

# **Energy Efficiency in Canada**

*-Final Report-*

**Energy Efficiency Working Group  
Energy Sector Sustainability Table**

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### **Preface**

The Energy Sector Sustainability Table (ESST) was established in 2005 as a multi-stakeholder advisory mechanism - including senior representatives from governments, industry, and civil society – created by the Government of Canada to provide advice on how best to meet the energy needs of Canadians so as to improve the environmental and economic sustainability of energy systems in Canada and to make recommendations on short-and long-term sustainable energy objectives.

Energy efficiency was identified as key priority for the ESST so the Table established the Energy Efficiency Working Group (EEWG). The EEWG is a committee of industry, government and civil society experts mandated to provide the ESST with an expert perspective on energy efficiency in Canada. The EEWG has produced several products including its Energy Efficiency in Canada Foundation Paper, a series of issue papers, and a final report summarizing the key conclusions and recommendations that resulted from the EEWG's work.

This Final Report is one in a series of papers. The Report, as well as all other EEWG products, was prepared by the EEWG in conjunction with Marbek Resource Consultants and Dr. Michael Margolick.

To access other EEWG documents or for more information about the Energy Sector Sustainability Table and its Energy Efficiency Working Group, please visit: <http://www.sst.gc.ca>

### **Disclaimer**

As a member of the EEWG, Margaret McCuaig-Johnston, Assistant Deputy Minister at NRCan, contributed to the development of the EEWG report and issue papers, but the core recommendations in the Final Report are the product of the EEWG as a whole and do not necessarily reflect the views or positions of the federal government.

Similarly, the Deputy Minister's of Environment Canada, Natural Resources Canada, and Transport, Infrastructure and Communities, are all members of the Energy Sector Sustainability Table and contributed to Table discussions including the EEWG report and issue papers. However, the Energy Sector Sustainability Table is an independent body and the core recommendations do not necessarily reflect the views or positions of the federal government.

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## 1. INTRODUCTION

Rising energy demand is a major challenge for Canada: energy use is the principal source of Greenhouse Gas (GHG) emissions and other air pollutants; the supply of electricity relative to demand is an energy security issue in some regions; and the increased prices are putting pressure on consumers (particularly low-income Canadians) and some manufacturers. Energy efficiency is one means to address rising energy demand and the costs associated with it. It allows Canadians to get more heat, light, industrial production and power out of the energy we use. Energy efficiency encourages the use of better technologies – both new and emerging – and better energy use practices in the way we heat our homes, cool our buildings, move ourselves and manufacture and transport our goods. The energy efficiency industry already employs thousands of Canadians who manufacture, sell and install efficient products and technologies. More jobs can be created in businesses such as the manufacture of advanced energy efficient building components and equipment, the design, construction and sales of certified green buildings built to specified environmental standards and for the retooling of industrial processes to improve energy efficiency.<sup>1</sup> Furthermore, the potential associated solely with those energy efficiency measures that are economically justified, is large.

Having identified energy efficiency as a key priority, the Energy Sector Sustainability Table (ESST) established the Energy Efficiency Working Group (EEWG) to provide expert advice and recommendations on how governments, working with other key players, could transform the market so that Canada could become a leader in energy efficiency. The EEWG began its work by developing a statement of principles to guide energy efficiency policy in Canada and the development of its recommendations. These principles were also transmitted to the Government of Canada in the form of *Key Considerations in the Design of Energy Efficiency Programs* and were eventually adopted as part of the *Principles for Energy Efficiency* outlined by the Council of Energy Ministers in their September 2007 document *Moving Forward on Energy Efficiency in Canada – A Foundation for Action*, which provides broad direction for federal, provincial and territorial action and a menu of policy instruments to support progress.

In parallel with the development of the principles, the EEWG also commissioned a Foundation Paper, which examined the state of energy efficiency in Canada, the barriers and the opportunities, and set the stage for debate and discussion. The Foundation Paper set the context for further research on key issues affecting energy efficiency. Recognizing that efforts were already underway in various ways to examine sector-specific issues, the EEWG chose to direct its attention to issues that cut across sectors and affected energy efficiency policy more broadly.

