



CANADIAN COUNCIL
of **CHIEF EXECUTIVES**

CONSEIL CANADIEN
des **CHEFS D'ENTREPRISE**



ENERGY-WISE CANADA
BUILDING A CULTURE OF ENERGY CONSERVATION

December 2011



Executive Summary

A key driver of Canada's future prosperity, and a source of comparative advantage for the country, is our diverse array of energy resources. By combining smart government policy with private sector commitment and innovation, Canada can demonstrate to the world that it can be a reliable and environmentally responsible energy supplier and partner.

In previous papers, the Canadian Council of Chief Executives has advocated a multi-pronged strategy, aimed at bringing on a larger and varied supply of energy to meet growing domestic and international demand. This includes investing in advanced energy technologies that can create new business and employment opportunities and position Canada to compete successfully in a world of rising energy prices.

Fundamentally, however, Canada needs to begin with a renewed commitment to energy conservation. We must use existing and future energy supplies as efficiently as possible, embracing the maxim that the cheapest form of energy is the unit that is not used. Better conservation practices will help to insulate Canadians from volatile energy prices, reduce costs for public institutions such as schools and hospitals, and improve the international competitiveness of Canadian companies.

Cutting our energy use would bring other benefits to society as well. Reduced use of carbon-based fuels would make urban air more breathable. Smart transportation choices would diminish traffic congestion and improve workplace productivity. And better urban design would make cities more livable and help Canadians achieve a better work-life balance.

Few of us deliberately waste energy. Yet the choices we make cause energy waste that cascades through the system. For instance, because of inefficiencies and losses at nearly every stage in production, transmission and end use, the amount of energy actually delivered to a light bulb in our home or to a fuel tank in our car is usually at least 50 percent, and sometimes as much as 90 percent, less than the energy content at source.

There are some signs of progress in our quest for energy efficiency. The overall energy intensity of our economy – the amount of energy consumed per unit of GDP – improved 22 percent between 1990 and 2008. The manufacturing sector overall used 8 percent less energy and produced 25 percent more output in 2008 compared to 1995. In the agriculture sector, energy intensity has declined steadily over the past 20 years. Some

municipal governments are ahead of the curve and are embracing sustainability in urban design and transportation planning. And programs such as LEED (Leadership in Energy and Environmental Design) are re-defining how new commercial and public buildings are designed for overall energy and environmental coherence.

In too many instances, however, such gains are outweighed by trends toward greater energy consumption. New building codes and better construction materials are helping to make Canadian homes more energy-efficient, yet the number of houses continues to grow with immigration and shifting demographics. Moreover, the average size of a house is larger and the percentage of homes with air conditioning has doubled since 1990, to 45 percent. Today's televisions and computers are more efficient than those manufactured as recently as five years ago, but many homes now have more than one of each, operating for many more hours. Vehicle fuel efficiency is set to increase significantly with the new North American standards recently announced, but overall passenger-kilometres travelled continues to increase. As well, there has been a significant shift to trucks as the mode of choice for freight transportation and to airlines for passenger travel.

This paper analyzes energy consumption trends and conservation initiatives in each of the major segments of Canadian society: industry, residential, commercial and institutional, transportation, municipalities and agriculture. Needless to say, there is scope for significant improvement in all of these areas.

A review of these trends leads us to two main conclusions. First, governments, industry and public-spirited groups should work together to improve Canadians' energy literacy. We do not underestimate the challenge of changing consumers' behaviour. After all, governments have been preaching the merits of energy conservation and efficiency since the first oil-price shocks of the mid-1970s, with limited success. Nevertheless, Canadians need to understand the energy choices that the country faces so that they can make informed decisions based on realistic assessments of their respective costs and benefits.

A second, closely related, conclusion is that the most effective means of promoting energy conservation is to allow energy prices to rise. It seems clear that higher prices will influence Canadians' behaviour in a way that public exhortation and appeals to the greater good have not. That is why the CCCE has previously stated its support for a broad-based carbon pricing scheme in Canada. Canadians – as business owners, farmers, building

managers and individual consumers – need to see the everyday cost of inefficient use of energy and be motivated to change their energy consumption patterns and investment decisions. To be sure, carbon pricing would have to be introduced gradually, both to allow businesses and consumers time to adjust and to avoid any disproportionate impact on Canada’s competitive position. (For Canadians on fixed incomes, the impact could be offset through other social or fiscal policies.)

The bottom line is that governments must resist the temptation to shield Canadians from higher energy prices. By any reasonable measure, energy remains a comparative bargain for Canadians. Electricity in particular is cheaper today on an inflation-adjusted basis than it was 20 years ago. In most provinces the regulated electricity rates paid by households and some industries do not even cover the cost of producing and delivering it, but ultimately these costs will have to be recouped through the broader tax base.

Canada’s vast array of natural resources, our growing population, our climate and geography push us towards above-average energy consumption. But the present trend is unsustainable. It is time for Canadians to get serious about energy conservation, for the health of our economy as well as the environment.

I. Introduction

In recent months, a growing chorus of voices has made the case that Canada's diverse array of energy resources, plus the skill and technologies to develop them, are some of this country's greatest sources of comparative advantage and key drivers of our future prosperity. The *Canadian Council of Chief Executives* believes Canada is very well placed to be a leader in the global transition to cleaner energy and advanced technologies that can deliver superior energy services with much less environmental impact.¹

In addition to traditional fuels and technologies, Canada is blessed with stockpiles and opportunities in low and non-carbon fuels – hydro, nuclear, wind, solar and geothermal, advanced biofuels, shale gas – as well as new transportation technologies such as electric, hydrogen and other alternative fuel vehicles. This opportunity brings significant national benefits – economic growth, jobs, training, research and new technologies, not to mention additional revenues to all three levels of government. Significantly, these benefits flow to Canadians from coast to coast, not just to those in regions with the largest energy resources.

Canada has an obligation to develop these resources wisely, to combine smart government policy with private sector commitment and innovation, and to demonstrate to the world that Canada can be a reliable partner, a source of sound energy to meet other countries' needs while also employing advanced environmental practices.

Realizing the full potential of our diverse energy assets while also reducing the overall social and environmental impact of energy development and use will certainly be a challenge. A large measure of this is a function of the structure of our economy and society, the variation in energy resources across the country, our geography, climate and lifestyle. Nonetheless, we believe it is a challenge Canadians must embrace, and presents enormous opportunities for the country. We have previously made the case that Canada must adopt a multi-pronged strategy, bringing on more and varied supply of energy to meet growing domestic and international demand for energy while also investing in advanced technologies that can create new business and employment opportunities and position Canada well to compete in a world of rising energy prices.

Fundamentally, however, we need to begin with a renewed commitment to energy conservation and making the most efficient use possible of existing and future energy supply. As has often been said, the cheapest form of

energy is the unit that is not used, and clearly Canadians everywhere can do a much better job.

This paper provides an overview of our energy conservation challenge, looks at Canada's performance at present and in comparison to key international competitors, and points to some of the most promising opportunities for us to reduce our energy use in ways that can enhance economic growth and job creation, stimulate new technologies and improve quality of life in Canada.

II. Why energy conservation and efficiency is important to Canada

The fact is that more than 85 percent of the world's energy needs today are met by burning fossil fuels. And that reliance on energy has brought enormous progress to developed economies around the world, and is the springboard upon which developing countries are looking to increase the living standards of their population. Canadians in particular owe a significant portion of our economic success and the lifestyle that we enjoy to our ability to tap into reliable and affordable energy.

It is also clear that increasing energy demand globally will continue to drive up the cost of energy for everyone, at the same time that it spurs a world-wide search for innovative technologies, for renewable and low-carbon fuels and for lower cost alternatives. All of this will require time, resources and expertise, but as a country we should be thinking about how to position ourselves on the leading edge of this transition. Reducing overall energy consumption will be part of what we as a country and as individuals can contribute to reducing the overall risks of climate change, a position that the CCCE has steadfastly held for the past two decades. But improvements in our energy use are worth pursuing in their own right and will bring a multitude of benefits.

"The problem with energy is not that it has been bad for us, but that it has been too good".²

Peter Tertzakian

One does not need to convince a business owner, of whatever size, that reducing his or her energy consumption is an important goal. For some businesses, energy costs are one of their largest expenditures. With the prospect of continually rising energy bills, finding ways to use energy more efficiently will be one of the keys to their competitive position. And usually investments in more advanced machinery and equipment bring other

productivity improvements in addition to lower energy costs. It would be nice to think that the same calculus could apply in Canadian households. While few would make a deliberate choice to waste energy, the reality is that too often the logic of reducing energy bills gets lost in the daily grind of other concerns or takes second place to the enjoyment that new energy-consuming devices can bring.

