École de gestion TELFER School of Management

LIÉE au LINKED with LEADERSHIP

Making it Happen – The Transition to a Sustainable Society

Final Report: Synthesis and Recommendations

What the federal government should do to remove barriers to innovation and change, and lead Canada to a sustainable society

A report produced by the Telfer School of Management

September 3, 2009

J. André Potworowski
Project Director

Advisory Board

For in formation, contact
André Potworowski, (613) 746-9600, email: potworowski@telfer.uottawa.ca

Executive Summary

This report on barriers to sustainability is based on a research project undertaken by the Telfer School of Management at the University of Ottawa.

This study addressed the following question. If we accept climate change and global warming as the most urgent challenge facing our planet, what do we need to do to become a sustainable society? What barriers need to be overcome to implement the required changes?

From the outset, we recognized that the challenges of making the transition to a sustainable society in Canada are formidable. But we know from practitioners that we have all the technology we need to reduce our green house gas emission by 60% in two decades.

Instead, the most immediate challenge is to address the large number of barriers to innovation and change. These barriers reflect the habits of individual consumers, they are related to established practices and institutions, they arise from the shortage of people with appropriate skills, or they reflect unsuitable structures of government regulation. We identified more than 100 such barriers in the areas we reviewed.

Addressing this situation demands innovative approaches: new legal and regulatory frameworks, better ways of measuring and tracking our sustainable achievements, new cost-sharing arrangements, or even new leasing arrangements between landlord and tenants. But above all it will require an unprecedented level of collaboration across all levels of government - municipal, regional, provincial and federal – as well as across functions within each level of government.

The range and power of various stakeholders and the entrenched barriers to change are so intractable that only leadership by federal government can take Canada toward sustainable development. This report proposes a compelling new opportunity for federal leadership through example, facilitation and direction.

Our first level of recommendations are directed at federal departments and agencies, which should pursue in-house energy conservation and sustainability measures aggressively, not only to show **leadership by example** *in making these a top priority but also to learn and demonstrate how to break internal administrative and bureaucratic barriers to innovation and change.*

A second set of recommendations focuses on **leadership by facilitation***. The government can provide key tools, standards, metrics and indicators that will allow all Canadians to understand how their actions can reduce greenhouse gas emissions and demand for energy, tracking these in real time.*

Lastly, a third set of recommendations focuses on **leadership by direction***. This involves changes in legislation and regulations that can ultimately yield targets and metrics that are agreed upon with the provinces.*

Table of Contents

Overview 5
The concept of sustainability (sustainable development) 6
Energy and sustainability: driving principles 8
Building a sustainable society 10
Barriers to change and innovation 11
Barriers to making the residential sector totally green 13
Barriers to building sustainable communities 16
Overarching conclusions for policy recommendations 19
Recommendations 20
Option One: Leadership by example 20
Option Two: Leadership by example and by facilitation 21
Option Three: Leadership by example, by facilitation and by direction 23
Final Observations 24

Overview

This report on barriers to sustainability is based on a research project undertaken by the Telfer School of Management at the University of Ottawa. Its findings and conclusions are based on literature reviews that include a variety of visions of sustainability proposed over the past 30 years, a series of four workshops and panels with subject matter experts and practitioners, and follow-up research on past practices.

Funding for the project was provided by the Walter and Duncan Gordon Foundation, Natural Resources Canada, the Canadian Gas Association, and the National Research Council of Canada.

The constraints of time and resources necessitated keeping the scope of the study to the energy dimensions of sustainability, focusing first on making the residential sector "green" and then on barriers to building sustainable communities. Detailed findings and conclusions are presented in background documents 1 to 4.

We take as axiomatic that environmental pressures - more specifically climate change and global warming - present the world with an unprecedented and increasingly urgent planetary challenge[1]. The human contribution to these pressures must be reduced by redirecting human activity quickly and significantly toward sustainability.

The objective of this study is to address the obvious practical issues. How might we translate the urgency of the problem into remedial action that will be pursued more immediately and persistently in the future than it is in the present? What new actions do we need to undertake to make that happen? What are the barriers to the implementation of innovation that need to be overcome?

From the outset, we recognized that the challenges of making the transition to a sustainable society in Canada are formidable. But in listening to practitioners we quickly learned that, in the short term at least, these challenges do not include overcoming any absence of technologies or addressing a lack of knowledge necessary to make a big difference.

Instead, the most immediate challenge is that posed by the large number of barriers to the innovations that change the way people at all levels of social organization perform activities that either supply or consume the world's non-renewable commodities. These barriers arise in many forms. They reflect the habits of individual consumers, they are related to established practices

[1]For example, this argument was reiterated very recently in a joint letter written by two formidable international politicians Madeleine Albright and Lloyd Axworthy, calling for the international community to save the Arctic. "Save the Arctic", Madeleine Albright and Lloyd Axworthy, Ottawa Citizen, May 7, 2009, p. A15

and institutions, they arise from the shortage of people with the appropriate skills, or they reflect unsuitable structures of government regulation.

Addressing this situation demands innovative approaches. This may include developing a new rationale for sharing the costs of improvements among consumers and institutions. It may involve work on necessary but unprecedentedly high levels of cooperation and collaboration across all levels of government - municipal, regional, provincial and federal – as well as across functions within each level of government. Silos, turf wars, fragmentation, and a lack of strategic coherence among governments in both policy and practice were tolerated - and widely bemoaned - in the past. Today they add up to an indulgence that Canadian society can no longer afford.

