tackling climate change.

Annual reporting of emissions of the six GHGs has shown that the UK has already achieved reductions in excess of its burden-sharing target required under the Kyoto Protocol by 2008-2012, while for CO_2 emissions alone, the recent Climate Change Programme Review has indicated that the progress to date equates approximately to a 7% reduction, with a 14% reduction projection for 2010 (ie below the UK's voluntary commitment target for CO_2 reduction). Measures to improve this performance and reach the national target are currently being evaluated.

Notably absent from the Kyoto Protocol is the USA – by far the world's largest emitter of GHGs, being responsible for around 23.7% of global CO_2 emissions (more than twice that

emitted by the second largest emitter, China). As a result of this, coupled with Australia's refusal to ratify the protocol, Kyoto's emission targets only apply to countries accounting for 32% of global GHG emissions. The USA's refusal to ratify is largely based on concerns over the economic impact of Kyoto and the absence of targets for developing countries.

In 1990, the USA emitted some 6,115 Mt of GHGs on a 'CO_2 equivalent' basis ($MtCO_2(eq)$). Had it ratified Kyoto, it would have been mandated to reduce its emissions by 7% from this baseline, ie to around 5,687 $MtCO_2(eq)$ by 2008-2012. By contrast, the latest US Department of Energy (DOE) figures estimate that 6,936 $MtCO_2(eq)$ was emitted in 2003, 13% above the 1990 level and 22% above the Kyoto target that it would have been mandated to achieve had it signed the Kyoto Protocol.

Of the 2002 CO_2 emissions in the USA, some 39.2% arose in the electric power sector, 32.4% from transportation, 18.1% from the industrial sector, 6.4% from the residential sector and 3.9% from the commercial sector.

On the other hand Canada, responsible for around 2.1% of global CO_2 emissions, did ratify the Kyoto Protocol in December 2002 which meant that it accepted a legally binding target of reducing GHG emissions to a level 6% below 1990 levels by 2008-2012. The 1990 GHG emission baseline was 596 $MtCO_2(eq)$, establishing Canada's Kyoto target as 560 $MtCO_2(eq)$ by 2008-2012.

Since 1990, with the exceptions of 1991 and 2001-2002, Canada's GHG emissions have risen inexorably, amounting to around 740 $MtCO_2(eq)$ by 2003 (the latest figures available from Environment Canada), some 24% above the 1990 baseline and 32% above the Kyoto target. The Canadian government estimates that the country's GHG emissions could reach 830 $MtCO_2(eq)$ by 2010 under a

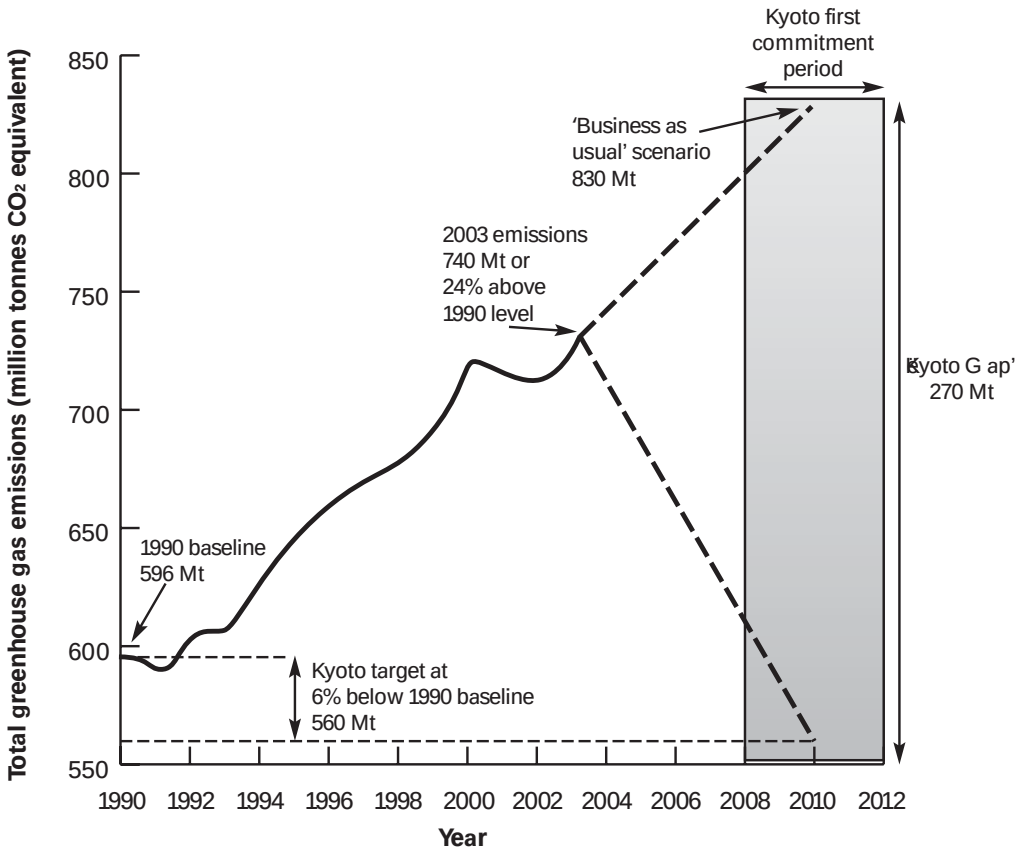

Exhibit A.1

Canada's 'Kyoto Gap'

'business as usual' scenario and would therefore need to abate ~270 $MtCO_2(eq)$ a year to achieve its 6% Kyoto reduction target – almost one third of the projected emissions. This is a formidable task when compared with the projected 90 $MtCO_2(eq)$ under the UK's existing Climate Change Programme. Canada's 'Kyoto Gap' is graphically illustrated in Exhibit A.1.

In 2002, some 24.6% of the total GHGs emitted in Canada derived from the transportation sector, 19% from the electric power generation sector, 19.8% from energy (excluding electric power), 13.7% from industrial, 8.3% from agriculture, 6.1% from residential, 4.6% from commercial and institutional, and 3.8% from waste and other sources.

Clearly, ratifying the Kyoto Protocol was not an easy decision for the Canadian government, especially since the USA, by far its largest trading partner, had decided not to do so for the reasons given above. This concern mainly revolved around the perceived competitive disadvantages that could result for Canada when compared to its neighbour, and the demanding reduction target it had to meet. Further, Alberta (which is self-sufficient in energy) and Saskatchewan had serious reservations. The problems that will face Alberta become apparent when considering that the Province produces around 30% of Canada's GHGs but only has 13% of Canada's 30 million population. However, Canada's federal government decided that ratification would be in the country's best interest, having concluded that it could remain competitive with the USA.

The federal government looks at the Kyoto target as a 'national project' to be achieved in partnership between the federal and provincial governments, non-governmental organisations (NGOs), businesses and the general public, with the risks managed and fairly shared amongst them. As the first phase of this national project – 'Project Green' – the Government of Canada announced its 2005 Climate Change Plan ('Moving Forward on Climate Change: A Plan for Honoring our Kyoto Commitment') in April 2005.

The 2005 Climate Change Plan and its six key elements (described in Section 2.1) are estimated to have the potential to reduce annual GHG emissions by about 270 $MtCO_2(eq)$ in the 2008-2012 timeframe, ie fully address Canada's 'Kyoto Gap' as described above.

A.2 Energy mix for Canada and USA

The energy mix, in terms of primary energy production, consumption and electricity generation in Canada is very different to that in the USA.

In Canada, the total primary energy production in 2003 (most recently available data) was 16,538 PJ. Of this, 42.5% was sourced from natural gas, 38.2% by petroleum, 8.8% by primary electricity (ie renewable energy and nuclear power), 8.0% by coal and 2.5% by wood waste, spent pulping liquor and firewood. Alberta accounted for 64% of this total production, with British Columbia producing 13%, Saskatchewan 9%, Quebec 4% and Ontario 2%.

Canadian primary energy consumption in 2002 totalled 11,064 PJ. 38.3% of this was sourced by petroleum, 25.9% by natural gas, 18.1% by primary electricity, 12.0% by coal and 4.9% by waste wood etc. Ontario accounted for 32% of this total consumption, with Quebec consuming 18%, Alberta 15%, British Columbia 11%, Saskatchewan 4%, Manitoba 3% and the Atlantic provinces 6%. Of the secondary energy consumption in Canada, the industrial sector accounted for 38.7%, transportation 28.1%, residential 17.0%, commercial and institutional 13.8% and agriculture 2.5%.

Electricity generation in Canada in 2003 amounted to 567 TWh (net), with 59% of this being generated by hydroelectric plant, 19% by coal-fired plant, 12% by nuclear plant and 10% by oil, gas and other fuel fired power plant. Quebec accounted for 31% of the total electrical output (97% from hydroelectric plant), Ontario 27% (41% from nuclear) and British Columbia 11% (89% from hydro, 6% natural gas, 4% wood and other, 1% diesel, light fuel oil and kerosene). In 2004, the proportion of the 567.6 TWh generated in Canada from hydro remained at 59%, with the proportion derived from nuclear rising to 15% at the expense of fossil fuel based generation. The split in British Columbia moved to 88% from hydro and 12% from fossil fuel sources.

In the USA, the total primary energy production in 2003 (most recently available data) was 73,767 PJ. Of this, 31% was sourced from coal, 28% by natural gas, 16% by petroleum, 12% by nuclear, 9% by renewable energy and 4% by liquefied gas.