In addition to reducing the greenhouse gas emissions that contribute to climate change, efforts to conserve fossil fuel energy in particular can have multiple environmental benefits, most notably reductions in related air pollutants that contribute to urban smog. And the overall community benefits are well-known – improved health, reductions in traffic congestion and enhanced liveability of major urban centres.

The focus of energy and environmental policy has too often been on questions of energy supply, whereas it is really on the demand side of the equation where the greatest potential for positive change exists. There are understandable reasons why Canadians are high per capita users of energy, but there are many ways in which we are wasteful in our energy use. The reality is that 80 percent of the GHG emissions from fossil fuels, and a considerable portion of other environmental stressors associated with energy, come from end-use, and only 20 percent from energy production and transmission. The best answer to rising energy costs and environmental impacts associated with energy use is to work effectively to reduce the country's energy consumption. It also is obvious that the most energy efficient countries will have a great comparative advantage in a world of expensive energy.

The “cascading” benefits of energy conservation

Few Canadians appreciate just how much energy is wasted throughout the production, transmission systems and end-use, even with today's modern technologies. For example, whether produced by burning coal or natural gas, more energy is lost in today's thermal electricity systems than is made available to consumers in the form of useable electricity. This is exacerbated by line losses in transmission and inefficiencies in appliances, lighting or other end-use applications in homes, offices and factories. The case is not much better for vehicles and modern internal combustion engines, where far more energy is lost, mostly in the form of waste heat, than is used to provide motive power.

Author Peter Tertzakian has called this the Asymmetry Principle of Energy Consumption: “a unit of energy saved at the consumer level cascades into

multiple units of energy saved at the source” and is illustrated in Figures 1 and 2² This is a powerful argument for reducing the amount of energy consumed in the first place.

Figure 1: Asymmetry Diagram for Natural Gas to Light

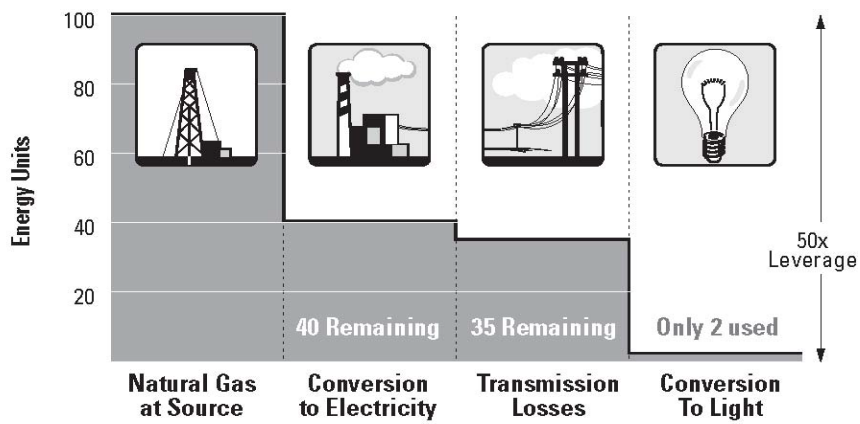
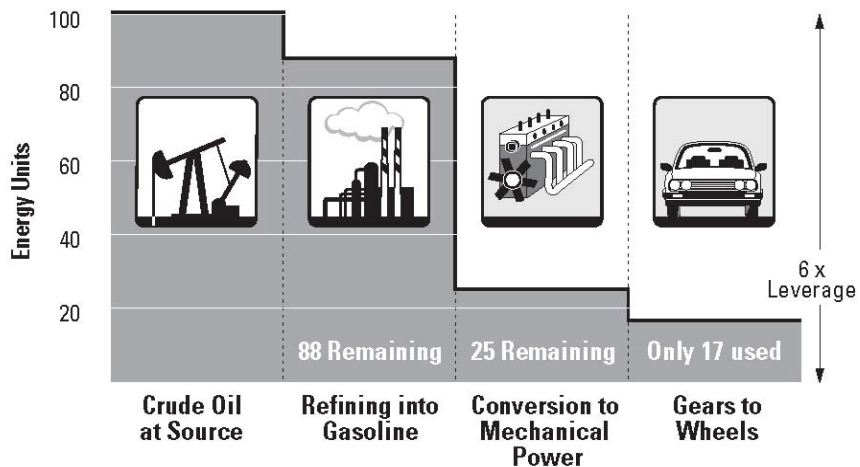
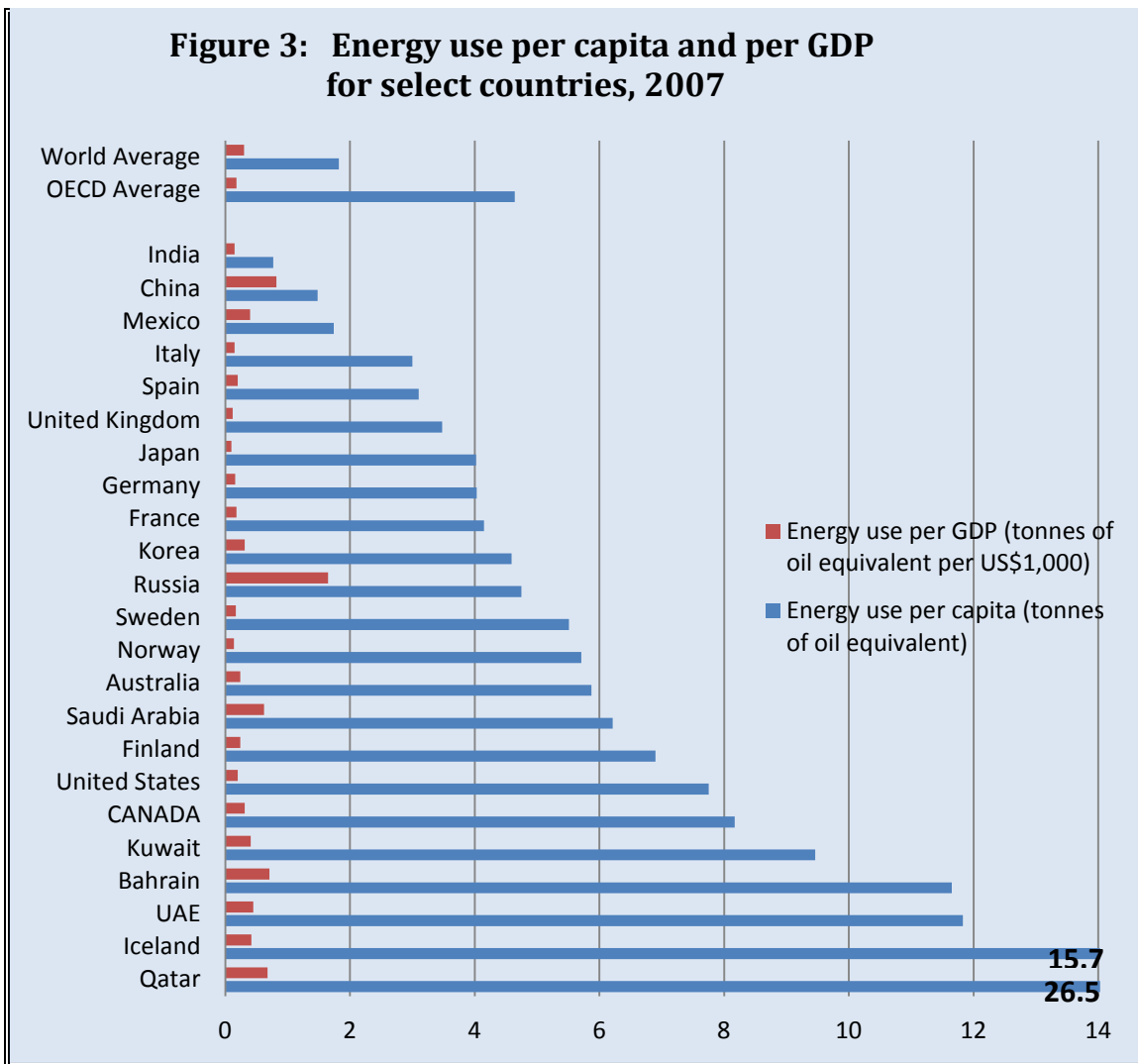


Figure 2: Asymmetry Diagram for Oil to Wheels



III. Canada's record on energy efficiency

The obvious question is where does Canada stand today on its record of energy efficiency and how do we compare to other countries? Figure 3 compares energy use per capita and per dollar of GDP for a select group of countries.