In short, the range and power of various stakeholders and the entrenched barriers to change are so intractable that it is essential for the federal government to take a leadership role in directing Canada toward sustainable development. This report identifies and proposes as its fundamental overall recommendation the pursuit of a compelling new opportunity for federal leadership through example, facilitation and direction.

Our first level of recommendations are directed at federal departments and agencies, which should pursue in-house energy conservation and sustainability measures aggressively, not only to show *leadership by example* in making these a top priority but also to learn and demonstrate how to break internal administrative and bureaucratic barriers to innovation and change.

A second set of recommendations focuses on *leadership by facilitation.* The government can provide key tools, standards, metrics and indicators that will allow all Canadians to understand how their actions can reduce greenhouse gas emissions and demand for energy, tracking these in real time.

Lastly, a third set of recommendation focuses on *leadership by direction.* This involves changes in legislation and regulations that can ultimately yield targets and metrics that are agreed upon with the provinces.

The concept of sustainability (sustainable development)

The notion of a sustainable way of life has been advanced as a way of mitigating the growing danger of climate change through reductions in our use of fossil fuels and energy. This paper takes as axiomatic that climate change has been driven by dramatic increases in man-made greenhouse gas emissions, largely derived from the combustion of fossil fuels. The scientific evidence for this proposition will not be discussed here.

Over the past 30 years, there have been many compelling visions of what would constitute a sustainable society[2]. One of the earliest of these was the Canadian study *The Conserver Society* developed by the Science Council of Canada. Other visions were produced by think-tanks such as the Club of Rome, the United Nations and its agencies, and a wide range of academic and nongovernmental organizations, including some in Canada.

While these visions differ in detail and rationale, they all agree that it is no longer possible to continue unrestricted use of non-renewable energy, minerals or water in shelter, transportation and industrial production. All of these studies point to the inevitable conclusion that the planet has limits and that its resources are finite.

Early on in our study it became clear that experts in the field understand the precise meaning of concepts such as "sustainability", or “conserver society”, or “reducing the carbon footprint” or “reducing our consumption of non-renewable commodities” or “going green” - but the general public does not. Some also believe that sustainable development is not a precise goal but rather a process or a means toward an end

To mobilize grassroots consumers and community action requires a simpler terminology such as "fighting waste" or "reducing inefficiency". The lack of a clear label or slogan that provides guidance to Canadians can be considered a fundamental barrier to change. However, in this paper, for lack of a better alternative, we will use the terms sustainability, sustainable society or sustainable community.

Producing a vision of sustainability at a theoretical level is one challenge; developing such a vision for a specific region or community is a very different exercise. The latter demands both a great deal of detailed data on the particular region as well as the capacity to arrive at a political consensus. We had neither. We chose to review existing visions and identify common elements. The notion of looking at a region "like Ottawa Gatineau" was intended to provide a framework for our study. We also took full advantage of the exercise *Choosing our Future,* which is currently being conducted in the Ottawa Gatineau region, as another element in defining a sustainable vision for the area over the next century.

We examined four elements of urban living within our simple framework of a “region like Ottawa-Gatineau” – energy, water, transportation and solid waste[3]. Our discussion of specific examples led us to conclude that it was necessary to consider both the supply and the demand side of each element. For example, in the case of solid waste, the demand side refers to its generation in households and businesses leading to a demand for its removal. The supply side refers to the available means for its disposal – the supply of removal capabilities. This simple

[2] See Backrounder 1 *Sustainability: Visions and Metrics* for a summary of the different visions of sustainable futures and detailed bibliography.

[3] See notes from Workshop # 1 on *Setting Hypothetical Targets for a Sustainable Region*.

classification led us to the important conclusion that any solutions have to address the concerns of consumers and the public with respect to demand-side issues and the concerns of institutions and businesses with respect to supply-side issues. These two sets of concerns, and the politics of dealing with them, are very different.

Energy and sustainability: driving principles

Early in the project, we chose to focus on energy as being the most critical dimension of sustainability. Other dimensions such as water are also important, but they lie beyond the immediate scope of our research. However, the inclusion of water in this analysis would certainly strengthen the case for our conclusions and recommendations. For example, saving water reduces both the costs of electrical pumping and the energy needed to provide hot water.

One fundamental principle that should guide energy decisions is that *reducing energy demand* is far more cost-effective than *increasing energy supply.* Every type of power system suffers losses as power is produced at the source and delivered to the end user. For example, in the case of electricity generated from the burning of fossil fuels, the unavoidable thermodynamic losses from the combustion process amount to at least 50% of the original energy content of the fuel, while switching, transmission and transformers (at both ends) account for close to another 30%. That means that the energy delivered to the end user is only about 20% of the energy that is contained in the fuel.

Paradoxically, this sequence of unavoidable losses presents conservation efforts with tremendous potential leverage: reducing demand for end-use energy by 1 kWh, reduces the need for chemical energy in the fuel by 5 kWh. This benefits the end-user but it benefits the energy utility even more since it represents additional capacity that does not have to be installed. Saving 1 kWh of existing end-use consumption and making it available to meet new demand elsewhere is much cheaper than installing new generation capacity and providing an additional 5kWh of chemical energy to meet that new demand.