US primary energy consumption in 2003 totalled 103,624 PJ. 40% of this was sourced by petroleum, 23% by natural gas, 23% by coal, 8% by nuclear and 6% by renewable energy. Washington State, visited as part of this mission, consumed 2,098 PJ of this, representing 2% of the total, with 43% of this being sourced by petroleum, 28% hydro, 16% natural gas, 5% coal, 4% nuclear and 4% wood. Of the secondary energy consumption in the USA, the industrial sector accounted for 33%, transportation 28%, residential 21%, commercial 18%.

Electricity generation in the USA in 2004 amounted to 3,953,407 TWh (net), with 52.3% of this being generated by coal-fired plant, 21.3% by nuclear plant, 13.8% by natural gas, 6.9% by hydro, 3.1% by petroleum, 2.5% by other renewable energy (ie non-hydro) and 0.1% by other gases. By contrast, the split in Washington State in 2001 was hydro 67%, coal 11%, natural gas 11%, nuclear 10%, wood and waste 1%.

A.3 Summary of key figures for Canada, USA and UK

The figures in Exhibit A.2 have been extracted from the Energy Information Administration (EIA) Country Analysis Briefs, from the US Department of Energy.[55]

Country	CANADA	USA	UK
Population (2004E)	32.5 million	293 million	60.3 million
Size	9,971,500 km^2	9,629,091 km^2	244,820 km^2
Administrative divisions	10 provinces and 3 territories	50 states and 1 district	8 RDAs in England and devolved administrations in Scotland and Wales
Gross domestic product (GDP) (2004E)	US$959 billion	US$11.7 trillion	US$2.12 trillion
Energy & Environment			
Oil consumption (2004E)	2.3 million bbl/d	20.4 million bbl/d	1.86 million bbl/d
Oil production (2004E)	3.1 million bbl/d	7.7 million bbl/d	2.08 million bbl/d
Natural gas consumption (2002E)	3.0 Tcf	23.0 Tcf	3.3 Tcf
Natural gas production (2002E)	6.6 Tcf	19.0 Tcf	3.6 Tcf
Coal consumption (2002E)	72.2 Mmst	1066.0 Mmst	64.2 Mmst
Coal production (2002E)	73.2 Mmst	1094.0 Mmst	32.6 Mmst
Electricity consumption (2002E)	487.3 BkWh	3641.0 BkWh	343.9 BkWh
Electricity generation (2002E)	548.9 BkWh Hydroelectric (57%) Thermal (28%) Nuclear (13%)	3858.0 BkWh Thermal-fired (76%) Nuclear (11%) Hydroelectric (11%) Renewables (2%)	360.8 BkWh Thermal (79.8%) Nuclear (17.9%) Hydro (2%) Other (0.2%)
Total energy consumption (2002E)	13.1 quadrillion Btu (3.2% of world total energy consumption)	98.3 quadrillion Btu (25% of world total energy consumption)	9.6 quadrillion Btu (2.3% of world total energy consumption)
Energy-related CO_2 emissions (2002E)	592.0 Mmt (2.4% of world CO_2 emissions)	5796.0 Mmt (24% of world CO_2 emissions)	552.8 Mmt (2.3% of world CO_2 emissions)
Per capita energy consumption (2002E)	418.0 million Btu	338.0 million Btu	162.2 million Btu
Per capita CO_2 emissions (2002E)	18.9 metric tons	20.3 metric tons	9.4 metric tons
Fuel share of energy consumption (2002E)	Oil (34%) Hydroelectricity (24%) Natural gas (23%) Coal (13%) Nuclear (6%)	Oil (40%) Coal (23%) Natural gas (23%) Nuclear (8%) Hydroelectricity (3%) Other renewables (3%)	Natural gas (37.1%) Oil (35.7%) Coal (15%) Nuclear (10.9%) Other renewables (0.7%) Hydroelectricity (0.5%)
Fuel share of CO_2 emissions	Oil (46%) Natural gas (28%) Coal (6%)	Oil (44%) Coal (36%) Natural gas (20%)	Oil (40.8%) Natural gas (32.9%) Coal (26.3%)

Exhibit A.2 Key figures for Canada, USA and UK

55 ENERGY INFORMATION ADMINISTRATION, 2005. *Country Analysis Briefs* (online). USA: Energy Information Administration. Available from: *www.eia.doe.gov/emeu/cabs/contents.html* (Accessed 25 July 2005)

Appendix B

MISSION ITINERARIES AND VISIT CONTACT DETAILS

B.1 Itinerary – east coast

OTTAWA	
Monday 21 June 2005	
morning	Environment Canada
afternoon	Office of Energy Efficiency (OEE) National Round Table on the Environment and the Economy (NRTEE) Federation of Canadian Municipalities (FCM)
Tuesday 22 June 2005	
morning	Canadian Centre for Housing Technology (CCHT)
afternoon	Canada Mortgage and Housing Corporation (CMHC) (International) Minister of State (Infrastructure and Communities)
TORONTO	
Wednesday 23 June 2005	
morning	Energy Efficiency Office (EEO), City of Toronto
afternoon	University of Toronto at Mississauga (UTM)
evening	Mission reception hosted by British Consulate
Thursday 24 June 2005	
morning	Toronto Community Housing Corporation (TCHC)
afternoon	Ontario Sustainable Energy Association (OSEA)
Friday 25 June 2005	
morning	Canadian Urban Institute (CUI) (Roundtable Breakfast)
afternoon	Toronto and Region Conservation Authority (TRCA) at the Kortright Centre
Saturday 26 June 2005	
morning	Sir Adam Beck II Hydroelectric Generating Station
afternoon	Stratus Vineyards

B.2 Itinerary – west coast

VANCOUVER	
Monday 21 June 2005	
morning	Greater Vancouver Regional District (GVRD) Council
afternoon	Simon Fraser University (SFU) at Burnaby Mountain *(no project review in main text)* City of Vancouver Works Yard Southeast False Creek (SEFC)
Tuesday 22 June 2005	
morning	University of British Columbia (UBC) Campus Sustainability Office (CSO)
afternoon	Gleneagles Community Centre Omicron office refurbishment VanCity Lynn Creek Branch Hanvey residence Seymour Capilano Filtration Plant
Wednesday 23 June 2005	
morning	Koo's Corner Semiahmoo Library City of White Rock 'Green' Operations Centre
afternoon	Dockside Green
SEATTLE	
Thursday 24 June 2005	
morning	Pioneer Square Neighbourhood *(no project review in main text)* Seattle Public Library Meeting with Arup
afternoon	British Consulate in Seattle (Cascadia Green Building Council, International Sustainability Solutions, Broderick & Smith Real Estate) South Lake Union *(no project review in main text)*
Friday 25 June 2005	
morning	Broderick & Smith Real Estate / Pioneer Square *(no project review in main text)* REI flagship store Tour of Mithun Architects facilities
afternoon	Lighting Design lab tour *(no project review in main text)*

B.3 Visit contact details

The following organisations and projects visited are listed alphabetically:

1 Canada Mortgage and Housing Corporation (CMHC) (International)
2 Canadian Centre for Housing Technology (CCHT)
3 Canadian Urban Institute (CUI) (Roundtable Breakfast)
4 Cascadia Region Green Building Council
5 City of White Rock Operations Centre
6 Dockside Green, Vancouver
7 Energy Efficiency Office (EEO), City of Toronto
8 Environment Canada
9 Federation of Canadian Municipalities (FCM)
10 Gleneagles Community Centre
11 Greater Vancouver Regional District (GVRD)
12 Hanvey residence
13 Koo's Corner townhouse development
14 Minister of State (Infrastructure and Communities)
15 National Round Table on the Environment and the Economy (NRTEE)
16 Office of Energy Efficiency (OEE)
17 Omicron office refurbishment
18 Ontario Sustainable Energy Association (OSEA)
19 Pioneer Square, Seattle *(no write-up)*
20 REI flagship store
21 Seattle Public Library
22 Semiahmoo Library
23 Simon Fraser University (SFU) at Burnaby Mountain *(no write-up)*
24 Sir Adam Beck II Hydroelectric Generating Station
25 Southeast False Creek (SEFC), Vancouver
26 South Lake Union *(no write-up)*
27 Stratus Vineyards
28 Toronto and Region Conservation Authority (TRCA)
29 Toronto Community Housing Corporation (TCHC)
30 University of British Columbia (UBC) Campus Sustainability Office (CSO)
31 University of Toronto at Mississauga (UTM)
32 VanCity Lynn Creek Branch
33 Vancouver Works Yard

1 Canada Mortgage and Housing Corporation (CMHC) (International)

Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa
Ontario
K1A 0P7
CANADA

T +1 613 748 2000
chic@cmhc-schl.gc.ca
www.cmhc.ca

Canada Mortgage and Housing Corporation (CMHC) is Canada's national housing agency, committed to helping Canadians access a wide choice of quality, affordable homes. To achieve this, the organisation undertakes leading-edge research, encourages innovation in housing design and technology, and promotes home ownership for all by developing new ways to finance home purchases.

The international division of CMHC is dedicated to helping Canadian manufacturers of housing products and expertise find markets outside Canada. Working in three areas – providing practical support and export advice to the industry; selling CMHC services; and developing international relations – the group has made strong links with UK industry. A major focus of the international outreach is the promotion of the 'Super E Program' – an advanced building system that is both highly energy efficient and healthy, and that builds on the federal government's R-2000 and Advanced Housing programmes to help reduce the emission of GHGs from housing.