Source: International Energy Agency, *IEA Scorecard 2009*

Canada's score is somewhat higher than the average of developed countries. This is not particularly surprising given that we are a large energy exporter, our economy is more energy-intensive than the OECD average and we also face more extremes of climate and distance. Indeed, this analysis tends to confirm that energy consumption per capita is highest in countries which develop and export large amounts of energy resources, especially in relation to the size of their population.

International comparisons are not always straightforward, and it is important to understand what underlies some of the key differences. Whatever their rationale at the time, some countries have made what now appear to be wise policy choices in a world of ever rising energy prices and increasing attention to the environmental and social impacts of energy. Often the decisions were dictated by their lack of any significant domestic stock of energy and their desire to be less vulnerable to price shocks. After the first oil price spikes of the 1970s, Japan and the Scandinavian countries in particular made deliberate choices to increase energy efficiency and lessen their reliance on unpredictable world oil markets.

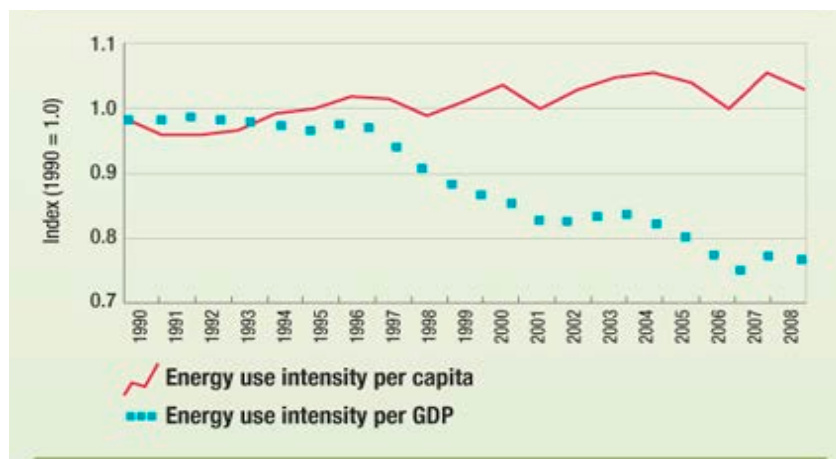
As well, consumers in Europe and Japan have faced much higher prices for energy, partly as a result of market conditions but also strongly affected by deliberate government policies. Those populations appear more willing to accept high energy prices. In comparison, citizens in North America have grown up with lower energy costs and we have many of the trappings to go with it – larger homes, a reliance on the automobile and more energy-consuming devices. Indeed, too often governments at all levels in Canada have sought to shield their voters from the true cost of energy.

Figure 4 illustrates that Canada's GDP grew 61.6 percent between 1990 and 2008, and yet end-use energy consumption grew by only 25.7 percent. Our energy *intensity*, that is the amount of energy consumed per unit of GDP, improved 22 percent between 1990 and 2008. Overall, our economy is becoming more energy efficient. And while there has been growth in certain energy-intensive industries, notably upstream oil and gas, it is also true as illustrated below that many of our manufacturing industries and resource industries have achieved considerable gains in efficiency. The federal government estimates that these overall gains in efficiency translated into savings of \$26.9 billion in 2008 and about 67 megatonnes of avoided greenhouse gas emissions.³

Even with growing awareness of climate change and other environmental issues, the Canadian experience in recent years has not been particularly

encouraging. Energy use per person has increased by 5 percent since 1990. In other words, each household is using a greater number of energy consuming goods and services compared to where we were in 1990. As noted in section V below, this also reflects changing demographics (fewer occupants per household), increased dwelling sizes and more use of auxiliary equipment, in particular air conditioning.

Figure 4: Total secondary energy use intensity per capita and per unit of GDP, 1990-2008



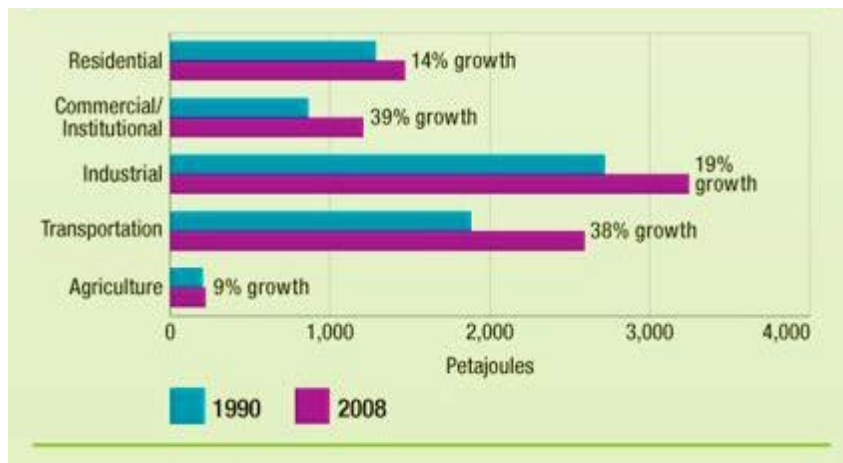
Source: Natural Resources Canada, *Energy Efficiency Trends in Canada, 1990-2008*

Figure 5 illustrates the trend of increasing energy use across the economy. While all sectors have grown, the largest increases are in transportation and in commercial/institutional. As discussed in section VI below, the latter is largely attributable to a significant growth in commercial floor space, increased use of air conditioning and office equipment, as well as such factors as extended hours of operation in the retail sector.

The largest overall growth in energy use came in the transportation sector, which also accounts for 27 percent of Canada's GHG emissions. A part of this increase results from expansion of freight modes of transport over this period, reflecting the significant expansion of Canada-US trade since the signing of the FTA and NAFTA. A substantial portion of transportation energy use (more than 50 percent) is accounted for by automobiles and

light-duty trucks. Between 1990 and 2008, the number of registered passenger vehicles in Canada increased from 14.2 million to 18.8 million and overall passenger-kilometres travelled grew by 37 percent.⁴ Recent analysis suggests that Canadians bought 16 million automobiles over the past decade, but less than 100,000 of them were hybrid vehicles.⁵

Figure 5: Total secondary energy use and growth by sector, 1990 and 2008



Source: Natural Resources Canada, *Energy Efficiency Trends in Canada, 1990-2008*

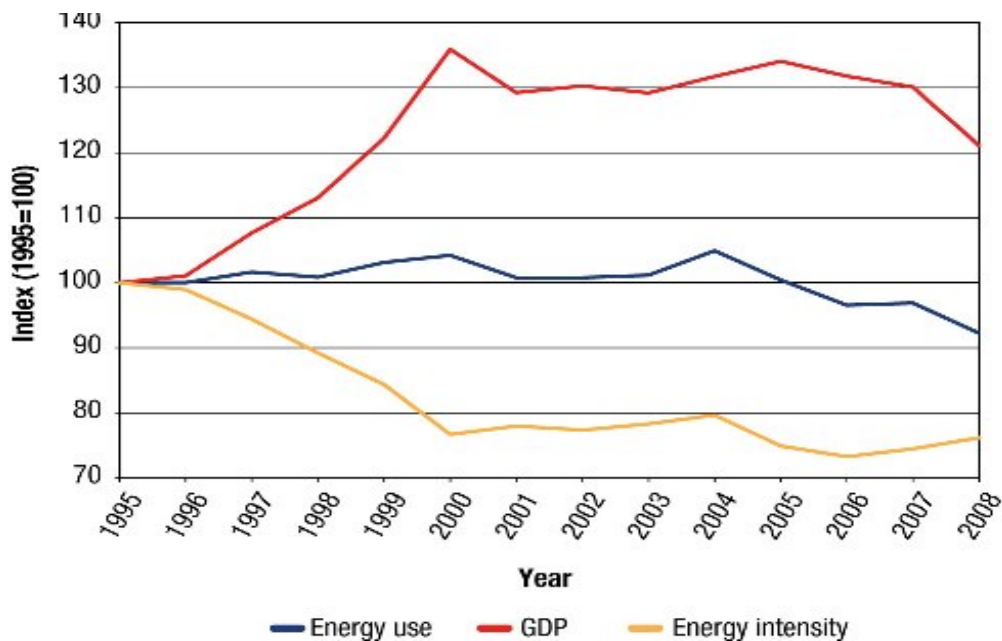
Part of what has happened reflects the reality that savings on energy efficiency do not automatically lead to an overall reduction in energy consumption. Economists long ago identified the “rebound effect” – essentially, the cost savings from more efficient use of energy in one application may result in more consumption elsewhere. To use a couple of obvious examples, the household that replaces all their incandescent light bulbs with compact fluorescents may think they have saved money and so are less conscientious about turning off lights. Or the family who purchases a hybrid vehicle may decide to buy that house in the country because they have saved on the cost of commuting.