Choosing energy conservation becomes even more attractive given the inevitable environmental effects arising from the use of energy of any type - even that generated using a "green" process. It is a proven principle of physics that all energy consumed in any end use is eventually dissipated into the environment as heat. Any effort to reduce impacts on the environment should stress conservation in consumption, yet this has not attracted the same public visibility as measures to promote growth in energy supply. As a result, modest investments to reduce energy use on the demand side do not stand comparison with the huge investments directed to megaprojects such as oil sands, pipelines, or carbon capture systems, all of which are intended to provide more energy on the supply side.

Another principle that should be reflected in the design of energy systems is to maximize "second law efficiency." This refers to the second law of thermodynamics which states that it is

important to consider not only the quantity of energy required in end use but also the quality of that energy. The price for getting this wrong is to use up too much of the energy resource unnecessarily. For example, industrial processes that require high-temperature heat produce waste heat at low temperature that can still be used to perform useful tasks such as warming houses and buildings. This is also known as energy cascading and when used systematically throughout a plant or a community it can lead to dramatic overall energy savings. Conversely, using electricity generated by coal, oil or gas to provide space heating is a particularly wasteful way of using energy because of the complete mismatch between the very high quality of energy supplied and the very low quality of the energy needed. The result is akin to using a racehorse to pull a child's wagon. The second law of thermodynamics teaches us to match the quality of energy to the most appropriate task. While many people understand this concept intuitively, there is a very long way to go before it is systematically applied across the economy.

A third principle that should govern the design of energy systems is the "whole system approach". A simple example is offered by a typical building. A whole system approach to its energy consumption would take into account not only the furnace and heating system, but also all other aspects of the building that affect its thermal performance, including lighting, HVAC (heating, ventilation, and air conditioning), water and hot water, all appliances, the building shell consisting of walls, windows and roof, as well as patterns of occupancy. When all these systems are carefully balanced, the building can be made comfortable with very little energy consumption. A good example of the “whole system” approach is the new generation of "net zero energy" houses currently being demonstrated by CMHC[4]. These houses are not only designed for maximum efficiency and conservation in their own operation but they also have the capacity to generate heat and electrical power through renewable energy systems and to make them available for use elsewhere.

On a larger level, the “whole systems approach” can be extended to sustainable communities, where the integration of energy, water and wastewater systems offer even greater savings and efficiencies.

A fourth element that should be included in design decisions and the selection of equipment and infrastructure is *life cycle costing.* For example, a piece of equipment with a slightly higher capital cost can yield major savings in energy over its life cycle. While this seems simple in principle, there exist some very real accounting and administrative barriers to promote such considerations in a systematic way. For example, in many organizations the responsibility for capital budgets is separate from that for operating budgets. Similarly landlords and tenants have different interests: the landlord is interested in minimizing capital expenditure, while a tenant is faced with paying utility bills. Life-cycle costing can be best applied where there is no such separation, and where capital and operating budgets are located in the same cost centre.

[4] See Report from Workshop #2: *What's stopping us from making the residential sector totally green?* for a more detailed discussion on the CMHC demonstration program.

Even in the federal government, departments and agencies have little or no control over when or how old energy systems are upgraded or changed. Responsibility for this generally falls to a department such as Public Works and Government Services Canada. Treasury Board regulation and the Financial Administration Act make it difficult for federal departments to use their capital budgets in a way that yields benefit from savings in their operational budgets. These are very real administrative barriers which impede any innovation and change that would lead to a "greener" and more sustainable federal government.

Building a sustainable society

Over the past three decades, many studies have shown how to enhance sustainability and build a sustainable society. Starting with Amory Lovins in the 1970s, through Ralph Torrie and most recently Peter Victor[5], this qualitative research has provided a wealth of detail. In 1976, Amory Lovins' *Soft Energy Paths* demonstrated that the economy could function using a fraction of the energy and fossil fuels consumed at the time. In 2002, Ralph Torrie showed convincingly that if some 160 existing technologies were deployed systematically across the economy, greenhouse gas emissions could be reduced by 60% by the year 2030[6]. The technologies used in his calculations were already proven and available on the market.

The main conclusion to be drawn is that moving toward sustainability is as much a social issue as a technical one inasmuch as far more can be done with the technologies that already exist. In fact, achieving sustainability does not depend to any great extent on developing any new technologies. It does depend on overcoming social and institutional challenges. It is, in effect, a challenge of change management. And this means that government cannot avoid the issue: what it does or does not do will either strengthen or weaken the movement toward sustainability.

The development of new technologies based on the results of new research is only promising over the long-term and even then no single new technology will serve as a silver bullet. Over the short term, if Canadian society is to reach the kind of energy savings needed to reduce our greenhouse gas emissions, we need to focus on new behaviors, new designs and the widespread application of existing conservation technologies[7].

An illustration of this point is provided by the University of Ottawa.[8] It has managed to keep its energy consumption constant even as its floor area has tripled over a period of three decades. This was achieved because the person in charge was a committed (and relentless) manager who

[5] Backgrounder #1, Appendix B, Environmental Bibliography.

[6] See Backgrounder #2, *Sustainable technologies: what does it take to make us green?* Annex A, *Inventory of technologies to reduce GHGs* for a detailed analysis and inventory of the 160 technologies.

[7] See Backgrounder # 2, p 3, for an analysis of factors affecting innovation and technology deployment.

[8] See Backgrounder #1, p 8 for a case study on the University of Ottawa.

understood the principles of energy conservation. He was supported by a champion occupying a senior position in the organization. The manager applied life-cycle costing in selecting the most appropriate versions of technologies available on the market. With the help of external experts in energy conservation, he systematically re-examined every single aspect of the energy and water systems employed across the University so as to reduce waste and optimize use. This remains a continuously improving operation that involves thousands of small but strategically consistent decisions every year.