2 Canadian Centre for Housing Technology (CCHT)

Canadian Centre for Housing Technology
c/o National Research Council Canada
1500 Montreal Road
Ottawa
Ontario
K1A 0R6
CANADA

T +1 613 991 1006
mike.swinton@nrc-cnrc.gc.ca
www.ccht-cctr.gc.ac

As Canada's national facility for researching, testing and demonstrating innovative housing technologies, the Canadian Centre for Housing Technology (CCHT) has a remit to accelerate the development of new technologies and their acceptance in the marketplace. Built in 1998, the Centre was formed as a result of the coming together of three different areas of federal government – National Research Council Canada (NRC), Natural Resources Canada (NRCan), and Canada Mortgage and Housing Corporation (CMHC) – with a common goal to improve the quality, affordability and environmental sustainability of Canadian housing.

Alongside acting as a virtual centre for a range of research projects and providing authoritative information, the CCHT facility features twin research houses that can be used by manufacturers and developers to test new technologies prior to full field trials in occupied houses, and an InfoCentre with industry technology showroom, meeting room and the CMHC Flex House demonstration home.

3 Canadian Urban Institute (CUI) (Roundtable Breakfast)

Canadian Urban Institute
100 Lombard Street
Suite 400
Toronto
Ontario
M5C 1M3
CANADA

T +1 416 365 0816
cui@canurb.com
www.canurb.com

The Canadian Urban Institute (CUI) is a non-profit organisation that works to provide solutions to important issues that have an impact on the quality of life in urban areas and communicate those solutions to a wide audience. Established in 1990 by the City of Toronto and the Municipality of Metropolitan Toronto, CUI has three main roles:

- To connect urban decision-makers at all levels of government, the corporate and community sectors to enhance policy making and management of urban areas.
- To convene groups of decision-makers throughout Canada and abroad to facilitate the exchange of information between urban areas within Canada and internationally.
- To communicate the results of applied research and provide training in order to foster cooperative approaches to urban issues.

The Roundtable Breakfasts are monthly debates that bring key decision-makers and industry experts together to stimulate discussion on a wide range of urban issues. Their profile means that the Roundtables are often the catalyst for new research and local/federal action.

4 Cascadia Region Green Building Council

Cascadia Region Green Building Council
Pier 56
1201 Alaskan Way
Suite 200
Seattle
WA 98101
USA

T +1 206 223 2028
F +1 206 623 7005
www.cascadiagbc.org

The Cascadia Region Green Building Council promotes the design, construction and operation of buildings that are environmentally responsible, profitable and healthy places to live and work in Oregon, Washington and British Columbia.

Incorporated as a charitable organisation in December 1999, Cascadia is one of two original chapters of the US Green Building Council.

5 City of White Rock Operations Centre

City of White Rock Operations Centre
877 Keil Street
White Rock
British Columbia
CANADA

Client: City of White Rock
Design: 2001
Construction: 2002-03

Lead Architect:

Busby Perkins & Will
1220 Homer Street
Vancouver
British Columbia
V6B 2Y5
CANADA

T +1 604 684 5446
F +1 604 684 5447
www.busby.ca/0118WhiteRock/index.htm

Busby & Associates Architects (B&AA) was established by Peter Busby in 1984. With the pool of experience, knowledge, and skill shared by Peter, the Associates, and the staff, the firm quickly became recognised as a leader in the fields of sustainable practices and design excellence.

In July 2004, the firm successfully joined forces with renowned American architectural practice Perkins & Will, forming Busby Perkins & Will Architects. This merger ensures that the B&AA spirit and mandate of sustainability will continue to resonate and flourish, while the combined strengths of these two noteworthy organisations will raise the bar of excellence in architecture to an even higher level.

6 Dockside Green, Vancouver

Dockside Green
Vancouver
British Columbia
CANADA

www.docksidegreen.ca

Lead Sustainable Architect:

Busby Perkins & Will
1220 Homer Street
Vancouver
British Columbia
V6B 2Y5
CANADA

T +1 604 684 5446
F +1 604 684 5447
www.busby.ca
www.perkinswill.com

Busby Perkins & Will believe their approach results in buildings that are a source of pride to their owners, users and the communities they serve. They aim to inspire others to produce buildings which are not only beautiful but contribute to the health of the environment.

Both Windmill and VanCity are jointly developing all site infrastructure requirements, amenities and other site commitments as equity partners:

Windmill Development Group Ltd
Victoria Office
1009 Hampshire Road
Victoria
British Columbia
V8S 4S8
CANADA

T +1 250 592 6769
F +1 613 820 2460
www.windmilldevelopments.com

VanCity Enterprises Ltd
510-815 West Hastings Street
Vancouver
British Columbia
V6C 1B4
CANADA

T +1 604 877 7546
F +1 604 609 7909
www.vancity.com

7 Energy Efficiency Office (EEO), City of Toronto

Energy Efficiency Office
21st floor
East Tower
City Hall
100 Queen Street West
Toronto
Ontario
M5H 2N2
CANADA

T +1 416 392 1110
eeo@toronto.ca
www.toronto.ca/energy

The Energy Efficiency Office (EEO) was established in 1990 by the City of Toronto (then Toronto Council) as a result of a landmark environmental conference that took place. Its remit is to develop a comprehensive energy efficiency and conservation strategy for Toronto in order to help the city meet its official commitment to reduce CO_2 emissions by 20% below 1988 levels by 2005 and enhance business competitiveness.

Working across all sectors – from planning and policy development; industrial, commercial and institutional; residential; transportation; to green power – the EEO has developed several highly successful carbon reduction initiatives in partnership with local public and private bodies including the Better Buildings Partnership (BBP), Community Better Buildings Partnership (CBBP), Better Transportation Partnership (BTP), Employee Energy Efficiency at Work (E^3@Work) and Electricity Demand Management & Response for Commercial Buildings.

8 Environment Canada

Environment Canada
10 Wellington Street
Gatineau
Quebec
K1A 0H3
CANADA

T +1 819 997 2800
enviroinfo@ec.gc.ca
www.ec.gc.ca/envhome.html

Environment Canada is a federal government department with a remit to advance sustainable development in Canada. It has two main functions – to provide a leadership and advocacy role in integrating sustainable development into decision-making processes throughout the government, and to provide national and international leadership in matters relating to environmental sustainability.

The department employs around 4,700 people located across 100 communities, and has an annual budget of more than half a billion Canadian dollars. It administers several built environment programmes developed to assist Canada in meeting its Kyoto commitments such as the One Tonne Challenge which provides tools and support to help Canadians reduce their individual GHG emissions; and hosts expertise such as the Climate Change Bureau which provides policy advice and a national focal point for climate change issues.

9 Federation of Canadian Municipalities (FCM)

Federation of Canadian Municipalities
24 Clarence Street
Ottawa
Ontario
K1N 5P3
CANADA

T +1 613 241 5221
www.fcm.ca

The Federation of Canadian Municipalities (FCM) was established in 1901 as a national voice for municipal government. Representing the interests of around 1,100 municipalities at a federal policy and programme level, FCM membership includes Canada's largest cities as well as small urban and rural communities, and the 17 major provincial and territorial municipal associations.

Within the FCM, the Centre for Sustainable Community Development delivers five programmes to encourage municipal governments to improve their environmental performance and reduce their GHG emissions: Green Municipal Fund (GMF); Partners for Climate Protection (PCP); Sustainable Community Awards; Affordability and Choice Today (ACT); and Community Energy Planning Missions. The integration of these programmes within a single centre enables the FCM to effectively promote strong and accountable municipal government through the sharing of knowledge and best practice.

10 Gleneagles Community Centre

Gleneagles Community Centre
6262 Marine Drive
West Vancouver
British Columbia
CANADA

www.patkau.ca/project%20html/patkau%20gleneagles%20community%20centre.htm

Lead Consultants:

Patkau Architects
1564 West 6th Ave
Vancouver
British Columbia
V6J 1R2
CANADA

T +1 604 683 7633
F +1 604 683 7634
info@patkau.ca
www.patkau.ca

Patkau Architects was founded in 1978 and is based in Vancouver. In the 1980s, a series of early houses, schools, libraries and galleries helped to establish the firm's design reputation. Success in a number of international design competitions in the 1990s set the stage for its current practice.

Since then, the work in the office has expanded to include a wide variety of building types. Projects vary in scale from gallery installations to urban planning, from houses to major urban libraries, from glassware and furniture design to research into sustainable practice and the future of educational technologies.

While circumstances of the work change, the interests of the practice remain constant; exploring the depth of the discipline, understanding it as a critical cultural act that engages the most fundamental desires and aspirations. Refusing singular definitions of architecture – as art, as 'green', as political position, as social construct – the practice continues to attempt to gather all of these into the rich, complex and vital depths that it believes architecture to be.

Cobalt Engineering
305-625 Howe Street
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V6C 2T6
CANADA

T +1 604 687 1800
F +1 604 687 1802
info@cobaltengineering.com
www.cobaltengineering.com

The Cobalt mission is: *Engineering Ideas Beyond Sustainability for Future Generations*. Cobalt are thinkers, problem solvers and visionaries who bring ideas about the entire building to the table – including the environment in which it will be built – in order to create critical synergies between passive building elements and active systems.

With creative input at the start of a project, Cobalt aim to help develop fresh ways to satisfy the needs of clients and occupants, enhance environmental sustainability, and keep a tight reign on budgets and timelines.

11 Greater Vancouver Regional District (GVRD)

Greater Vancouver Regional District
4330 Kingsway
Vancouver
British Columbia
CANADA

T +1 604 451 6642
www.gvrd.bc.ca/sustainability
www.gvrd.bc.ca/buildsmart/building-green.htm
www.buildsmart.ca

The Greater Vancouver Regional District (GVRD) is a partnership of 21 municipalities and one electoral area that make up the metropolitan area of Greater Vancouver. The first meeting of the GVRD's Board of Directors was held in 1967, when there were 950,000 people living in the Lower Mainland. Today, that number has doubled to more than two million residents, and is expected to grow to 2.7 million by 2021.