The Canadian record, then, is less than stellar. It is worth examining the major categories of energy use in more detail, looking at the key challenges and opportunities, before returning to the question of what are some of the elements that might turn this story around.

IV. Industrial energy efficiency

Figure 6 shows that the manufacturing sector used 8 percent less energy and produced 25 percent more output in 2008 than it did in 1995. The sector’s energy intensity (energy use per dollar of GDP) declined by 26 percent over this period.⁶ While energy intensity has been generally on a downward trend, this reversed slightly with the economic slowdown in 2007-08, no doubt because factories were operating at less than optimal capacity.

Figure 6: Energy Intensity, Energy Use and GDP for the Manufacturing Sector, 1995 - 2008



Perhaps more than any other segment of Canadian society, Canada’s industrial firms have compelling reasons to pursue energy conservation and efficiency. For many of these companies, energy costs are one of their largest line items and energy savings translate immediately to the bottom line. In the relentless race to stay competitive in increasingly globalized markets, managers seek to develop or adopt leading-edge technologies that improve efficiency and performance and reduce operating costs. In

particular, Canadian firms increasingly are adapting information technology and investing in sophisticated supply chain management systems, which among other things should help reduce their need for energy.

Though they may not participate significantly in global markets, smaller manufacturing firms face similar pressures to reduce energy costs. What they often lack is access to expertise, either on staff or for hire, that can help them identify inefficiencies in their operations, explore new technologies and find opportunities to reduce energy costs.

The Canadian Industry Program for Energy Conservation (CIPEC) is one example of longstanding government-industry collaboration in this area. Started more than 20 years ago, it brings together some 1,400 companies and trade associations to promote various means to reduce industrial energy use per unit of production and manage greenhouse gas emissions. Task forces covering some 25 industrial sectors set targets and develop action plans for improving energy efficiency. CIPEC also encourages energy management best practices and is one of the best networking opportunities, particularly for SMEs, to access practical advice, such as energy management workshops and toolkits.

The federal government recently announced they will support early implementation of the Canadianized version of the International Standards Organization's ISO 50001 – Energy Management Standard. This will further raise the bar and help Canadian industry establish the systems and processes necessary to take a systematic approach to improving energy efficiency and reducing consumption and intensity.⁷

One CCCE member company, *Linamar Corporation*, decided to look at energy consumption in one of its main facilities. It began with an energy audit to identify the most promising opportunities, and sought to reinforce an energy conservation attitude amongst employees. Through such means as identifying compressed air leaks in machinery, putting all lights on occupancy sensors, engaging auto-shutoff on computers, and instituting a weekend and off-shift checklist for the shop floor, the company reduced its energy consumption per dollar of sales by 18 percent year-over-year.

Industrial firms of all sizes should be looking to practical and easily implementable steps to address energy conservation. The old business

adage of “what gets measured, gets done” is entirely applicable here. There are many resources available, including online tools and specialists in energy audits, that can help firms get a better fix on their largest energy costs and what can be done. Front line managers should be involved and can be given responsibility for finding energy savings. And employees who know the company’s operations best are often a good source of practical ideas. Firms should encourage employees to be creative and reward them with a portion of the money saved. Lastly, more firms should be developing alternative work arrangements, such as telecommuting, to decrease the amount of daily commuting by employees.

V. Energy use in the residential sector

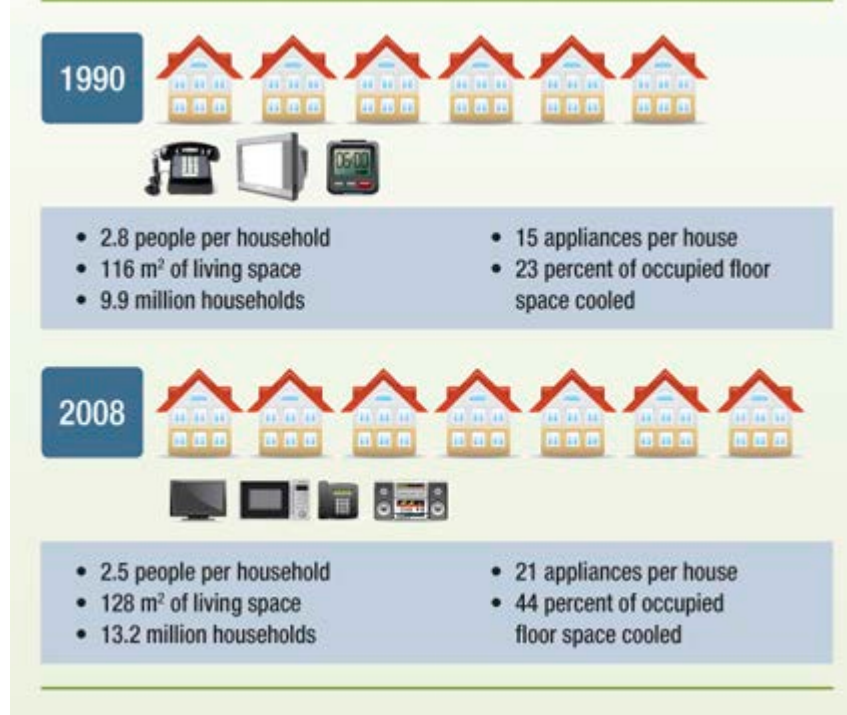
Nation-wide, residential energy use increased 14 percent between 1990 and 2008.⁸ There have been significant improvements in the building envelope (insulation, windows, etc.) over the years. As well, improvements are continually being made in the efficiency of new furnaces, appliances and lighting. Nonetheless, this has been outweighed by the larger number of dwellings, the increase in the average size of living space, a greater percentage of homes using air conditioning and the sheer increase in the number of energy-using appliances, computers and electronic equipment in the average Canadian home. In fact, the number of such “small” appliances (computers, TVs, music systems, DVD players, espresso machines, etc.) in Canadian households increased by 55% between 1990 and 2008, and the energy consumption attributed to them grew by almost 150 percent.⁹

As illustrated in figure 7, air conditioning is increasingly becoming a feature in Canadian homes. AC can account for one-third of a home’s energy use in the summer months and most Canadians would do well to acquaint themselves with the best ways to moderate power demand from air conditioning – including purchasing Energy Star rated equipment, keeping it in top operating form through regular maintenance, use of programmable thermostats, as well as turning off lights and closing blinds to reduce unwanted heat.

The recently renewed federal program, *ecoENERGY Retrofit - Homes*, provides grants of up to \$5,000 per household for major energy efficiency retrofits. These cover heating, cooling and ventilation systems, new insulation, upgrades to domestic hot water equipment, as well as installation of energy efficient windows and doors. However, that program has only been extended until March 31, 2012. Of course, even with the enticement of government grants the cost of retrofitting (e.g. grants range from \$400 to

\$800 for a new Energy Star qualified furnace, whereas the total installed cost may range from \$4,000 to \$6,000) ¹⁰ can be substantial for many Canadian families, especially those on tight budgets in these tough economic times. And expenses are upfront, whereas the savings in energy bills will come slowly over several years.

Figure 7: Residential energy indicators, 1990 and 2008



Source: Natural Resources Canada, *Energy Efficiency Trends in Canada, 1990-2008*

Sometimes the cost incentive does not fall on the person who has primary control over energy use. In the energy economics literature, this is referred to as the “agency” problem. When a tenant does not pay individual unit heating bills, he has little incentive to lower the thermostat or keep windows tightly closed. Similarly, where the tenant does pay for heat, many landlords would be less inclined to pay for upgraded insulation or the installation of a more efficient furnace.

If the current state of residential energy use is not entirely encouraging, the kinds of information technology that increasingly dominate our homes also

offer the potential for many innovative solutions. In the “smart” home of the future, technology undoubtedly will allow a central control connected to a home’s thermostat, lighting, air conditioning, water heater, major appliances and various electronics to both optimize energy use within the home and shift operation of some devices to times of lower energy demand.¹¹ The first step already is being implemented in many Canadian homes with the installation of “smart meters”.