The eight issues chosen were:

- Targets – (1) *How should energy efficiency goals and targets be framed?*
- Drivers – *What drives energy efficiency decision-making by (2) individuals and (3) corporations?*

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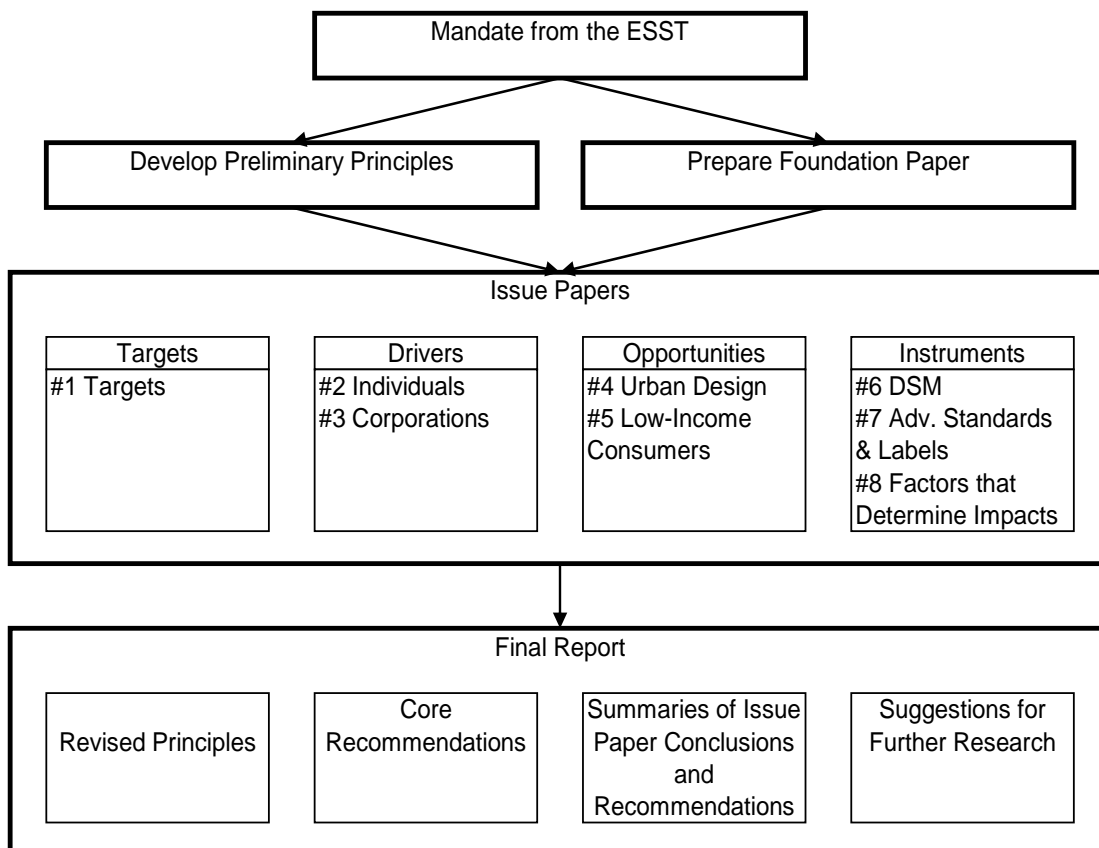
<sup>1</sup> Council of Energy Ministers. *Moving Forward on Energy Efficiency in Canada: A Foundation for Action*. September, 2007.

- Neglected opportunities – (4) *Is there a long term potential in urban design?* (5) *Are there opportunities to promote energy efficiency in parallel with energy affordability?*
- Instruments to promote energy efficiency – (6) *What are the barriers that hinder utilities from offering Demand-Side Management (DSM) programs?* (7) *What role can voluntary advanced standards and labels play in a balanced policy mix?* (8) *What are the factors that affect the impact of energy efficiency incentive programs?*

For each of the eight issues, the EEWG commissioned a short issue paper, and developed a series of key messages, conclusions and recommendations. It is noted that the themes selected are not exhaustive, and the EEWG has identified areas for further research in Section 13.