Amidst this growth, the GVRD's role is to deliver essential utility services like drinking water, sewage treatment, recycling and garbage disposal that are most economical and effective to provide on a regional basis, and protect and enhance the quality of life in the region by managing and planning growth and development, as well as protecting air quality and green spaces.

12 Hanvey residence

715 East 18th
North Vancouver
British Columbia
CANADA

www.gvrd.bc.ca/buildsmart/PDFS/greenhomefeaturesandresources2.pdf

See Section 4.2.2 for a write-up on this private residence.

13 Koo's Corner townhouse development

560-598 Hawks Avenue
Vancouver
British Columbia
CANADA

Lead Consultants:

reSource Rethinking Building Inc
450-319 West Pender Street
Vancouver
British Columbia
V6B 1T4
CANADA

T +1 604 678 9024
F +1 604 678 8884
www.rethinkingbuilding.com/projects/multi.html

reSource provides expertise and information to support the creation of healthy and environmentally friendly buildings. It will work with a client to define the health and environmental priorities for the project, while matching the design and financial objectives. Once these goals are set it will work with the client throughout the design and building process to ensure that they are achieved. Its aim is to enable the client to create a building that is both healthy for its occupants and the planet.

Lead Architects:

Hotson Bakker Boniface Haden Architects
406-611 Alexander Street
Vancouver
British Columbia
V6A 1E1
CANADA

T +1 604 255 1169
F +1 604 255 1790
www.hotsonbakker.com/koos.html

Hotson Bakker Boniface Haden Architects offers a wide range of services to both public and private sector clients in the fields of architecture, planning, urban design, and interior design. The firm has the expertise and the resources to complete projects at all scales and complexities. Significant emphasis is placed on the quality of design in buildings and the creation of both interior and outdoor spaces that people truly enjoy.

14 Minister of State (Infrastructure and Communities)

The Honourable John Ferguson Godfrey
Minister of State (Infrastructure and Communities)

Infrastructure Canada
6th Floor
90 Sparks Street
Ottawa
Ontario
K1P 5B4
CANADA

T +1 613 948 1148
info@infrastructure.gc.ca
www.infrastructure.gc.ca

Infrastructure Canada was established in August 2002 as a new government department responsible for infrastructure issues, research and programmes. The department plays a major role in helping to build sustainable communities across Canada, through the making of strategic investments in local sustainable infrastructure projects.

Led by John Godfrey, Infrastructure Canada also coordinates federal efforts in the New Deal for Cities and Communities (NDCC), a programme seeking to deliver stable, long-term and predictable funding to cities and neighbourhoods in urban and rural areas, so as to help build communities that thrive economically, socially, environmentally and culturally.

The work of Infrastructure Canada is undertaken in partnership with the provinces, territories, and municipalities, the private sector and research institutes, to help cities and communities identify their own priorities and meet local needs, while at the same time contributing to the broader, national objective of sustainability.

15 National Round Table on the Environment and the Economy (NRTEE)

National Round Table on the Environment and the Economy
Canada Building
344 Slater Street
Suite 200
Ottawa
Ontario
K1R 7Y3
CANADA

T +1 613 992 7189
admin@nrtee-trnee.ca
www.nrtee-trnee.ca

The National Round Table on the Environment and the Economy (NRTEE) is an independent body that provides advice to the federal government, the provinces and other people on the integration of the economy and the environment. Created by an Act of Parliament in 1994, it is the only crown agency that reports directly to the Prime Minister.

NRTEE comprises two components: a 'Secretariat' of professional staff who manage programmes and undertake research projects relating to the economy and environment; and a 'Plenary' policy review and development group of 24 appointed members representing a range of sectors, and who act as a 'think tank' on pertinent and urgent issues.

This structure allows NRTEE to provide strategic advice on how to reconcile the sometimes competing interests of economic prosperity and environmental preservation, and recommend changes to public policy, while at the same time conducting analysis and technical research to back up such advice.

16 Office of Energy Efficiency (OEE)

Office of Energy Efficiency
Natural Resources Canada
580 Booth Street
18th Floor
Ottawa
Ontario
K1A 0E4
CANADA

www.oee.nrcan.gc.ca

The Office of Energy Efficiency (OEE) was established in 1998 under the government department – Natural Resources Canada. As Canada works towards its Kyoto targets, the OEE plays an important role in renewing, strengthening and expanding the country's commitment to energy efficiency, particularly as a means to reducing GHG emissions.

The OEE operates across eight programme areas – industry, housing, buildings, equipment, transportation, government operations, outreach and multi-sectoral – and through its market transformation and incentivisation activity is able to offer financial incentives, regulatory support, voluntary programmes, leadership and information to a range of clients, including individual consumers, schools, hospitals and large corporations.

17 Omicron office refurbishment

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V7X 1L4
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T +1 604 632 3350
F +1 604 632 3351
www.omicronaec.com

Omicron provides all the services and expertise needed to take a project from design through to construction – that's Omicron's 'Total Building Solutions' approach. Architects. Designers. Engineers. Builders. All under one roof, all focused on providing extra value for its clients through collaboration, consistency, and creativity. The end result: successful projects which have considered the client's requirements from the word go; cost savings as a result of smoothly integrated processes; budgets contained and timelines met. Omicron has successfully applied its Total Building Solutions to projects in each of four chosen market sectors – commercial, institutional, retail and renewals. Omicron assembles integrated teams across all required disciplines which work together to exceed client expectations. Launched in 1998 in Vancouver, BC, by three founding partners, Omicron has grown to a staff of over 125 professionals and has expanded to include branch offices in Calgary, AB and Bellevue, WA.

18 Ontario Sustainable Energy Association (OSEA)

Ontario Sustainable Energy Association
401 Richmond Street West
Suite 401
Toronto
Ontario
M5V 3A8
CANADA

T +1 416 977 4441
deb@ontario-sea.org
www.ontario-sea.org

Ontario Sustainable Energy Association (OSEA) is a provincial non-profit umbrella organisation of individuals and groups working to develop sustainable energy projects in their communities. The aim of the organisation is to help facilitate the transition to a sustainable energy economy in Ontario through the development and support of community-based sustainable energy initiatives.

Established in 1999 with grant funding, OSEA represents around 20 members working across the renewable energy sector, including wind, biogas, solar and micro-hydro, and currently employs four staff.

As an umbrella organisation, OSEA takes a leadership role for community-based sustainable energy initiatives, working to build a network that will allow disparate groups to pool their efforts and encourage the development of more sustainable energy projects across the Province of Ontario.

The continuation of grant funding, alongside membership fees, means that OSEA is able to support communities through a capacity building programme of face-to-face workshops, working groups, individual mentoring and technical support.

19 Pioneer Square Neighbourhood

Gregory Broderick Smith Real Estate
810 Third Avenue
Suite 615
Seattle
WA 98104-1648
USA

T +1 206 262 2880
F +1 206 262 2889
www.gbsre.com

South Downtown is a complex neighbourhood. It includes two world-class stadiums, an exhibition centre, a highly effective waterfront, as well as eight existing and proposed transportation systems, including the Alaskan Way Viaduct.

Goals of the project:

- A foundation of the Pioneer Square Neighbourhood Plan of 1998
- Continued historic preservation in Pioneer Square
- Re-evaluation of existing land-use regulations
- Planning without constraint of existing property ownership
- Inclusion of the stadiums and terminals 37-46
- Inclusion of substantial public open space

Greg Smith is an active member of Seattle Vision, a plan for real estate and economic development of South Downtown Seattle in and around Pioneer Square, prepared by major property owners in the area.

Please note: the main text of the report contains no write-up on this project.

20 REI flagship store

REI Flagship
222 Yale Avenue N
Seattle
WA 98101
USA

Lead Architectural Consultant:

Mithun
Pier 56
1201 Alaskan Way
Suite 200
Seattle
WA 98101-2913
USA

T +1 206 623 3344
F +1 206 623 7005
mithun@mithun.com
www.mithun.com

Mithun is a 50-year evolution of ideas, values, visions and people with one guiding inspiration: design excellence. Mithun's innovation and collaborative spirit encompass architecture, urban planning, landscape architecture and interior design services.

Mithun has embraced resource-efficient and sustainable design for over a decade. Experience and commitment to design-based on the relationship between nature, technology and structures results in developments that enhance a community's quality of life.

21 Seattle Public Library

1000 4th Ave
Seattle
WA 98104
USA

T +1 206 386 4636
www.spl.org/default.asp?pageID=branch_central&branchID=1

Key Consultant:

Arup
403 Columbia Street
Suite 220
Seattle
WA 98104
USA

T +1 206 749 9674
www.arup.com

Arup provides multidisciplinary engineering design and project management services across the full range of building types.

The objective is to use its skills and experience to create value for clients, whether designing a high-rise commercial office building, a sports stadium or a museum, or project managing a campus development.

Arup aims to be an active design partner to architects, and practice truly multidisciplinary building engineering, integrating structure and building systems with the architectural systems. Building sector clients are offered additional value-added services in acoustics, communications and IT design, façade design, lighting design, building commissioning and fire and life safety planning.

22 Semiahmoo Library

Semiahmoo Library
1815 – 152nd Street
Surrey
British Columbia
CANADA

www.mcmparchitects.com/portfolio.cfm/inc=institutional/CatID=8

Lead Consultants:

Musson Cattell Mackey Partnership (MCMP)
1600 – Two Bentall Centre
555 Burrard Street
Box 264
Vancouver
British Columbia
V7X 1M9
CANADA

T +1 604 687 2990
F +1 604 687 1771
mcmp@mcmparchitects.com
www.mcmparchitects.com

Cobalt Engineering

(See commentary earlier in this appendix under item 10 – Gleneagles Community Centre.)