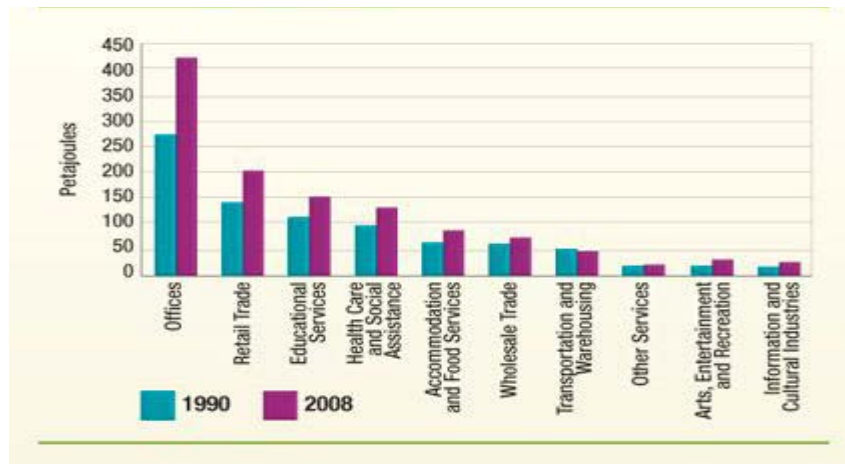
Smart meters will give consumers much better information about how much energy they use at different times of the day. This is important because most utilities across the country will move from flat-rate electricity pricing to billing higher rates for electricity consumed during peak demand periods. Although there will be grumbling when the full impact is felt by electricity consumers, this only makes sense since power generators have to ramp up increasingly costly electricity sources to meet peak demand. A more balanced demand throughout the day will reduce the need for utilities to build expensive back-up power, and lessen some of the environmental impact of electricity generation. But in the future these meters also will allow interested homeowners to enrol in a program that will enable their electricity provider to control and cycle energy use during peak times. Often this would be done when no one is at home and the homeowner will not notice the difference, except that it will lower their electricity bill.

VI. Energy use in the commercial/institutional sector

Between 1990 and 2008, total commercial/institutional energy use increased 39 percent. At the same time, GDP for the sector grew 73 percent, employment increased 40 percent and floor space grew 37 percent. Aside from the overall increase in activity levels and floor space needed to be heated, the biggest factors in increased energy use have been higher utilization of building air conditioning and more auxiliary equipment, mainly computers and related equipment. Higher energy use in the retail sector reflects in part longer hours of operation.

Since much of a building’s energy use over its life is determined by decisions made in the formative stages, a key focus has to be on improving the design of new commercial buildings. Leadership in Energy and Environmental Design (LEED) is a third-party certification program and an internationally accepted benchmark for the design, construction and operation of high performance buildings. It promotes a whole-building approach and assesses performance in five areas: sustainable site development; water efficiency; energy efficiency; materials selection, and indoor environmental quality.¹²

Figure 8: Commercial/institutional energy use by activity type, 1990 and 2008



Source: Natural Resources Canada, *Energy Efficiency Trends in Canada, 1990-2008*

At their July 2011 meeting, federal, provincial and territorial ministers of energy endorsed the creation of a new “National Energy Code for Buildings”. The 2011 code is expected to provide an overall 25 percent improvement in energy efficiency over its predecessor, and could save an average building in Canada \$1.7 million dollars over its life span.¹³ When fully implemented, it is expected that this new code will put Canada on a comparable footing with the leading jurisdictions worldwide in terms of energy efficient building construction.

Given the long life of most commercial buildings, addressing energy improvements in the existing stock also is critical. The “agency” problem described above for residential

“Today, almost all major government projects, and most private sector projects managed by established developers, are designed and constructed to meet sustainability standards. Now that the costs of sustainable projects are coming down and the long-term benefits are being recognized, private developers are embracing the concept. Tenants want to move into sustainable, healthy spaces. Building managers want lower operating costs as well. It has a snowball effect that is driving all construction in this direction.”

*Paul Douglas
 President and CEO
 PCL Constructors Inc.*

apartment buildings applies equally to commercial buildings, i.e. often the building owner who could make the changes to heating and cooling equipment, insulations, windows, lighting, etc. has little incentive since they are not the ones paying the monthly energy bills. Nonetheless, examples of successful retrofits abound. The City of Toronto has long been considered a leader when it comes to energy retrofits of existing buildings. Its current “Better Buildings Partnership” program offers, among other things, interest-free, repayable loans to building owners in the MUSH and not-for-profit sectors for qualified energy conservation and green energy projects.

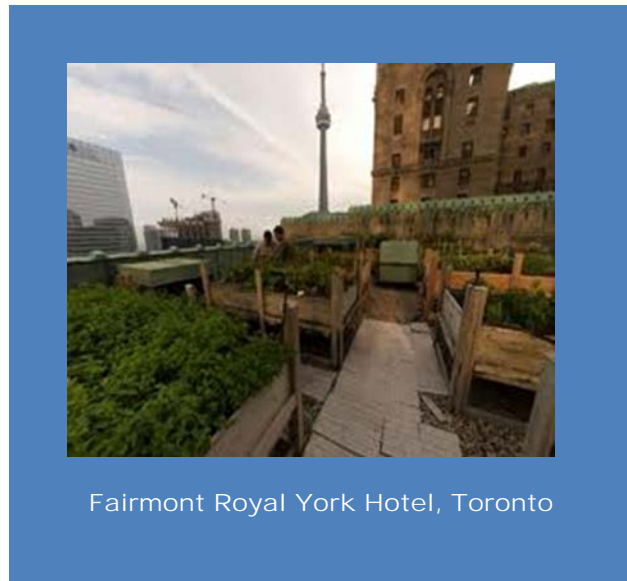
The federal ecoENERGY retrofit program for commercial buildings ended on March 31, 2011, but a number of provincial governments, utilities and a few private sector organizations offer somewhat similar services. In Canada’s largest province, the Ontario Power Authority (OPA) coordinates a number of programs that can help small business, retailers, commercial building owners and institutions like schools and hospitals better manage their energy use. Incentives of up to 50 percent of project costs are available for pre-approved retrofits that result in electricity savings for commercial, industrial, and municipal facilities. The OPA also offers compensation to eligible industrial and commercial businesses that lower their electricity demand during peak periods. And it provides qualifying small businesses with up to \$1,000 to help upgrade lighting systems to make them more energy efficient. Several provinces also offer incentives to conduct electricity-focused audits for a variety of private and quasi-public facilities.

In an effort to improve the energy and environmental performance of commercial buildings across Canada, the Building Owners and Managers Association of Canada (BOMA) created BOMA BEST in 2005. It has evolved from a forum to identify best practices and provide educational tools to the point where it now develops common standards, manages a four-level performance certification program, and facilitates independently verified data on building performance.¹⁴

Another positive development is the recent announcement by the federal government that they will support the development of a national building energy benchmarking tool based on the US Environmental Protection Agency’s “Portfolio Manager” tool. This will enable building owners and facility managers to compare their building’s energy performance, raising its visibility, and supporting the business case for taking action.¹⁵

A practice more prevalent in Europe but that is gaining ground in Canada is the establishment of what are known as “green roofs” on existing and new

commercial buildings. In addition to the aesthetic value of turning workmanlike surfaces into lush greenery, green roofs can help reduce energy costs by absorbing more of the sun's energy in summer and acting as an additional insulation blanket in winter. Green roofs also help manage stormwater and can incrementally improve air quality in large urban centres. Several municipalities across North America have tried various incentives, including tax credits, reduced development charges and streamlined approvals, to entice more of this kind of development. Needless to say, this is easier done for new buildings in the design phase than attempting to affix a significant addition to an existing roof. And cost/benefit will be a consideration for any building owner, but costs no doubt will come down with increased availability of green roof design and installation experience.



Not surprisingly, the stumbling block to more retrofits of existing buildings across the country is most often financial, though a variety of innovative financing schemes have been tried. Anyone operating a business understands the concept of “return on investment” and the most attractive investments are those that offer concrete payback in the short term – two to three years. But energy efficiency improvements are among the most reliable of investments and often bring other related benefits. It is to be hoped that more owners can be persuaded of the benefits of adopting a longer time horizon for their “ROI” calculations.