Barriers to change and innovation

Conventional wisdom may see the absence of appropriate technology as the main barrier to innovation but our discussions with practitioners revealed many obstacles in putting existing technology to use. We discovered a great variety of different barriers to innovation based on existing technology, ranging from the obvious one of higher cost, through a variety of institutional barriers, to the far more subtle barriers of culture and tradition.

One important set of barriers to innovation reflects the division of responsibility in the Canadian Confederation[9]. This is a problem in the present context because many of the issues that must be resolved before moving toward sustainability require the consistent application of municipal, provincial and federal authority, either individually or in various combinations.

At the level of the consumer, the benefits of going green can be abstract and distant, while the barriers of cost and inconvenience are very real and immediate. Moreover, market signals such as rising gasoline prices and electricity rates tend to be perceived by consumers only as problems of supply rather than issues arising from the balance between supply and demand. Recent major oscillations in oil prices sent conflicting market signals that did not help consumers make longer-term decisions with respect to investing in energy efficiency. This is not only a problem that calls for new solutions; it is a challenge of communicating with consumers individually and with the public at large.

For example, net zero energy houses such as those being built by CMHC across the country, typically cost $130,000 $150,000 more than a regular house[10]. A number of novel mechanisms and business models are being proposed to bridge this gap, including rental vs. ownership, green mortgages, grants and other types of incentives.

Some of these mechanisms involve the federal government. For example, it could apply something like the Accelerated Capital Cost Allowance (ACCA) to promote investments in renewable energy or conservation while reducing their costs. This is already being done on the supply side with respect to oil sands development in Western Canada, where industry currently

[9] See Backgrounder #3: *Barriers to sustainability*, and Workshop 3: *What's stopping us from building a sustainable community in a region like Ottawa Gatineau?*

[10] Workshop #2.

enjoys an accelerated capital cost allowance worth almost $2 billion a year[11]. A parallel arrangement on the demand side could serve as a very effective policy instrument to promote conservation.

At the provincial level, other government-sponsored measures could include incentives and tax rebates such as reduced development property taxes. New business models could be introduced involving the rental of renewable energy equipment such as solar water heaters, or the provision of energy through an Energy Service Company, or ESCO[12]. Measures such as these could be adopted to reduce the financial burden on the home consumer.

There are also barriers associated with the skilled trades. The introduction of new conservation technologies into the marketplace must be accompanied by the presence of sufficient numbers of trained people who understand them sufficiently to install, maintain and repair them reliably. This is true not only for new construction but also for the retrofit of existing buildings, which represent by far the largest part of the potential for significant gains. There are approximately 10 to 15 million houses or residential units in Canada and retrofitting them all would require one million qualified FTEs from the skilled trades[13]. There are currently no systematic measures to develop such a significant workforce.

To make the challenge even more specific, if new measures are to be successful in lowering barriers to acceptance at the consumer end, energy conservation systems must be designed with user interfaces that are intuitive, simple and convenient for the public to use them properly.

There is plenty of experience to show that life-cycle costing is the right approach to making good economic decisions about conservation systems. In theory, this approach is easier for institutions and companies that have the budgets to absorb high front-end costs than it is for individual consumers. In practice, however, even the federal government is hampered in life-cycle costing by a number of bureaucratic barriers, including the separation of capital budgets from operational budgets as provided for by the Financial Administration Act and by Treasury Board. In the rental market, the corresponding barrier is raised by the distinction between the landlord who wants to minimize capital costs and the tenant who wants to minimize operational and utility costs. This suggests a need for innovation in the business models used to finance buildings. It also points to a need for budgeting regulations that take into account the life-cycle costs of the conservation systems installed in them.

---

[11] See Pembina Institute, http://www.oilsandswatch.org/media-release/1242.

[12] An ESCO or Energy Service Company provides an energy supply service contract (heating, lighting, etc) to an enterprise, and takes on responsibility for any investment in energy conservation equipment and measures, and thus reaps any benefits arising from the savings.

[13] Workshop # 2, concluding remarks.

Consider the situation within the federal government. Because it manages all public buildings, Public Works and Government Services Canada operates as a landlord while all other federal departments and agencies are its tenants. There is no incentive for federal departments to use their scarce capital funds on technologies that could yield downstream benefits from savings in energy consumption. It is not even easy for a deputy minister or the CEO of an agency to say with any certainty how much energy has been saved in the past quarter. This is a structural problem arising from the machinery of government but its persistence suggests the low priority accorded to energy efficiency and sustainability within the federal government. The obvious response is to propose an alternative model in which overall goal setting, monitoring and incentives are set centrally but where individual targets, implementation and the reaping of rewards are decentralized.

Another barrier to innovation is the silo mentality that still prevails in many aspects of new building construction. It is becoming clear that "whole-system design" is the preferred approach to new projects because it makes it easier to optimize the interaction of components in meeting the functional requirements of an entire building whether office, factory, commercial property or residence. While the concept of whole system design makes a great deal of sense, and has been proven in practice, there continue to be barriers against it. Today's buildings typically involve architects; foundation engineers; structural engineers; mechanical, electrical and HVAC specialists; acoustical and illumination engineers, etc. Bringing them together in one place at one time to develop a common language and an integrated design can result in front-end loading of professional fees in the project cash flow. We have heard of situations where this was resisted as an unwarranted departure from established practice. Overcoming barriers of this sort requires a concerted effort driven by the insistence of the owner.