23 Simon Fraser University (SFU) at Burnaby Mountain

SFU Community Trust
Suite 150
8960 University High Street
Burnaby
British Columbia
V5A 4Y6
CANADA

T +1 604 291 3220
F +1 604 291 3189
www.univercity.ca

Formerly known as the Burnaby Mountain Community Corporation, it was incorporated in February 1999 with the mandate to manage the planning and development of a complete new community on ~65 ha (160 acres) of land surrounding the SFU campus on Burnaby Mountain.

The goals are twofold:

- To create a community which complements existing and future university development, worthy of local and international acclaim.
- To establish an Endowment Fund and other sources of revenue to support a variety of university purposes.

Please note: the main text of the report contains no write-up on this project.

24 Sir Adam Beck II Hydroelectric Generating Station

Ontario Power Generation
700 University Avenue
Toronto
Ontario
M5G 1X6
CANADA

T +1 416 592 2555
www.opg.com

Hydroelectric power accounts for around 60% of Canada's electricity generation, a significant amount of which comes from the province of Ontario. As one of the world's greatest sources of hydroelectric power, the Niagara River provides the driving force for over 4 million kilowatts of electricity (almost 2 million kilowatts from a number of power plants on the Canadian side, and 2.4 million kilowatts from two plants on the American side).

The plants on the Canadian side of the river are owned and operated by Ontario Power Generation (OPG). The largest is the Sir Adam Beck II Generating Station, which was opened in 1958 and has a capacity of 1,328 MW.

25 Southeast False Creek (SEFC), Vancouver

1800 Spyglass Place
Vancouver
British Columbia
CANADA

T +1 604 871 6859
www.vancouver.ca/commsvcs/southeast/index.htm

The City of Vancouver recognises a need to take a leadership role in protecting the environmental quality of its region.

In 1991, Council directed that Southeast False Creek (SEFC) be developed as a residential community that incorporates principles of energy efficient design in its area plan and explore the possibility of using SEFC as a model ‘sustainable community’.

26 South Lake Union

Vulcan
South Lake Union Discovery Centre
101 Westlake Ave N
Seattle
WA 98109
USA

T +1 206 342 2493
F +1 206 342 3493

www.vulcanrealestate.com

'Vulcan creates and advances a variety of world-class endeavors and high impact initiatives that change and improve the way we live, learn, do business and experience the world.'

The mission statement is a reflection of Vulcan's values. It basically says that it is committed to making the world a better place. This mission drives Vulcan Real Estate's whole approach to development whereby it is focused on 'doing the right thing'.

These values support Vulcan's development philosophy according to which it evaluate its projects based on the 'triple bottom line'.

First, Vulcan needs to generate a market return on its capital investment commensurate with the risk of development. The Paul Allen Foundation supports many charitable initiatives but real estate is not one of them.

As if making money in the real estate business was not hard enough, the Allen family has challenged Vulcan to have a positive impact on the community by doing quality, sustainable development. Lastly, Vulcan wants to be respectful of the environment by developing in urban areas primarily and by utilising building materials and systems that conserve natural resources.

Please note: The main text of the report contains no write-up on this project.

27 Stratus Vineyards

Stratus Vineyards
2059 Niagara Stone Road
Niagara-On-The-Lake
Ontario
L0S 1J0
CANADA

T +1 905 468 1806
www.stratuswines.com/index.html

Stratus Vineyards, established in 2000, is a sustainable, innovative winery that has become the first building in Canada to be certified through LEED Canada. Receiving its 'Silver' certification in June 2005, it is also the first winery in the world to be certified under LEED.

To achieve the certification, the building had to meet criteria in five main categories: sustainable site; water efficiency; energy efficiency; green materials; and indoor environmental quality – many of which can be noticeably seen in many features around the building:

- The design itself is a flexible, adaptable series of spaces that could be changed to suit different purposes in years to come.

- The building's heating and cooling is provided by pumping air from 24 geothermal wells (70 m deep) around spaces which can be individually controlled to ensure optimum temperature is attained for the different activities within the building.

- Daylighting is provided through large glazed areas, meaning that electrical lighting can be eliminated during the daytime.

- Green building materials are used throughout, with reclaimed timber and steel, locally sourced materials and insulation made from recycled materials, being chosen. Galvanised steel is also used to reduce the need for paint.

- Lifestyle issues are also considered – bicycle racks and showers are provided to encourage staff and visitors to cycle, environmentally friendly cleaning products are used and an extensive recycling programme is in place.

The work at Stratus is leading the way for other wineries in the region of Niagara to adopt a more sustainable approach to wine growing, with several other vineyards now looking at options for their businesses and the Wine Council of Ontario developing an Environmental Charter.

28 Toronto and Region Conservation Authority (TRCA)

Toronto and Region Conservation Authority
5 Shoreham Drive
Downsview
Ontario
M3N 1S4
CANADA

T +1 416 661 6600
info@trca.on.ca
www.trca.on.ca

Toronto and Region Conservation Authority (TRCA) is a non-profit partnership organisation founded in 1957 to help conserve and manage the natural resources in the Toronto area. It was originally established as a result of the province of Ontario enacting the Conservation Authorities Act, which permitted municipalities in a watershed to form a Conservation Authority, but exists today because of municipal support and private sector partnerships.

TRCA's Living City initiative aims to engage leadership from across the Greater Toronto Area in transforming the region into one of the most sustainable, liveable communities in the world, and since its formation TRCA has developed and delivered many successful programmes that work towards this aim, including the Kortright Centre – the largest renewable energy training centre in Canada, Greening Retail, Sustainable Schools and the Mayor's 'Megawatt Challenge.'

TRCA also offers information and advice on environmental projects and good land-management practices, and delivers an outreach education programme to help raise awareness and build knowledge amongst local school children.

29 Toronto Community Housing Corporation (TCHC)

Toronto Community Housing Corporation
931 Yonge Street
Toronto
Ontario
M4W 2H2
CANADA

T +1 416 981 5500
info@torontohousing.ca
www.torontohousing.ca

Toronto Community Housing Corporation (TCHC) is the largest social housing provider in Canada, with 165,000 low- and moderate-income tenants housed in around 65,000 households. The Corporation's portfolio includes more than 360 high-rise and low-rise apartment buildings, as well as around 800 houses and duplexes throughout the city. The age of much of this portfolio, however, now means that TCHC is at a point where major stock refurbishment is required.

Seeing this as an opportunity to regenerate some of the local communities, TCHC has instigated several community revitalisation initiatives, including Regent Park – a 50 year old, 70 acre (~28 ha) site in downtown Toronto that is home to 7,500 people. Following extensive community consultation, through which residents have fed back their views that they want 'a community that looks like any other neighbourhood' and that they would like it to be a 'green community', TCHC has set ambitious environmental targets for the Regent Park regeneration project.

30 University of British Columbia (UBC) Campus Sustainability Office (CSO)

University of British Columbia
Campus Sustainability Office
2210 West Mall
Vancouver
British Columbia
CANADA

T +1 604 822 0473
T +1 604 827 5641
www.sustain.ubc.ca
www.sustain.ubc.ca/greenbuilding.html

Buildings visited:

- C K Choi Building
- Liu Centre

In 1997, the University of British Columbia (UBC) became Canada's first university to implement a sustainable development policy after signing both the Halifax Declaration and the Talloires Declaration, documents that pledged its signatories to sustainability. A year later, the university opened Canada's first Campus Sustainability Office (CSO).

The CSO is committed to developing an environmentally responsible campus that is economically viable and reflects the values of campus community members. It is assisting UBC in assuming a leadership role through practicing sustainable development and instilling sustainable development values in its graduates and employees through research, teaching, and operations.

The CSO is currently facilitating at least a dozen focused programmes that aim to reduce energy and resource consumption on campus, encourage the construction of green buildings and involve all members of the campus in this ongoing goal to make the university a fully sustainable community.

The CSO is completely funded by savings from energy reduction programmes.

31 University of Toronto at Mississauga (UTM)

University of Toronto at Mississauga
3359 Mississauga Road North
Mississauga
Ontario
L5L 1C6
CANADA

ccheh@utm.utoronto.ca
www.utm.utoronto.ca

The University of Toronto at Mississauga (UTM) is the second largest division at the University of Toronto, with a student population of around 9,000. The campus is currently facing the challenge of rapid expansion over the next three years, with the population expected to rise to 11,500 by 2006-07.

Recognising the need to grow in an environmentally responsible way, the university has adopted the banner *'Grow Smart, Grow Green.'* Under this banner, a number of programmes have been developed to assist in moving forward.

The Centre for Emerging Technologies was set up in 2003-04, to act as a focus for the commercialisation of new energy technologies, including fuel cells and renewable energy sources; this in turn saw the launch of the Hydrogen Village Partnership which aims to accelerate the commercialisation of hydrogen and fuel cell technology in Canada; and in 2004 the University of Toronto's first Environmental Affairs Office opened to help drive the ongoing improvement of overall campus sustainability.

32 VanCity Lynn Creek Branch

VanCity Lynn Creek Branch
1370 Main Street
North Vancouver
British Columbia
V7J 1C6
CANADA

T +1 604 877 7463
F +1 604 877 7946
www.vancity.com/MyCommunity/AboutUs/MediaCentre/MediaArchive2003/Jun30NewsVancityOpensNewBranch

VanCity: working for positive change in Canadian communities. The VanCity vision is to be a strong financial co-operative and a catalyst for a socially just and environmentally sustainable economy.