VII. Transportation

The last 20 years has seen a significant shift in North America vehicle purchases from what we traditionally think of as “cars” to what are classified as “light duty trucks” – pick-ups, minivans and SUVs. Figure 9 also reflects the growing popularity of air travel in Canada, and correspondingly

a decline in inter-city travel by train. With respect to the movement of goods and commerce, the biggest change has been the growth of trucks as the mode of choice for freight transportation. This is in large measure a reflection of increased Canada-US trade since the FTA and NAFTA, the significant growth of supply chains within Canada and throughout the North American continent, and the prevalence of just-in-time inventory systems.

Harmonized North American vehicle emissions standards are an important step in addressing the growth in transportation sector energy use and greenhouse gas emissions. Among other things, a larger market, as opposed to one fragmented by differing standards, will enable the introduction of lower-cost solutions for customers. As recently finalized by the federal government, new GHG emissions standards for cars and light-duty trucks will take effect for the 2011 model year and will become more stringent each year through 2016. As a result of these new harmonized regulations, it is projected that the average GHG emission performance of new vehicles for the 2016 model year will be 25 percent lower than that of vehicles sold in Canada in 2008. In addition, General Motors, Ford and Chrysler have pledged that as much as 50 percent of the vehicles they produce in the United States in 2012 will be flex-fuel.

**Figure 9: Energy use in the transportation sector,
 1990 and 2008 (petajoules)**

	1990	2008	% Change 1990 to 2008
Passenger Transportation	1,184.5	1,396.9	17.9%
Cars	730.6	648.5	-11.2%
Light Trucks	212.1	440.1	107.5%
Motorcycles	2.4	4.1	67.1%
Buses	53.5	51.8	-3.1%
Air	180.9	249.6	38.0%
Rail	5.1	2.8	-44.2%
Freight Transportation	640.0	1,094.5	71.0%
All Trucks	442.5	901.3	103.7%
Air	6.5	5.1	-21.4%
Rail	84.4	87.7	3.9%
Marine	106.5	100.4	-5.8%

Source: Natural Resources Canada, *Energy Use Data Handbook, 1990 to 2008*

The federal government also has recently announced it was moving ahead, in conjunction with the United States, with new fuel efficiency standards for the whole range of new on-road heavy-duty vehicles (buses, freight trucks, service vehicles, garbage and dump trucks). These are expected to be in effect for the 2014 model year.

These initiatives, together with the commitment to further align North American passenger vehicle regulations for the 2017 model year and beyond, are significant steps in stemming the pattern of energy use in transportation. Nonetheless, it will take time to turn over the stock of vehicles to a much larger proportion of the fuel-efficient variety. Automakers around the world are spending billions on the next generation of vehicles -- hybrids, all-electric vehicles, hydrogen fuel cells, and flex-fuel vehicles that can run on up to 85 percent ethanol. As well, an energy bill introduced in the last session of the US Senate would give a boost to natural gas vehicles in North America, at least the potential for fleet conversion to natural gas. But all of these alternative fuels raise questions about the cost and length of time needed to get an adequate re-fueling infrastructure in place, not to mention whether the vehicles will quickly gain public acceptance.

As much as these new vehicles and alternative fuels will help in the medium to longer-term, the short-term priority has to be to get more people out of their cars and using public transit, car-pooling, cycling and walking. As outlined in the next section, much of this has to take place at the municipal level, where local authorities have many of the levers to encourage greater use of alternatives to driving. Employers can also help by the encouragement of telecommuting and other flexible work arrangements that mean fewer vehicles on the road at peak times.

One important area of energy conservation/efficiency is in commercial fleets. Many businesses and indeed public institutions like municipal governments and school boards operate fleets of vehicles. A valuable source of information is the federal government's *FleetSmart* program, which has developed a number of specially tailored programs, driver training, as well as information on new products and services that can assist operators engaged in highway trucking, motor coaches, school buses and the like. In addition, case studies are available to show real-life examples of how fleet operators in various parts of the country have reduced costs and improved operations through increased focus on energy efficiency opportunities.¹⁶

VIII. Municipalities and regions

Media and public attention tends to focus on the federal and provincial governments when it comes to setting standards and measuring Canada's performance against environmental objectives. What municipal and local governments do and fail to do has a significant effect on our country's trendline of energy consumption. It is estimated that 80 percent of Canadians live in cities, and this is projected to increase to 85 percent in the next few decades.

Canada's pattern of urban and suburban community design, as well as a significant portion of our energy infrastructure, have been built around the model of the private automobile as the mode of transport of choice for Canadians. Section VII above highlighted some of the coming changes in vehicle technology. However, the short-term priority has to be to get more people out of their cars and using public transit, car-pooling, cycling and walking. Over the longer term, this has to be addressed by significant changes to urban form – density and land use in particular. In addition

"In this vision of 2050, communities of all sizes approach energy supply and demand in an integrated fashion. A focus on energy efficiency and clean energy is fully ingrained in the way communities are planned, designed, built, operated and revitalized. "

....

"Communities are also stronger. Reduced spending on energy means that more money stays in the local economy. Efficient local services enhance financial performance. Residents enjoy a higher quality of life. Industry and commerce are drawn to communities by their increased attractiveness."

....

"By 2050, communities are making effective use of local energy sources ranging from on-site renewable energy to waste heat and organic waste, allowing optimal use of the broader clean energy grids. District energy networks, in many cases, distribute thermal energy for heating and cooling, while smart electrical grids manage local energy supply and demand."

....

"In communities of the future, street orientation, building sites and building design work together to enable the integration of active and passive renewable energy technologies. Through good design and effective retrofits, buildings of all ages exploit the latest energy efficient technologies and integrate renewable energy technologies."

....

"Community members have access to safe, efficient and reliable transportation options, using the best modes for the needs of their trip. In smaller and rural communities, town centres are pedestrian and bike-friendly, car-pooling and mini-shuttles are well organized, and alternative fuel vehicles are commonplace. In larger communities, residents travel within and between neighbourhoods by using a mix of transportation modes. Pedestrian pathways and cycling lanes for shorter trips are seamlessly connected with powered transit through multi-modal hubs."

Excerpt from "Picturing Canadian Communities in2050", found in *Integrated Community Energy Solutions – A Roadmap for Action*, Council of Energy Ministers, 2009

to the GHG reductions, there will be multiple benefits – reduced urban smog, less traffic congestion and more livable communities.

A recent study by the Pembina Institute illustrates this challenge. While there has been progress made by some of Canada’s largest cities through encouraging higher density housing and more use of public transit, these gains have been offset by population shifts to suburban areas surrounding the urban core where there are longer commuting distances and higher reliance on the automobile.¹⁷

It is also at the local level that much can be accomplished in integrating local land-use, energy, transport, water and waste management into a holistic approach that can optimize energy use, minimize waste and improve quality of life in Canada’s urban centres. Important work is being undertaken by QUEST (Quality Urban Energy Systems of Tomorrow) to further examine the potential for reduced energy use and GHG emissions, while enhancing economic growth, through advanced application of integrated community energy solutions.¹⁸

The key is to ensure that local governments build sustainable energy use into community planning – zoning, urban and transportation design, the planning of new buildings, neighbourhoods, and infrastructure, public transit projects – as well committing to appropriate use of urban densification as opposed to the “sprawl” that seems to afflict so many of our largest urban centres.

While the lessons are not always easily transferrable, several European cities have shown what can be accomplished by use of district heating, whereby waste heat from a power plant can be used to heat nearby buildings. Fortunately, some Canadian examples are beginning to emerge. The new community of “Dockside Green” is a collection of commercial and residential buildings built on what was once an industrial site on Victoria’s upper harbour. A variety of wood scraps and forest waste is fed into a high-tech industrial boiler, which then provides heat and hot water to the adjacent buildings. Homeowners paid slightly more for their condos, but it is estimated that this system will save the community an average of \$500,000 per year on energy costs.¹⁹ While it is obviously easier to think about such systems when new communities are being planned, technology may eventually allow their application to more existing neighbourhoods.

Another area where most Canadian municipalities are behind their European counterparts is in the production of energy from waste. Modern

combustion technology together with advanced emissions control systems can virtually eliminate harmful discharges, a fact recognized in Europe, but still facing public and regulatory obstacles in Canada.

Some of these issues are being addressed by the national organization that represents local governments. The Federation of Canadian Municipalities has developed a “Green Municipal Fund”, based in part on significant funding from the federal government. The GMF provides grants for the development of sustainable community plans, feasibility studies and field tests. As well, a combination of grants and loans are available for approved capital projects.²⁰

IX. Energy use in agriculture

The agriculture sector accounts for slightly more than 2 percent of total secondary energy use in Canada and a somewhat greater proportion of Canada’s GHG emissions. As illustrated in Figure 5 above, energy use in agriculture grew at a slower pace (9 percent overall from 1990 to 2008) than in other sectors of the Canadian economy. And the track record has been relatively good in recent years in terms of improving energy intensity (Figure 10).