Whole system integration at the community level leading to sustainable communities faces an even wider number of barriers related to legislation and regulations tied to development and zoning, municipal infrastructure, development charges, and other municipal, provincial and federal laws and regulations that may be in conflict.

Barriers to making the residential sector totally green

In examining barriers to innovation and change that would make the residential sector totally green, a workshop of practitioners and subject matter experts identified awareness and information as critically important[14]. There is a basic need to educate all stakeholders and actors along the value chain about the significance of energy efficiency through labels, indicators and common measurement standards.

[14] See Backgrounder #3, p 6, and Workshop # 2.

Architects, builders, and skilled trades need to be familiar with the latest energy conservation technologies, their components, approaches to design and techniques of assembly as well as their contribution to the overall energy consumption of the house.

Real estate agents, banks, mortgagors and consumers all need to have reliable data on performance that would quantify the value proposition associated with added investments in energy conservation. The market needs to see energy performance indicators and MLS listings should incorporate these clearly as an attractive selling feature. This matters because calculations of mortgage eligibility include utility costs and taxes. Consumers should know the full operating costs of a particular building and the market should recognize the reduction in operating costs arising from lowered energy consumption. Improving awareness and information in this area requires the development of easily understandable and reliable metrics.

The Ontario government has already enacted a requirement that before a house is sold, its energy performance has to be documented and the information made available to the buyer. Having access to this information in a consistent and reliable way across the whole value chain will contribute significantly to moving the housing market toward appreciating energy efficiency which will, in turn, encourage energy conservation and a reduction in the amount of energy from external sources used to provide a comfortable living environment. In other words, energy efficiency will become a value-added feature in houses which the market will recognize and price appropriately.

The Federal Energy Conservation Act and the *EnerGuide* program have achieved an enviable track record over the years. But these tools need to be extended into all aspects of the energy and environmental performance of houses and buildings. Ultimately, they should reach into the energy performance of entire sustainable communities.

The motivation behind this is to provide consumers with an accurate measurement in real time of the impact of their choices on energy use. Institutional and industrial energy consumers obtain such information from well-instrumented control rooms but the only data of this type currently available to most individual homeowners comes from their thermostats. The installation of smart electric power meters is beginning to address this limitation, but even smart meters cannot identify which practices in a household or which appliances are contributing to energy consumption and by how much. This is important, because having such indicators will dramatically improve a consumer's ability to change behavior in order to achieve an optimal reduction in energy demand.

A corollary to the need for specific indicators along the value chain of energy conservation is the broader need for making all success in energy conservation as visible and concrete as possible. As noted by one of our study participants "energy efficiency is invisible. An energy performing house looks no different than an ordinary house. You have to make that visible." This should be a challenge not only to designers and architects but to those who set, monitor and disseminate

building standards, as well as to those who use them to evaluate, finance or market buildings so as to make new energy-efficient features immediately visible and accessible to the general consumer.

Another barrier to innovation in energy conservation is the lack of uniform measures to demonstrate that "green" houses are reliable, proven, tested and inspected. This requires not only generally accepted standards and codes, but also a newly trained workforce of trades people, inspectors and building officials who can properly assess new energy conservation practices. One workshop participant calculated that it would require 1 million trained contractors and trades people to retrofit the existing housing stock, estimated as between 10 and 15 million units. To start moving in that direction, much larger numbers of people would have to be motivated to consider such skilled trades as a career, new training programs would have to be developed and the institutions that provide that training would have to grow substantially. Moreover, all of this has to be done soon: a process of growth this rapid would quickly face its own barriers to progress.

At first glance,the total cost of retrofitting the existing building stock to high energy performance standards would seem very high. In fact it would be relatively modest by the scale of current fiscal stimulus spending. For example, if the federal government provided a grant of $5000 to each residential unit in the country for energy efficiency, the retrofit would cost a minimum of $50 billion. Moreover, given the timescales involved in building up the capacity of the sector through training the additional people to do this work, such spending would have to be spread over several years and the annual expenditure would probably amount to well below 1% of GDP. Furthermore, considered in the context of a broadly based stimulus package, it might make more sense than to inject money into an auto industry that has actively fought higher efficiency standards for automobiles and rejected them totally for trucks.

However, subsidization by government is not the only alternative. A less direct and more facilitative approach could move much of that cost into private hands. It could be based on providing essential tools and metrics all along the energy value chain. This would allow consumers, the real estate market and financial institutions to recognize the value of specific energy conservation measures and encourage investment in them. Such an approach could have a more lasting impact on changing behaviour and the operations of marketplace, especially if it factored in the real and total environmental and social costs associated with emissions and inefficiencies.

In terms of education, formal training programs are important but so is sharing of best practices and learning through a variety of other channels. This can ensure that more broadly available knowledge and skills can have the maximum impact. This is as true for individual housing projects as it is for larger sustainable community initiatives.

A final set of barriers to innovation in home energy conservation has to do with the risks associated with building "green houses". These arise from faulty construction but also from regulatory models, standards, codes and especially bylaws, as well as from the fact that some new technologies have not been broadly tested in the marketplace over time. Allocating all liability to a building contractor constitutes a clear disincentive for assuming any risk on new energy conserving technology. Distributing the risk and liability arising from product or design failure throughout the value chain (e.g. having it shared by supplier, vendor and inspector) reduces the risk to any one party, thus decreasing a significant barrier to innovation. Indeed, some new public-private model might have to be devised to share the risk among a number broader group of actors. If the issue of risk is addressed appropriately, more green houses might be built.