To get there, VanCity makes business decisions that consider the wellbeing of members, employees, communities and the environment – so all prosper together. Significant resources – financial and non-financial – are dedicated to support those working for positive change in Canadian communities.

33 Vancouver Works Yard

www.omicronaec.com/gallery.php

Client: City of Vancouver
Construction value: C$22 million
Completion date: February 2004

Lead Consultant:

Omicron
Fifth Floor
Three Bentall Centre
595 Burrard Street
PO Box 49369
Vancouver
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V7X 1L4
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F +1 604 632 3351
solutions@omicronaec.com
www.omicronaec.com

Details of Omicron expertise are given on page 137 under item 17 – Omicron office refurbishment.

Appendix C

MISSION PARTICIPANTS

East coast team

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CRed (Carbon Reduction Programme)
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www.cred-uk.org

CRed (the Community Carbon Reduction Programme) was launched by the UK government's Chief Scientific Advisor, Sir David King, at Westminster in May 2003. The Programme is dedicated to working with businesses, schools, government (at all levels) and householders to produce partnerships aimed at reducing carbon emissions by 60% by 2025.

CRed is the brainchild of climate scientists based at the internationally renowned School of Environmental Sciences at the University of East Anglia.

Although CRed is based in and focused on Norfolk, the Programme has operating partnerships with other districts throughout East Anglia and the UK. The CRed approach is also being piloted in North Carolina (USA) and Okinawa (Japan).

In the two years since the Programme was launched, over 2,000 households, 80 companies and 30 schools have become partners in CRed. All participants are undertaking carbon reduction measures with the long-term aim of reducing their carbon emissions by 60%.

East coast team

Michael Crilly
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Tees Valley Regeneration
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Stockton on Tees
Tees Valley
Tyne and Wear
TS17 6QY
UK

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michael.crilly@teesvalleyregeneration.co.uk
www.teesvalleyregeneration.co.uk

Tees Valley Regeneration is in business to create irresistible development and investment opportunities and to deliver sustainable and meaningful economic activity for the long-term development of the Tees Valley region.

Tees Valley Regeneration came into being in 2002 as one of the first wave of urban regeneration companies established by the government across England. Its shareholders are the five councils that comprise the Tees Valley – Darlington, Hartlepool, Middlesbrough, Redcar & Cleveland and Stockton on Tees; One NorthEast – the regional development agency (RDA); and English Partnerships – the national regeneration agency.

East coast team

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nicholas.doyle@pfp-group.co.uk
www.places-for-people.co.uk

The Places for People Group is one of the UK's leading housing and regeneration specialists and is responsible for more than 52,000 homes in England, Scotland and Wales.

The focus of the Group is to improve existing neighbourhoods and create new ones, with the aim of providing well-designed mixed-tenure areas that offer a range of homes for rent and sale, as well as high-quality childcare facilities, job and learning opportunities and access to financial services.

These services are delivered through ten subsidiary companies – six housing associations, a company which provides homes for market rent, one which builds homes for sale, and a company which specialises in creating community facilities and childcare facilities.

The skills and resources available through the range of specialist companies enable Places for People to be a 'one-stop-shop' for regeneration and a model of public-private partnership.

The Group employs around 1,600 people and has Group Support Centres in London, Preston and York together with 25 local offices around the country.

East coast team

Paul Fleming
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The Gateway
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LE1 9BH
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T +44 (0)116 257 7963
pfleming@dmu.ac.uk
www.iesd.dmu.ac.uk

The Institute of Energy and Sustainable Development (IESD) is a specialist research, consultancy and teaching group based within De Montfort University. The main focus is on the clean, efficient use of energy in the built environment, and developing ways in which greater use can be made of renewable energy, particularly in dwellings, industry and commerce.

Research undertaken by the Institute's multidisciplinary team covers a seamless range from basic modelling, through component and building simulation and performance evaluation, to city-scale energy and environment analysis, management, planning and policy. Research collaboration and partnerships have been developed with local government, other UK and EU universities, and industry. This research work underpins the Institute's consultancy activities, which are undertaken for business, government and international organisations. It also provides the platform for a wide variety of postgraduate research degree projects (MPhil and PhD).

IESD's MSc in Climate Change and Sustainable Development is a specialist programme designed to equip students with the skills and knowledge needed to develop a career in the sphere of sustainable development in both the public and private sectors.

East coast team

Sarah Greenwood
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INREB Faraday Partnership
Building Research Establishment
Garston
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Hertfordshire
WD25 9XX
UK

T +44 (0)1923 664 521
greenwoodsa@bre.co.uk
www.inreb.org

The INREB Faraday Partnership harnesses the expertise of the Building Research Establishment (BRE) – the UK's leading research and technology organisation (RTO) in the built environment – and four world-class academic research groups at the universities of De Montfort, Loughborough, Nottingham and Ulster to deliver a programme of industry-aligned research, technology transfer and training that focuses on low-carbon technologies, buildings and communities.

Since its launch in November 2001, INREB has been working towards the establishment of a fully integrated national programme of activity aimed at helping the UK meet its ambitious target for a 60% reduction in CO_2 emissions from the built environment. Through projects focused on developing and delivering low-carbon technologies, buildings and communities, the Partnership has gained a reputation for delivering high-quality activity that is relevant to industry, and that meets the needs of modern business and society.

INREB's activities are derived from 'industry needs and drivers' which are identified through comprehensive 'industry contact' activity with key stakeholders in the construction industry and energy sector, including the government, professional institutions, local authorities, consultancies, developers and product manufacturers.

Such contact not only ensures the relevance of INREB's work to the construction and energy sectors, but also enables the Partnership to be at the fore of innovation, encourage advancement in the industries and consequently assist the UK in exploiting the business opportunities afforded by the low-carbon agenda.

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Yorkshire Forward is the regional development agency (RDA) responsible for the sustainable economic development and regeneration of the Yorkshire & Humber area. Yorkshire & Humber boasts one of the UK's most powerful and diverse economies, growing consistently faster than the European average; with a total GDP of £71.2 billion, the region ranks alongside the top third of the world's economies. Yorkshire Forward's aim is to make it a truly world-class region in which to live, work and invest and it is actively investing in key business sectors to accelerate economic growth and encourage higher value-added business.

Seven key industry clusters in the region have been identified as drivers of this growth, with each cluster selected either because it has been traditionally strong or because it has potential for rapid growth. These clusters are:

- Advanced Engineering and Metals
- Bioscience
- Chemicals
- Digital Industries
- Environmental Technologies
- Food and Drink
- Healthcare Technologies

The region is actively building critical mass in these industry sectors, developing companies up and down the supply chain and forging closer links with the universities, to help businesses innovate. With access to an industrial infrastructure on their doorstep and better access to potential customers and suppliers – all drawn to the area by the availability and range of jobs, employers and customers in their industry – turnover increases and ultimately strengthens the regional economy.

Yorkshire Forward was the first RDA to adopt a target within the Regional Economic Strategy in line with the government goal to reduce CO_2 emissions by 20% by 2010. It has established a number of major programmes to achieve this target, including resource efficiency and recycling initiatives, the establishment of Future Energy Yorkshire to bring niche carbon reduction technologies to market, and carbon exemplar projects with associated capacity building work.

Yorkshire Forward's support includes providing funding for capital projects and for initiatives to improve the supply chain or to enhance knowledge transfer or innovation.

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Leicester City Council (LCC) was Britain's first Environment City and was the only local authority commended for its actions to reduce GHG emissions at the Rio Earth Summit in 1992. Ten years later, Cllr Ross Willmott attended the World Summit on Sustainable Development in Johannesburg.

LCC recently commissioned its 'Ball Mill' recycling and composting facilities which aims to put Leicester at the top of the league in recycling. Leicester recently agreed its own Climate Change Strategy and continues with ambitious programmes to achieve its target of 60% CO_2 reductions by 2020.

The East Midlands Development Agency (emda) is one of nine regional development agencies (RDAs) in England set up in 1999 to bring a regional focus to economic development.

RDAs were set up in 1999 and 2000 by the UK government to promote sustainable economic development in England. They are business-led and their main tasks are to help the English regions improve their relative economic performance and reduce social and economic disparities within and between regions.

In 1999 emda set a vision for the economy of the East Midlands – to be a top-20 region in Europe by 2010. This is an ambitious target, but one that emda believes it can achieve by making its region a place where people want to live, work and invest; through the creation of a vibrant, successful economy; a healthy, safe and inclusive society; and a good quality environment.

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jmarchitects has developed into one of the country's leading architectural practices since its foundation in 1960 by professor Percy Johnson Marshall, an architect and town planner of international repute. During its existence the practice has evolved from being relatively small to one of the largest in the country with around 140 staff in five offices. With its founding office in Edinburgh, growth has been steady during the last ten years with offices opening in London, Leeds, Glasgow and Manchester.

jmarchitects has an established record of work throughout the UK and overseas in architecture, environmental design, regional planning, urban design and town planning. It offers services in architecture, planning and urban design for a wide range of public and private clients.

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Whitbybird was founded in 1984 and now numbers over 300 staff. It provides all the engineering services required for the design of buildings and bridges. Structural, civil and building services engineering teams are supplemented by specialists in façade engineering, fire engineering, building physics and infrastructure. Its work has always been characterised by its variety: office developments, schools and universities, research buildings, housing, factories, bridges, theatres, health projects, sports facilities, shops and community buildings. It is commissioned both for new-build and refurbishments and the capital value of its projects now ranges from £0.2 million to over £500 million.