Farm operators, like most businesses, look for opportunities to reduce their input costs and energy can be a significant share of operational expenses. Energy audits conducted by qualified professionals can identify obvious sources of inefficiency and point to cost-effective solutions. In some provinces, local utilities will help pay for the cost of these audits for small farm operations.

The best solution for many farms is a mix of greater attention to energy efficiency and investigation of alternative energy sources. In Ontario, many farms have taken advantage of the generous feed-in tariff rates offered under the *Green Energy Act*. Installation of small wind turbines or solar panel systems can provide supplemental electricity to the farm, with the excess being sold back to the grid.

The “Integration of Renewable Energy on the Farm” project is a partnership between Agriculture Canada, Natural Resources Canada, the Canadian Federation of Agriculture and several other agricultural and energy organizations across the country. It aims to be one-stop shopping for farmers to learn more about renewable energy opportunities, including solar, wind, small hydro, biodiesel and ethanol. For example, anaerobic

digestion is a process whereby organic matter such as manure can be broken down to produce both material suitable for fertilizer as well as a biogas which can be burned to produce electricity and heat. However, the upfront cost and overall economics can make it challenging at present for small farm operations to adopt such technology.

**Figure 10: Energy use and energy intensity
 in the agricultural sector, 1990 to 2008**

	1990	1995	2000	2005	2008
Total Energy Use (PJ)	199.15	209.25	231.93	208.54	217.21
GDP (million \$2002)	18,373	18,051	20,592	21,047	23,208
Energy Intensity (MJ/\$2002 – GDP)	10.84	11.59	11.26	9.91	9.36

X. Making conservation the new norm

This paper has drawn a broad sketch highlighting some of the ways that Canadians, from all walks of life and in thousands of different ways, can contribute to making Canada a model of more sustainable energy use. As we have tried to outline, there are many positive steps being undertaken, but many challenges ahead. The importance of energy conservation and efficiency is not something new, nor is it gaining prominence only because of the fears of volatile energy prices or the potential impacts of a warming planet. Governments have been preaching the merits of wiser energy use since at least the first oil price shocks of the mid-1970s, with only limited success. So clearly a new model is needed. We do not pretend to have all the answers to this conundrum, but two overarching policies seem paramount.

1. Improving energy literacy

Since energy has been and will continue to be fundamental to our way of life and the Canadian standard of living, we need to ensure that Canadians are more actively engaged in an informed discussion about our energy future. Most experts agree that energy demand will continue to grow, both in Canada and internationally. With so much attention focused on the predominance of fossil fuels, and their contribution to climate change and other environmental stresses, governments, companies and researchers worldwide are devoting tremendous resources to the research, development

and demonstration of lower carbon energy forms and new goods and services with lower environmental impact. The reality is that the full realm of advanced technologies will need to be deployed, and most, if not all will have their challenges – economic, environmental and social.

What has become increasingly apparent is that the debate in Canada is frustrated by a general lack of understanding about the key attributes of Canada's energy system, how they relate to each other and the implications for us as consumers. The reality is that most Canadians expect energy to be there when they flip the light switch or turn the ignition in their car, without thinking much, if at all, about how the energy was produced or how it was delivered to them. Affordable and reliable energy is almost part of our birthright. At the same time, it is fair to say that most consumers do not value energy per se, but rather the services that it provides – comfort, mobility, entertainment, etc.

It is difficult to have a useful discussion with Canadians about appropriate energy choices if basic information and understanding is lacking. That is why many thoughtful advocates in the country are calling for a more focused approach to improving *energy literacy*.

Canadians need better information about the costs and benefits of particular energy choices, and about smarter choices they can make in day-to-day energy use. It is not that Canadians, or consumers in other parts of the world for that matter, are deliberately wasteful. But the combination of other priorities, insufficient attention and lack of information means that very few Canadians have a good sense of how much better their energy use could be on a daily basis, without sacrificing material comfort to any real degree.

One promising initiative in this field is the work of the environmental organization Pollution Probe. It has developed the *Primer on Energy Systems in Canada*,²¹ a comprehensive look at how various forms of energy are produced, refined, transported and used by Canadians. Some

There are many online tools that Canadians can use to track their energy use and get useful tips on how to make improvements. One such tool is the **Personal Energy Dashboard** developed by Canadian Geographic magazine in association with Shell Canada. Individuals or households can log their energy use, follow some of the suggested changes and watch their energy footprint shrink.

www.energydiet.canadiangeographic.ca

measure of the complexity of the issues involved is the fact that the primer is 180 pages in length. Nonetheless, it is one of the first attempts to give Canadians a comprehensive picture of Canada's energy system, its many inter-related parts and the impact of individual energy choices.

We need to look at more innovative ways that governments, the private sector, educators and community organizations can participate in a sustained effort on energy education. And business of all sizes should be stepping up their efforts to support Canadians in their choice of environmentally preferable goods and services.

2. Putting a price on carbon

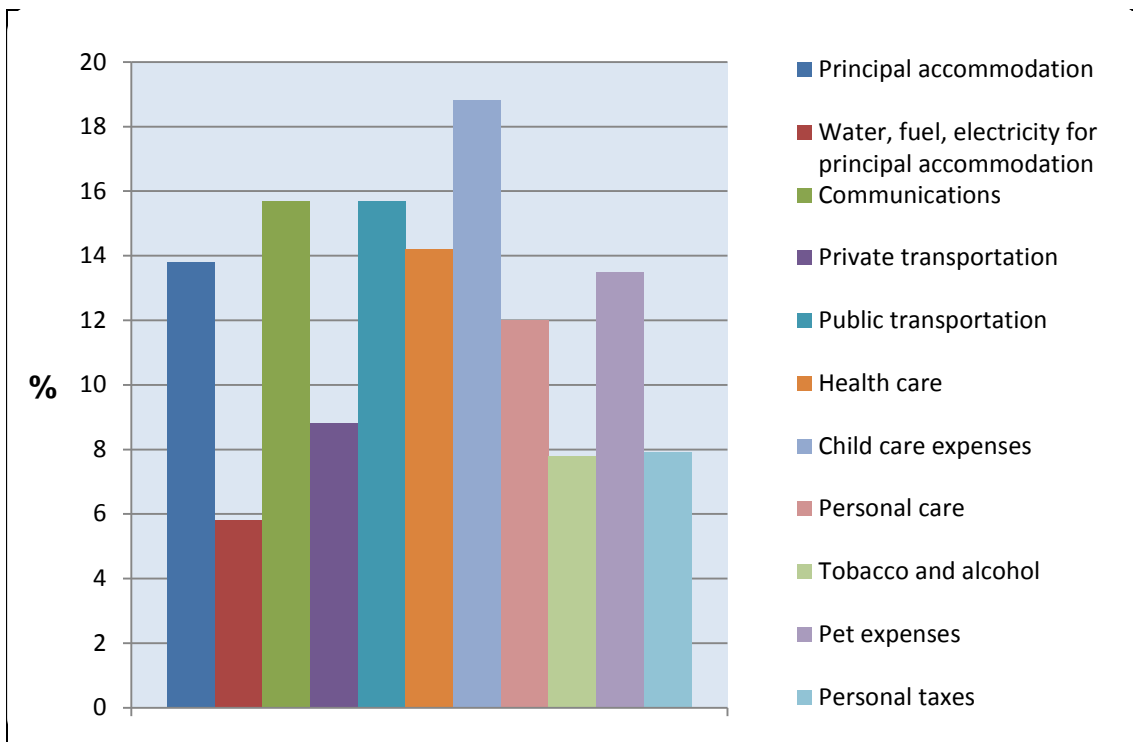
Although Canadians profess to be environmentally conscious, their actual behaviour tells a somewhat different story. And concern for environmental issues, as any politician can attest, tends to move with the state of the economy. There are heartening signs that Canadians are increasing their efforts to reduce their personal environmental impact, from participation in expanded recycling programs to the growth of the organic and local food movements. But action still does not equate with the scale of the challenge.