It should be added that many of the barriers to making the residential sector “green” are also to be found in commercial buildings, as noted by the National Roundtable on the Environment and the Economy[15].

Barriers to building sustainable communities

Sustainable communities represent a higher level of aggregation. More than just sustainable private residences, such communities include sustainable transportation, workplaces, recreational options and lifestyles, integrated in mutually reinforcing ways. In effect, sustainable communities represent the next level of the “whole systems approach.” One good example is the model pursued by Quality Energy Systems of Tomorrow (QUEST – see box)[16].

[15] Backgrounder #3 p 5.

[16] “Integrated Energy Systems in Canadian Communities: A Consensus for Urgent Action”, QUEST, March 2008.

Key Features of Integrated Urban Energy Systems (QUEST)

In an integrated system approach to land-use, energy, transport, water and waste management, greater emphasis is placed upon achieving efficiency for the systems as a whole, and upon creating systems that are more resource efficient, adaptable, resilient and sustainable. This includes:

- Clustered, higher density, self-reliant, mixed use developments of energy efficient housing, commercial space and industry which facilitate implementation of more efficient, accessible and affordable energy, water, waste, and transportation infrastructures.
- District energy / utility grids and cascading of energy use between industrial, commercial and residential applications.
- Smaller scale urban energy systems, distributed more widely, located closer to and within buildings, integrated with elements of buildings, and integrated with other infrastructure systems.
- Increasing contribution from multiple local energy sources: solar; geothermal; energy from landfill and municipal, agricultural and forestry waste; wind; hydro; supplemented by larger scale electricity and gas grids as necessary.

Examples in Canada and around the world show that compared to a traditional approach, over 50% reduction in grid energy use can be achieved using an integrated approach.

Based on our workshop with federal, provincial and municipal politicians and practitioners[17], we have learned that the single most important barrier to building sustainable communities is the lack of integrated decision-making. There are real obstacles caused by the fragmentation of responsibilities among different institutions. For instance, very close municipal-provincial collaboration and coordination would be required to ensure that all land-use decisions are explicitly linked to their implications for energy and water use. Similarly, new federal and provincial infrastructure funding is currently not tied to any sustainability objectives.

To promote the sustainability of communities, there need to be targets for sustainable communities expressed in metrics that are uniform across Canada. At present, there are no commonly accepted metrics or indicators for the key parameters that define a sustainable community in Canada.

Public transit is an extremely important consideration in moving toward sustainable communities. All communities face a decision on whether to build more public transit or more roads for cars. Shifting the balance toward transit involves getting the private sector to provide

[17] Workshop #3 *What's stopping us from building a sustainable community in a region like Ottawa Gatineau?*

more high-density housing, which allows the city to provide transit and other services to relatively more people in an area, thereby enhancing the overall efficiency of city-services. Beyond securing the support of developers, such a shift also requires changes in the preferences of consumers who would have to accept living in higher density neighborhoods. Municipalities already find that creating new public transit routes is less expensive than building more roads and freeways for cars. Implementing that reality on the demand side could require the imposition of fair pricing to reflect all of the costs involved in using infrastructure and public municipal services. To take one example, it might include putting a surcharge on low density development to account for additional costs of providing municipal services.

Overcoming these barriers requires an alignment of current laws, bylaws, regulations and other tools to support sustainable communities. To begin this process, each law or regulation should be tested according to the minimum requirement that it NOT act as an obstacle to sustainability.

Other barriers can be overcome by fine-tuning existing regulatory and fiscal provisions and constraints, many of which fall under federal jurisdiction. The federal government has a unique role to play in ensuring that environmental regulations are exempted from the threat of Chapter 11 under NAFTA. In addition, the federal tax system can be applied to encourage sustainable communities and protection of the environment. For example, specific tax adjustments can include adjusting the capital cost allowance to encourage LEED buildings, or providing tax rebates for residential homes that are R2000 or better.

There is no question that there is real urgency involved in enhancing cooperation between federal, provincial and municipal politicians. Fragmentation, turf wars, and the lack of strategic consistency are luxuries that Canada can no longer afford.

At the end of the day, the greatest barrier to innovation comes from resistance to change on the part of the consumer. New attitudes are needed toward sustainable living, positive attitudes that see it as healthy and comfortable and not as something that must be endured. People must begin to see the possibility of profiting from sustainability. Instead of looking to growth they can start looking to sustainability to provide a whole new set of business opportunities.

In other words, there is a need for a paradigm shift in popular perception: people need to discover that they can have a "good life" that is not driven by consumption. From Canada's "Conserver Society" through Herman Daly's economics, all the way to Peter Victor's latest book, the idea has constantly been repeated that continued growth and unlimited consumption of materials and resources are unsustainable. Blissful ignorance of that fact is the last barrier that needs to be overcome.

Overarching conclusions for policy recommendations

Based on our analysis and findings over the course of this project, we have drawn the following overarching conclusions which have led us to our policy recommendations.

- There are currently sufficient technologies on the market to reduce greenhouse gases in Canada by at least 60% by the year 2030.