This Final Report compiles the results of the studies, papers and reflections, including the Foundation Paper, and the conclusions and recommendations regarding each of the key issues. It also presents a revised set of principles (reflecting what was learned in the process) and a series of ten core recommendations. The process used to develop the EEWG reports is illustrated in the following Figure.

**Process Used by the EEWG**



This Report does not seek to provide a full summary of each of the studies and papers, as each of those is available for review.<sup>2</sup> The purpose here is only to establish the context for the recommendations.

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<sup>2</sup> To streamline the presentation, the information presented in this Report is not referenced; however, original sources for facts and figures are identified in the Foundation Paper and relevant Issue Papers.

## 2. FOUNDATION

Energy efficiency is the use of less energy for the same productive activity. This is distinguished from energy conservation that involves a reduced demand for energy services. Both are affected by a variety of factors, including:

- Consumer awareness of energy use and options to reduce their consumption and willingness to adopt those measures
- Energy prices and the demand response to price
- Progress of technology and development of standards, including the cost of energy efficient options
- Public policy instruments, such as regulations, market instruments, fiscal/tax regime, incentives, and information dissemination
- Culture of decision-making by individuals and firms
- Capacity of professions and trades to deliver energy efficiency services

### Trends

Energy use in Canada increased by 23 percent from 1990–2004. The increase was driven by a 33 percent increase in economic output, offset by an increase in economy-wide energy efficiency of 13 percent over the same period. Canada has the highest population growth rate among G8 countries and this, along with increased economic activity (particularly in resource sectors), is driving much of the growth in energy use.

The highest-level picture is one of increasing technical efficiency combined with greater demand for movement of goods and people, for residential and commercial services and for industrial output of all kinds, including especially energy itself. That is, new machines, buildings, vehicles, and industrial processes tend to be more efficient than old ones, and average EE is increasing as old replaces new. However the energy consumption effect of economic/population growth and greater output is greater than the effect of better technical efficiency and so total energy consumption continues to grow.

### Institutional Landscape

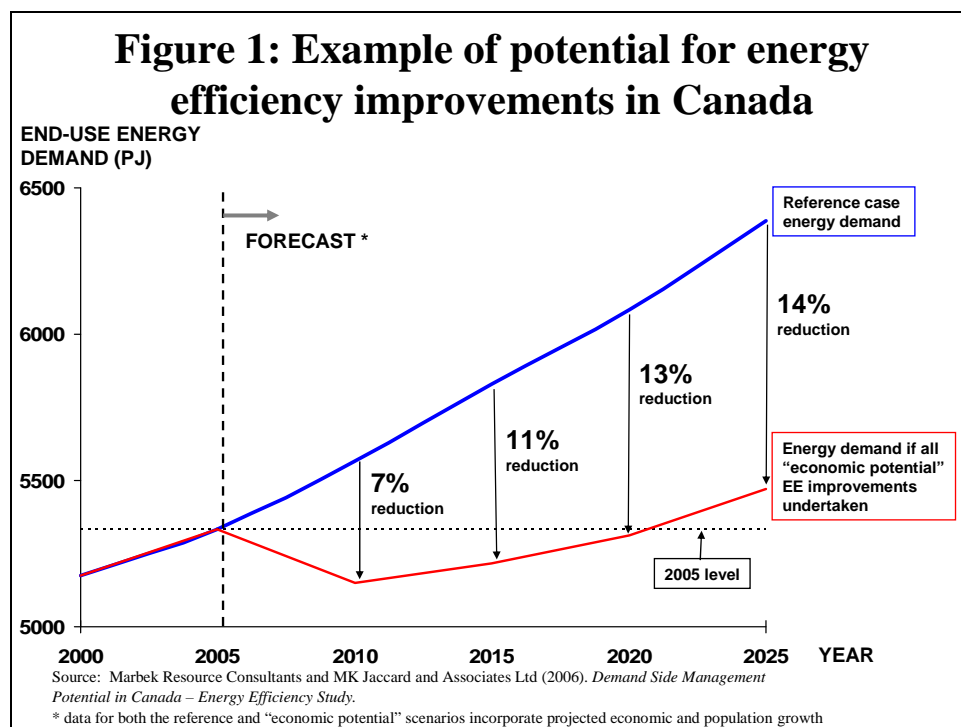
Government bodies at all levels have substantial roles in EE policy and implementation. Natural Resources Canada is the lead federal agency. Other federal agencies include the Canada Mortgage and Housing Corporation (CMHC), the National Research Council (NRC), Transport Canada, Environment Canada, the National Round Table on the Environment and the Economy (NRTEE), and Sustainable Development Technology Canada (SDTC). Canada also belongs to international agencies, notably the International Energy Agency.