The Whitbybird Sustainability and Renewable Energy team is a UK leader in its field. Services include design for low-energy buildings and developments, renewable energy engineering, environmental assessment (BREEAM, EcoHomes, NHER, etc), energy masterplanning and R&D project management. Recent projects have included a 115 kWp photovoltaic array on the CEME building, London (for the Ford Corporation), environmental design and building physics for 20 schools across Birmingham and Edinburgh, and lead sustainability consultant on a bid for the redevelopment of the £300 million Whipps Cross Hospital in North East London.

Whitbybird also has a joint venture in the form of Element Energy Ltd. This specialist company provides engineering consultancy to the energy sector, taking an integrated approach to renewable energies, hydrogen, fuel cells and other low-carbon energy technologies.

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The INREB Faraday Partnership harnesses the expertise of the Building Research Establishment (BRE) – the UK's leading research and technology organisation (RTO) in the built environment – and four world-class academic research groups at the universities of De Montfort, Loughborough, Nottingham and Ulster to deliver a programme of industry-aligned research, technology transfer and training that focuses on low-carbon technologies, buildings and communities.

Since its launch in November 2001, INREB has been working towards the establishment of a fully integrated national programme of activity aimed at helping the UK meet its ambitious target for a 60% reduction in CO_2 emissions from the built environment. Through projects focused on developing and delivering low-carbon technologies, buildings and communities, the Partnership has gained a reputation for delivering high-quality activity that is relevant to industry, and that meets the needs of modern business and society.

INREB's activities are derived from 'industry needs and drivers' which are identified through comprehensive 'industry contact' activity with key stakeholders in the construction industry and energy sector, including the government, professional institutions, local authorities, consultancies, developers and product manufacturers.

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Rickaby Thompson Associates was founded in 1982 as an architectural practice specialising in energy efficient design. Since then it has evolved into a specialist energy and environmental consultancy working throughout the building and housing industries.

Its services include energy efficient design, energy surveys and energy ratings, housing stock energy consultancy, building performance testing and monitoring, environmental assessment (BREEAM and EcoHomes), energy training, and urban and regional sustainable development consultancy. The aim is to combine leading technical expertise with professionalism, and to promote a high standard of environmental responsibility amongst the organisations with which it works.

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Max Fordham LLP is one of the UK's leading firms of consulting building services and environmental engineers. Established in 1966, the practice designs services at the rate of £55-60 million a year. The practice is currently staffed by over 100 engineers and administrators based in offices in Camden, London; Grantchester, Cambridge; and Haymarket, Edinburgh. In 2004 the practice won The Queen's Award for Enterprise in the category of Sustainable Development.

The practice aims to push the boundaries of sustainable and low-energy design by firstly enhancing the relationship of the built environment to the natural external environment and secondly optimising the performance of any artificial conditioning used. It aims to design buildings that achieve the highest BREEAM rating by reducing heating and lighting energy consumption, avoiding the need to air condition, and by careful selection of materials. It also contributes to the successful development of masterplans by modelling, analysis and measurement of microclimate and ambient energy sources in order to achieve the highest environmental standards and flexible infrastructure.

Max Fordham advises design teams on the form, fabric and orientation of buildings to make the best use of solar gain and daylighting, minimise summertime overheating, and provide secure ventilation. Devising the environmental strategy involves investigating options for heating, hot water and ventilation, from bespoke solutions to standard systems. The aim is to design installations that are minimal and sustainable, with robust detailing, good maintenance access, and low running costs.

Its Sustainable Urban Design group extends this award-winning approach to the design of clusters of buildings and urban development. The group works collaboratively in design teams to advise and support architects, planners and developers to plan sustainable communities from the strategic city level to the environmental services for an individual building.

West coast team

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The Department of Trade and Industry (DTI) Global Watch Service provides support dedicated to helping UK businesses improve their competitiveness by identifying and accessing innovative technology and practices from overseas. As part of the Service, Global Watch Technology Partnering provides free, flexible and direct assistance from international technology specialists to raise awareness of, and provide access to, technology and collaborative opportunities overseas. This is delivered to UK companies by a network of 21 International Technology Promoters (ITPs), with some 8,000 current contacts, providing support ranging from information and referrals to more in-depth assistance with licensing arrangements and technology transfer.

The ITPs can help:

- Identify relevant overseas technological developments, opportunities and best practices
- Access advances which could enhance a company's strategies and plans
- Transfer products, technologies, processes or management techniques
- Set up business alliances
- Establish licensing arrangements on emerging technologies and new markets
- Overcome language and cultural barriers

The ITPs work across a range of sectors including:

- Environmental and Sustainable Energy Technologies
- Information Technology, Electronics and Communications
- Life Sciences
- Performance Engineering and Materials

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Research in the Department of Architecture at Cambridge was first formally established when the late Professor Sir Leslie Martin set up the Land Use and Built Form Studies Centre – since renamed the Martin Centre for Architectural and Urban Studies – in 1967. The Martin Centre has quickly established an international reputation, and was recently referred to as 'the leading British architectural research unit' in Architectural Science Review.

The Department's research focus can broadly be described as concerned with the three cornerstones of sustainable architecture and urbanism: environmental, cultural and socio-economic.

The Martin Centre coordinates funded research contracts and physically houses the Sustainable Design research group. The primarily technical work carried out in this group ranges in scale from regional and urban modelling to building components, and from climate change risk to health and comfort in buildings.

Three principles underpin the research work of the Department: a profound sense of responsibility towards the environment, a respect for architectural history and precedent, and the development of mathematical and image-based techniques.

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Arup thinks about sustainability as a part of everything it does. Sustainable development is the process of development towards a state of equilibrium between man and his natural world. As it seeks social opportunity and equality, it acknowledges the key enabling role of prosperity in this process.

Sustainable development starts locally from different points and progresses at varying speeds driven by communities. The primary objective is accelerating in the right direction, through simultaneous improvements in all three of the social, economic and environmental aspects. The long-term challenge is findings ways of meeting our needs through substantially less use of natural resources and reduced environmental impact. Renewable sourcing together with using and reusing the material we have already extracted, forms the fundamental basis for a sustainable future. The ultimate benchmark for this process relates to *per-capita* equality within the capacity of our natural world.

Arup is an international consultancy providing high-value professional advice in every field related to design. It is known for its creativity, design flair, open-minded approach to problem solving and for its collaborative approach to the design process. It has more than 6,000 staff in 35 offices and its projects have taken it to more than 100 countries.

Arup's major goal is to help its clients meet their business objectives through technical excellence, efficient organisation and personal service. This is reflected in its multidisciplinary approach to the services it provides.

Arup has a strong culture of social responsibility and a driving belief in technical excellence. These and other deep-rooted ideals are encapsulated in its future statement *We Shape a Better World* which describes the company's approach to its projects and its vision of the future.

Arup has developed and grown organically with at least one additional skill being added to its portfolio during every one of its fifty years in practice.

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Edward Cullinan Architects is committed to producing fine architecture that fulfils the needs of the client, the user and those of the wider society. In every project it strives to develop appropriate solutions, through its architecture and through education, that are respectful to the world's resources. It welcomes new experiences, challenges and approaches, as well as building upon a broad base of experience. It endeavours at all times to conduct its business with integrity, competence and discretion. It aims to be an equal opportunities employer, promoting mutual respect and encouraging lifelong development.

Edward Cullinan Architects has been designing carefully composed innovative buildings for many years and now is increasingly working on urban regeneration, urban design and buildings in city centres, to which it is bringing its common interests:

- A positive response to the particular context, be it urban or rural, historic or ordinary, greenfield, or brown
- A desire to create good public spaces between buildings
- A continuing focus on energy conservation and sustainability, both strategically and in detail design in line with the government's commitment to meeting the Kyoto Protocol

- A belief that consultation and participation by users can be a crucial part of the design process
- An enjoyment in the construction of the buildings as an integral part of its architecture
- Construction to tight programmes and whole-life costs within a commitment to improving efficiency, lean thinking and the Egan agenda

In a national survey of UK architects in 2003 by the Architects' Journal, Ted Cullinan was chosen as the second most admired British architect. The team's projects have consistently won awards including 13 RIBA awards, one Prime Minister's Better Public Building Award, the prestigious major project BCIA Award in 2003 and the small project BCIA Award in 2002. The Downland Gridshell was shortlisted for the Stirling Prize and won both the Gold Wood Award and the first European Wooden Façade Award. Two projects were awarded Millennium Product status and two projects are (M4I) Constructing Excellence Demonstration Projects.

Edward Cullinan Architects is quality assured to ISO 9001 and is working towards Investors in People accreditation.