- Even existing and proven technologies that could lead us to a sustainable society face a broad range of barriers to innovation and deployment. These barriers need to be identified and removed where possible. Where different perspectives collide to erect a barrier (as between landlord and tenant), there is a need to identify and implement forces that can offset the adverse effect of the barrier.

- The adoption of a "whole system" or integrated approach to designing and implementing energy or water conserving technologies, or to building sustainable communities, is seen as the preferred way of doing things since it can help optimize the interactions among components. However, there are barriers of tradition and established practice that impede this approach.

- The transition to a sustainable society involves the coordination of activities where power, information and resources are distributed over a broad range of stakeholders. Because the federal government is only one of a number of players essential to this transition, federal efforts should be targeted in such a way as to leverage and engage as many stakeholders and jurisdictions as possible in the process of innovation and transformation toward a sustainable society.

- Accordingly, much federal effort should focus on facilitative tools that address many different barriers and meet an underlying need or requirement but that are still wholly within federal jurisdiction.

From an energy perspective, the following overarching conclusions were also drawn from our research:

- Greater emphasis should be directed to the reduction of end-use demand across all sectors. This is based on the established principle that a unit of energy saved and diverted to meeting a new demand is much cheaper than an additional unit of energy generated to meet that new demand.

- To provide energy to meet new needs, first it is essential to increase efficiency through reduced losses, next to apply conservation to existing demand and finally to select sources of new supply that have a minimal environmental impact.

- There is also a need for greater recognition of the importance of matching the quality of energy supplied to the quality of energy required by its end use. The price of mismatching is to use more energy than needed - often much more. For example, using electricity generated from coal or natural gas for space heating is a particularly bad match. It is like using a racehorse to tow a child's wagon. The price paid is in the energy wasted through the very large losses inherent in the generation and transmission of electric power. This is a very obvious instance, but there are many that are less obvious, e.g.: for example a process in which waste heat at high temperature is dispersed into the environment instead of being used as a source of heat for another process requiring lower temperatures.

- Similarly, life-cycle costing should be applied far more widely in the design and selection of energy equipment. It should become as commonplace in project economics and financial transactions as is net present value.

Recommendations

The following policy recommendations are presented in order of increasing involvement in the economy by the federal government and Natural Resources Canada.

Option One: Leadership by example

1. Allow market forces, international trading pressures, and provincial and municipal initiatives to push for change toward sustainability in the private sector and the broad community.

2. Focus federal efforts on in-house federal operations. Make contributing to energy efficiency and sustainability *the business of each federal department*, and require energy conservation in *how each department carries out its business*. This builds on the success of "Federal House in Order Leadership Measures[18]", but dramatically increases its scope and raises its priority level. Include making the green transition a top priority in the mandate letter from PMO to each Minister and DM; publicize their successes and best practices; drive the message throughout the entire public service.

3. Adopt aggressive measures that would reduce energy consumption and carbon footprints in all buildings and facilities owned, operated and rented by the federal government. Develop incentives that would decentralize decision-making and encourage departments and agencies to develop and implement their own targets and tracking measures for reducing their carbon footprint and greenhouse gas emissions. Such incentives could be created by making necessary changes to the Financial

[18] See http://oee.nrcan.gc.ca/Publications/statistics/parliament06-07/chapter8.cfm?attr=0

Administration Act and Treasury Board regulations, as well as any necessary changes in the landlord-tenant relationship that exists between Public Works and Government Services Canada and all federal departments and agencies that occupy PWGSC's buildings. These changes should allow departments and agencies to use their capital funds to invest in technologies and equipment that would conserve energy (and reduce their carbon footprint) and to benefit from savings in operational funds. More importantly, they would also allow federal departments to learn how to remove any in-house barriers to sustainability in their operations and those lessons could be communicated to the public.

Pro: This option is the least costly path for the federal government and is likely to generate the least conflict among provinces and other stakeholder groups. It will provide *leadership by example*, by showing that the government is serious about energy efficiency and greenhouse gases.

By addressing and eliminating the in-house regulatory and administrative barriers to rapid energy conservation and sustainability, this option will also provide a *didactic dimension*, by providing a living example of how to eliminate bureaucratic and administrative barriers to innovation and change.

It will also lead to *substantial financial savings* in operational funds for the federal government by reducing overall energy consumption. Because the federal government is the largest landlord in Canada, purchasing equipment and technologies that conserve energy and reduce carbon footprints could help supplier companies to develop their capacity to serve the rest of the market. It would also send a clear signal that the government is serious about energy conservation and greenhouse gas emissions by "greening" how it carries out its own business.

Con: By focusing exclusively on federal properties and buildings, and allowing market forces to lead change in the rest of the country, this option could arguably generate the least amount of change and reduction in greenhouse gases for Canada. It will also likely generate the least amount of political credit for federal action. Environmental groups and international partners might well consider this to be insufficient.

Option Two: Leadership by example and by facilitation

This option includes all the measures in the previous option, plus the following:

1. Develop and distribute a toolkit providing basic information that supports and facilitates the transition to a sustainable society. Such a toolkit could include not only a new "green" building code for residential and commercial buildings as well as for urban infrastructure; it could include a whole new range of tools specifically intended to help individuals, households, organizations and corporations, as well as municipalities and

regions to measure their carbon footprint and greenhouse gas emissions accurately. There is no consensus in the marketplace on how to measure what is "green" and this lack of standardized information represents a major barrier to the proper valuation of energy conserving investments and technologies.