It seems clear that price will work in a way that public exhortation and appeals to the greater good have not. That is why the CCCE has previously stated its support for a broad-based carbon pricing scheme in Canada.²² Carbon pricing can be a primary means, whereby Canadians – as business owners, farmers, building managers and individual consumers – see the everyday cost of inefficient use of energy and are motivated to change their energy consumption patterns as well as their investment decisions and purchasing habits. To be sure, carbon pricing will have to be phased in, to allow businesses and consumers time to adjust and to avoid any disproportionate impact on Canada's competitive position.

The current economic uncertainty may affect demand in the short term and cause energy prices to fluctuate somewhat. Yet the medium and longer-term trend line is fairly clear. Canadians can expect energy prices to rise. The combination of increasing demand globally, mostly fuelled by emerging economies seeking a higher standard of living, coupled with the reality that energy supply is increasingly found in more remote and difficult to access locations, along with more stringent environmental standards, will continue to put upward pressure on energy prices. Energy is still relatively inexpensive in Canada, compared to a number of industrialized countries,

and when viewed in comparison to other common expenses for Canadians households (Figure 11).

Figure 11: Percentage change in average Canadian household expenditures on select items, 2005 - 2009



Source: Statistics Canada, *Spending Patterns in Canada*, 2009

If governments are serious about promoting energy efficiency and reducing the environmental burden associated with energy development and use, they should not be shielding Canadians from the realities of energy pricing. Undoubtedly, lower income Canadians will be disproportionately affected, since they spend a greater share of their disposable income on energy and energy-related goods. Social policy can be fashioned to protect the most vulnerable. But governments have to refrain from short-term populist measures that blunt the conservation and efficiency message across Canadian society.

While fundamental, carbon pricing alone will not drive the necessary changes. Consumers are not the simplistic rational actors of the economics textbooks. People gain other advantages from their energy-using devices – mobility, entertainment, convenience, etc. – that go beyond mere considerations of cost. There are many small, fuel-efficient and relatively inexpensive vehicles on the market today that fail to capture significant market share. And fuel efficiency ratings are often well down the list of considerations when purchasing a new vehicle, competing with such things as passenger and carrying capacity, ride and handling, perceived safety, or mere status.

One obvious example is the predominance of automobiles as a means of getting to work rather than public transit or other options. Even where the economics would suggest that public transit is cheaper, given the costs of vehicle operation and maintenance, insurance, parking, etc., people still value the private automobile as their mode of commuting. A recent survey by Statistics Canada found that in 2010, 82 percent of Canadians travelled to work by car, 12 percent took public transit and 6 percent walked or cycled. Even in Canada's largest cities, with the most developed public transit systems, transit usage was at 29, 32 and 41 percent for the urban core of Toronto, Vancouver and Montreal respectively.²³

The study also presented some interesting findings on Canadians' tolerance for long commute times and traffic congestion. The average round-trip commuting time has

Motivating Environmental Behaviour – Lessons from Human Psychology

We all have seen the notes in hotel rooms encouraging us to save energy and water by re-using the towels provided. A professor of psychology in the United States tested different messages to see how effective they were. He found that simple messages about helping to save the environment generated only a lukewarm response. However, when the message in hotel rooms suggested that the occupant should join other guests, most of whom already were participating in this environmental effort, the rate of re-use of towels increased to almost 50 percent. Peer pressure does make a difference.

See Robert Cialdini, "Don't Throw in the Towel: Use Social Influence Research", *APS Observer*, April, 2005

**"Nothing so needs
reforming as other
people's habits."**

Mark Twain

increased from 54 minutes in 1992, to 59 minutes in 1998 and to 65 minutes in 2010. The proportion of Canadians who profess to be satisfied with work-family life balance declined from 79 percent for those with commute times of less than 15 minutes to 65 percent for those with commute times of 45 minutes or more. As well, 36 percent of workers with the longest commute times said that most days were quite or extremely stressful, in contrast to 23 percent of those with commutes of less than 15 minutes.

It also must be recognized that even where Canadians recognize the longer term benefits of increasing their homes' energy efficiency, they may be constrained by financial considerations. Installing a new high-efficiency furnace, triple-glazed windows or new insulation would involve several thousand dollars upfront, a difficult proposition for many families when the payoff in reduced energy bills comes only slowly over many years. Government programs can help reduce the cost of these upfront expenditures, and both federal and provincial governments have tried various home retrofit programs. But subsidies of this sort have always struggled with the problem of rewarding those who would have done it anyway, raising questions about the extent to which they capture new and additional energy savings and at what cost.

To effectively change Canadians' perceptions and energy consumption patterns, we have to look to other social marketing campaigns that have had greater success in changing behaviour. The efforts to get Canadians to quit smoking and to reduce incidences of drinking and driving involved increasingly stringent government legislation and regulation over the years. But real success came when social mores changed, when it was no longer socially acceptable to put other peoples' lives at risk from second-hand smoke and inebriated drivers.

It is not the purpose of this paper to catalogue and critique the various government programs over the years that have sought to enroll Canadians in greater efforts on energy conservation and efficiency. Some undoubtedly have proven reasonably effective, while for many others it would be easy to question the value, at least in terms of gains produced per dollar of government expenditure. Canada's vast array of natural resources, our growing population, our climate and geography push us towards above-average energy consumption. But the present trend is unsustainable. It is time for Canadians to get serious about energy conservation, for the health of our economy as well as the environment.

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- ¹ For a fuller description of the CCCE's views on Canada's energy advantage and our responsibilities related thereto, see *Clean Growth 2.0: How Canada Can Be A Leader in Energy and Environmental Innovation*, Canadian Council of Chief Executives, November 2010, available at www.ceocouncil.ca.
- ² Peter Tertzakian, *The End of Energy Obesity: Breaking Today's Energy Addiction for a Prosperous and Secure Tomorrow*, Hoboken: John Wiley & Sons, Inc., 2009.
- ³ Natural Resources Canada, *Important Facts on Canada's Natural Resources*, October, 2010, p. 16.
- ⁴ Natural Resources Canada, *Energy Efficiency Trends in Canada, 1990-2008*.
- ⁵ According to automobile analyst Dennis Desrosiers, as quoted in *The Globe and Mail*, July 28, 2010.
- ⁶ Natural Resources Canada, Office of Energy Efficiency, *Industrial Consumption of Energy (ICE) Survey, 1995-2008*, accessed at www.oeenrncan.gc.ca.
- ⁷ Government of Canada, *ecoENERGY Efficiency for Industry*, accessed at ecoaction.gc.ca.
- ⁸ Natural Resources Canada, *Energy Efficiency Trends in Canada, 1990-2008*.
- ⁹ Natural Resources Canada, *Energy Use Data Handbook: 1990 to 2008*, published 2011.
- ¹⁰ Similarly, replacement of an existing air conditioning system with an Energy Star qualified one is eligible for a grant of \$250; new energy efficient windows or doors qualify for a \$40 grant per unit.
- ¹¹ For a fuller description of the some of the potential for information technology to manage energy use in homes of the future, see: chapter 12 of Thomas L. Friedman, *Hot, Flat and Crowded: Why We Need a Green Revolution and How It Can Renew America*, New York: Picador, 2009; and chapter 12 of Tertzakian, *op. cit.*
- ¹² Canada Green Building Council, *Introduction to LEED*, accessed at: www.cagbc.org.
- ¹³ Natural Resources Canada, Office of Energy Efficiency, July 2011.
- ¹⁴ Building Owners and Managers Association, *What is BOMA BEST*, accessed at www.bomabest.com.
- ¹⁵ Government of Canada, *ecoENERGY Efficiency for Buildings*, accessed at ecoaction.gc.ca.
- ¹⁶ Natural Resources Canada, Office of Energy Efficiency, *FleetSmart*, accessed at www.fleetmart.nrcan.gc.ca.
- ¹⁷ The Pembina Institute, *Canada's Coolest Cities*, May, 2010, www.pembina.org.
- ¹⁸ Quality Urban Energy Systems of Tomorrow, www.questcanada.org.
- ¹⁹ As reported in *The Globe and Mail*, Wednesday, November 23, 2011, page A10.
- ²⁰ Federation of Canadian Municipalities, *Green Municipal Fund*, accessed at www.fcm.ca.
- ²¹ Pollution Probe, *Primer on Energy Systems in Canada*, 2011, accessed at www.pollutionprobe.org.
- ²² See *Clean Growth: Building A Canadian Environmental Superpower*, Canadian Council of Chief Executives, October 2007; and *Clean Growth 2.0, op.cit.*

²³ Statistics Canada, Canadian Social Trends, *Commuting to Work: Results of the 2010 General Social Survey*, Catalogue No. 11-008, August, 2011.