Appendix D

LIST OF EXHIBITS

Exhibits in Appendices B and C are unnumbered and uncaptioned

Appendix E

GLOSSARY

~	approximately
≈	approximately equal to
<	less than
AB	Alberta (Canada)
ACT	Affordability and Choice Today (housing initiative, Canada)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers (USA)
BATISO	'batiment isotherm' – the Swiss concept meaning 'constant temperature building'
bbl	barrel
BBNCP	Better Buildings New Construction Program (Toronto, Canada)
BBP	Better Buildings Partnership (programme, Toronto, Canada)
BC	British Columbia (Canada)
BCIA	British Construction Industry Awards
BkWh	billion (10^9) kilowatt-hours
BRE	Building Research Establishment (UK)
BREEAM	Building Research Establishment Environmental Assessment Method
BTP	Better Transportation Partnership (Toronto, Canada)
Btu	British thermal unit (= 1055 kJ)
ºC	degrees Celsius
C$	Canadian dollar (£1 ≈ C$2.2)
C5	Canadian 'hub' cities (Calgary, Montreal, Toronto, Vancouver, Winnipeg)
CABE	Commission for Architecture and the Built Environment (UK)
CaGBC	Canada Green Building Council
CANMET	Canada Centre for Mineral and Energy Technology
CBBP	Community Better Buildings Partnership (Canada)
CBIP	Commercial Building Incentive Program (Canada)
CCAP	Climate Change Action Plan (Canada)
CCBFC	Canadian Commission on Building and Fire Codes
CCHT	Canadian Centre for Housing Technology
CCP	Cities for Climate Protection (campaign, ICLEI)
cd	candela
CEET	Centre for Emerging Energy Technologies (UTM, Canada)
CHP	combined heat and power
CMHC	Canada Mortgage and Housing Corporation
CO_2	carbon dioxide
COP	(1) coefficient of performance; (2) Conference of the Parties (under UNFCCC)
CRed	Carbon Reduction Programme (University of East Anglia, UK)
CSB	Code for Sustainable Buildings (UK)
CSO	Campus Sustainability Office (UBC, Canada)
CUI	Canadian Urban Institute
d	day
DCL	Development Cost Levy
DEFRA	Department for Environment, Food and Rural Affairs (UK)

DOE	Department of Energy (USA)
DTI	Department of Trade and Industry (UK)
E	(1) emissivity; (2) estimated
E^3@Work	Employee Energy Efficiency at Work (City of Toronto, Canada)
EAE	Efficiency and Alternative Energy (programme, Canada)
ECC	Energy Council of Canada
EEC	Energy Efficiency Commitment (UK)
EEO	Energy Efficiency Office (City of Toronto, Canada)
EIA	Energy Information Administration (DOE, USA)
EIT	economies in transition
emda	East Midlands Development Agency (UK)
ESCo	energy supply/service company
EU	European Union
EU15	the EU's 15 pre-2004 member states – including the UK
F	fax
ºF	degrees Fahrenheit
FAR	floor area ratio
FCM	Federation of Canadian Municipalities
FSC	Forest Stewardship Council (international)
FSR	floor space ratio (total built living area / total site area)
ft	foot/feet
G4	Netherlands city network (Amsterdam, Hague, Rotterdam, Utrecht)
G7	Group of Seven (Canada, France, Germany, Italy, Japan, UK, USA)
G8	Group of Eight (G7 + Russia)
gal	gallon
GB	Great Britain (England, Scotland and Wales)
GDP	gross domestic product
GHG	greenhouse gas
GJ	gigajoule (= 10^9 joule)
GMF	Green Municipal Fund (Canada)
GRI	Global Reporting Initiative
GTA	Greater Toronto Area (Canada)
GVRD	Greater Vancouver Regional District (Canada)
ha	hectare
HVAC	heating, ventilating and air conditioning
ICLEI	International Council for Local Environmental Initiatives (Canada)
ICT	information and communications technology
IESD	Institute of Energy and Sustainable Development (De Montfort University, UK)
IGU	International Gas Union (Denmark)
in	inch
INREB	The INREB Faraday Partnership (UK)
IT	information technology
K	kelvin
kg	kilo(gram)
kJ	kilojoule
km	kilometre
kW	kilowatt
kWh	kilowatt-hour (= 3.6 MJ)

kWp	kilowatt peak
l	litre
lb	pound (mass)
l/s/p	litres per second per person
LCC	Leicester City Council (UK)
LEED	Leadership in Energy and Environmental Design (scheme, USGBC, USA)
LEED-CI	LEED for Commercial Interiors
LEED-NC	LEED for New Construction and Major Renovations
LFE	large final emitter
LGA	Local Government Association (UK)
LLP	Limited Liability Partnership
m	metre
M4I	Movement for Innovation (UK)
MAH	Ministry of Municipal Affairs and Housing (Ontario, Canada)
MJ	megajoule
mm	millimetre
Mmst	million short tons (10^6 st)
Mmt	million metric tons (10^6 t)
MNECB	Model National Energy Code for Buildings (Canada)
MNECH	Model National Energy Code for Houses (Canada)
Mt	megatonne
MW	megawatt
MWh	megawatt-hour (= 3,600 MJ = 3.6 GJ)
NDCC	New Deal for Cities and Communities (programme, Canada)
NGO	non-governmental organisation
NHER	National Home Energy Rating (UK)
NRC	National Research Council (Canada)
NRCan	Natural Resources Canada
NRTEE	National Round Table on the Environment and the Economy (Canada)
OBC	Ontario Building Code (Canada)
ODP	Official Development Plan
OEE	Office of Energy Efficiency (NRCan, Canada)
OMA	Rem Koolhaas' Office for Metropolitan Architecture (Netherlands)
OPG	Ontario Power Generation Inc (Canada)
OSB	oriented strand board
OSEA	Ontario Sustainable Energy Association (Canada)
p	person
PC	personal computer
PCP	Partners for Climate Protection (programme, Canada)
PJ	petajoule (= 10^{15} joule)
pph	persons per hectare
PST	Provincial Service Tax (Canada)
PTPACC	Provincial/Territorial Policy Advisory Committee on Codes (Canada)
PV	photovoltaic(s)
PVC	polyvinyl chloride
R&D	research and development
RCEP	Royal Commission on Environmental Pollution (UK)
RCMP	Royal Canadian Mounted Police

RDA	regional development agency (UK)
REI	Recreational Equipment Inc (USA)
RIBA	Royal Institute of British Architects
RPPI	Renewable Power Production Incentive (programme, Canada)
RTO	research and technology organisation
s	second
SAP	Standard Assessment Procedure (for energy rating of dwellings, UK)
SCP	Sustainable Communities Plan (UK)
SEFC	Southeast False Creek (Vancouver, BC, Canada)
SFU	Simon Fraser University (Canada)
SO_2	sulphur dioxide
st	short ton (= 2,000 lb ≈ 0.907 metric ton (tonne (t)))
SUV	sport(s) utility vehicle
t	tonne (metric ton = 1,000 kg)
T	telephone
TAF	Toronto Atmospheric Fund (Canada)
Tcf	trillion (10^{12}) cubic feet
TCHC	Toronto Community Housing Corporation (Canada)
TRCA	Toronto and Region Conservation Authority (Canada)
TREC	Toronto Renewable Energy Co-operative (Canada)
TWh	terawatt-hour (= 10^{12} watt-hour)
U	thermal conductance / heat transfer coefficient
UBC	University of British Columbia (Canada)
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
US(A)	United States (of America)
USGBC	US Green Building Council
UTM	University of Toronto at Mississauga (Canada)
VOC	volatile organic compound
W	watt
WA	Washington (state, USA)
WC	water closet
WPPI	Wind Power Production Incentive (programme, Canada)
yd	yard
YMCA	Young Men's Christian Association
yr	year

Appendix F

ACKNOWLEDGMENTS

The INREB Faraday Partnership on behalf of the east and west coast mission teams would like to express its sincere thanks to the many individuals and bodies that made this mission possible:

East coast – Ottawa

- Dr Julie Wright-de Hennin and George Norris, British High Commission Ottawa for their help in arranging meetings and support in accompanying the mission team in Ottawa.

East coast – Toronto

- Helen McCart and Isabell French, British Consulate-General Toronto for their help in arranging meetings and support in accompanying the mission team in Toronto. Special thanks also go to Helen and Isabell for their wonderful efforts in organising the Mission Reception.

- Brent Gilmour and others at the Canadian Urban Institute for organising the Roundtable Breakfast.

West coast – Vancouver

- Andy Newlands, Deputy Consul General, British Consulate-General Vancouver for the excellent organisational arrangements.

- Helen Goodland, Senior Advisor, Sustainable Buildings, Greater Vancouver Regional District for an excellent programme of visits.

West coast – Seattle

- Dennis Leith, Consul and Tom Ramsson, Business Development Associate, British Consulate Seattle for an excellent programme of visits.

UK – DTI Global Watch Service

- David Thompson of DTI London who provided the financial support.

- The DTI International Technology Promoter (ITP) network, and particularly the ITP for Environmental and Sustainable Energy Technologies in North America – Philip Sharman – whose support was outstanding.

And…

- All the individuals and companies the teams visited who were extremely hospitable, open and helpful in making themselves available to answer our questions and show us round their facilities.

The DTI Global Watch Service provides support dedicated to helping UK businesses improve their competitiveness by identifying and accessing innovative technologies and practices from overseas.

Global Watch Information
Global Watch Online – a unique internet-enabled service delivering immediate and innovative support to UK companies in the form of fast-breaking worldwide business and technology information. The website provides unique coverage of UK, European and international research plus business initiatives, collaborative programmes and funding sources.
Visit: www.globalwatchservice.com

Global Watch magazine – distributed free with a circulation of over 50,000, this monthly magazine features news of overseas groundbreaking technology, innovation and management best practice to UK companies and business intermediaries.
Contact: subscriptions@globalwatchservice.com

UKWatch magazine – a quarterly magazine, published jointly by science and technology groups of the UK Government. Highlighting UK innovation and promoting inward investment opportunities into the UK, the publication is available free of charge to UK and overseas subscribers.
Contact: subscriptions@ukwatchonline.com

Global Watch Missions – enabling teams of UK experts to investigate innovation and its implementation at first hand. The technology focused missions allow UK sectors and individual organisations to gain international insights to guide their own strategies for success.
Contact: missions@globalwatchservice.com

Global Watch Secondments – helping small and medium sized companies to send employees abroad or receive key people from another country. Secondments are an effective way of acquiring the knowledge, technology and connections essential to developing a business strategically.
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Global Watch Technology Partnering – providing free, flexible and direct assistance from international technology specialists to raise awareness of, and provide access to, technology and collaborative opportunities overseas. Delivered to UK companies by a network of 21 International Technology Promoters, with some 8,000 current contacts, providing support ranging from information and referrals to more in-depth assistance with licensing arrangements and technology transfer.
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For further information on the Global Watch Service please visit
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