2. The federal government's very positive track record with the Energy Conservation Act and the success of programs such as *EnerGuide* and *Eco-Energy* are well established and should be continued and augmented. But the federal government also oversees legislation and regulations the sole purpose of which is to set standards and provide methodologies of measurement in areas such as weight, length, electricity and gas. It also operates a number of measurement and data collection agencies such as Measurement Canada, Statistics Canada, and NRC's Institute for National Measurement Standards. Collectively, these could develop methods and certify equipment that would allow all consumers to measure their GHG emissions and undertake measures to reduce them.

3. Systematically collect and broadly disseminate the best practices in innovation and change that can lead to a sustainable society. The government, including NRCan and CMHC, already disseminate some best practices to reduce energy consumption, increase efficiency and reduce GHG emissions. But there are major innovations currently under way at the municipal and regional levels where Canadian communities are developing novel ways of becoming sustainable. These successes should be captured and disseminated by the federal government to facilitate widespread adoption.

4. Support, encourage, publicize and celebrate leaders, innovators and change agents who are undertaking initiatives and leading projects that lead to sustainability. As the population becomes more aware of the urgency of reacting to climate change, an increasing number of individuals and organizations are taking on a proactive role to implement measures and innovations that can lead to sustainability. These should be identified early and supported.

5. Continue and, where possible, enhance current federal incentives such as "Eco-Energy." Many of these programs build on a long succession of previous incentives and innovation programs: over the years they have evolved to be more cost-effective and targeted. These should be continued and where possible augmented.

6. Provide Accelerated Capital Cost Allowance to commercial building-owners, landlords, organizations and corporations for investments in renewable and energy conserving technologies and thus offset the inherent risk involved in installing new technologies. On the supply side, the oil sands industry benefits from close to $2 billion annually[19] in

[19] See Pembina Institute, http://www.oilsandswatch.org/media-release/1242

accelerated capital cost allowances for capital investments related to expansion of their business. It would help significantly with the transition to a sustainable society if similar benefits were accorded to demand-side investments targeting greenhouse gas reductions.

Pro: These measures will go a long way beyond purely in-house incentives to demonstrate *federal leadership by example.* By providing key tools to all segments of the economy on how best to achieve sustainability, they will define *federal leadership by facilitation*, expanding on a track record of success by adding new measures requiring financial and fiscal commitment. These measures are unlikely to generate significant provincial and territorial resistance. They may even contribute to a national consensus around measurement and tracking methodologies and lead to a stronger commitment to sustainability.

Con: There may be pressures from environmental groups that such an unhurried pace may be inappropriate to the urgency of the challenge and slow in yielding results. There is also a risk that because of international agreements in Bonn or Copenhagen, international opinion may put stronger pressure on Canada to act more quickly.

Option Three: Leadership by example, by facilitation and by direction

This option includes all the measures in the previous options, plus the following

1. Review departmental mandates and establishing/supporting legislation to ensure that they do not contradict, impede, or delay the move to a sustainable society. Where possible, explore the possibility of amending relevant legislation to include wording that relates to support for the transition to a sustainable society.

2. Prepare an omnibus bill to eliminate any barriers or impediments in federal statutes that would impede innovation supporting a transition to a sustainable society, to greater energy efficiency and to reduced greenhouse gas emissions.

3. Initiate a dialogue with the provinces to explore mechanisms for achieving strategic coherence among federal, provincial and municipal governments to move toward sustainability. Examples of this might be a system in which there could be a national target for greenhouse gas emissions, national standards for energy efficiency in buildings as well as manufactured goods, national standards for energy efficiency in transportation, together with the necessary enforcement powers; as well as national projects such as a smart electric power grid, high-speed passenger rail, etc. The federal government should facilitate the creation of any new institutions to achieve this.

4. Introduce carbon pricing that reflects the true cost of a clean environment and provide the economic infrastructure to make energy conservation and renewable energy more attractive in the marketplace.

5. Provide grants and incentives to retrofit all existing households and commercial buildings in Canada.

Pro: in addition to all previous measures, this option would provide the top down *leadership by direction* required to accelerate the transition to a sustainable society, as well as visibly demonstrate government action. It will certainly satisfy environmental pressure groups and in the eventuality that the United States and China agree to ambitious greenhouse gas reductions, is likely to put Canada on the same level.

Con: there is no question that this option would generate opposition from provinces that resist any attempt to increase federal powers at their cost. Moreover, a legislative review of this magnitude would, under normal circumstances, take a very long time. It would also be a very costly option. To retrofit 10 to 15 million individual households with a minimum grant of $5000 per house would cost at least $50 billion.

There is little doubt that, prior to the current economic downturn only a major catastrophe analogous to 9/11 or World War II could have galvanized public support from all Canadians and induced the bureaucracy to undertake such measures. However, the recent economic downturn and its attendant stimulus spending open up an opportunity for tilting some of this spending toward sustainability. With properly internalized energy costs, and the costs of environmental impacts, there arises the possibility of redressing the traditional balance of implicit and explicit subsidies and incentives, and of redirecting the nation's economy onto the sustainable track.

Final Observations

These recommendations are a result of careful consideration of the many barriers to innovation and change necessary to achieve a sustainable society. In the course of this project, many people have contributed to developing them, including practitioners, subject matter experts, senior academics and experts in government decision-making. Addressing these barriers is not a luxury but an urgent necessity. We believe that these recommendations provide a unique opportunity for the federal government to exercise leadership in a transition to sustainability that will benefit future generations of Canadians.