Provinces and territories typically have a ministry responsible for energy that develops overall policy and runs programs. Some provinces also have arms length energy efficiency agencies that promote the concept, and in some cases, deliver programs. However, many aspects affecting energy efficiency are split among several ministries – finance, local governments, housing, codes, environment, transport, etc. In most provinces, gas and electric utilities play an important

role, through implementation of various forms of Demand-Side Management (DSM) programs. The extent to which this happens often depends on the mandate and policies of utility regulators.

## Potential

Results of studies estimating the potential energy efficiency improvements of proven technologies and practices in various sectors of the Canadian economy typically estimate that energy demand could be 10 to 20 percent lower than baseline projected levels over the next 20 years, if all economically viable energy efficiency investments are undertaken (see Figure 1, below). When possibilities for future technology advancement, broader policy development and changes in behaviour are considered, the potential for energy efficiency improvement is even greater.



## Barriers and Opportunities

Among the many barriers to EE are: lack of a long-term price signal that reflects the long-run marginal cost of infrastructure and services including the externalities associated with them, lack of information, lack of access to capital, misplaced incentives, flaws in market structure, performance uncertainties, transaction costs, limited professional and trade capability, split jurisdiction among governments, consumer misperception about required lifestyle changes, and product unavailability. Some barriers are clearly “market failures”, where a precondition for economically-efficient decision-making is absent. However, there is a range of views on the other barriers, and therefore on the need for policies to overcome them. There are also different views on the effectiveness of programs that have been used to implement those policies.

Governments have a range of policy instruments to overcome barriers: regulation, program spending, fiscal policy, labour market policy, utility regulatory regimes, market instruments, leadership and procurement policies, training and capability building, and information and suasion. Different types of instruments may be appropriate, depending on the maturity of technologies and practices. In general, use of a well coordinated set of policies of all types is needed to be effective.

### 3. PRINCIPLES

The EEWG believes that the following principles can help guide government energy efficiency policy in Canada. These principles have been applied to the development of the conclusions and recommendations that follow.<sup>3</sup>

- **The Role of Prices.** Clear price signals should be the starting point but price alone may not be sufficient. To the extent that energy prices reflect full social and environmental costs, consumers and investors will be given an incentive to improve EE.
- **Multiple instruments.** Different market actors respond in different ways to policy instruments. No single tool provides a complete solution to improve energy efficiency. Rather a variety of tools that complement each other is required, including: standards, taxes, incentives, regulations, government procurement, public education, and R&D.
- **Make Strategic Choices.** Program resources should be targeted to achieve the greatest efficiency and effectiveness, while taking into account sectoral coverage and finding the appropriate balance between short-term and long-term efforts. Strategies should identify the key approaches and outcomes that matter most and that will guide program and policy design.
- **Seek Market Transformation.** The objective should be to achieve changes in products and practices that eventually become self-sustaining and do not depend on ongoing government programs.
- **Know your Market.** Instruments should be designed to respond to market conditions and motivate key actors. This means gaining an appreciation for the level of awareness and understanding of key players through adequate market research. Markets can be both "pulled" and "pushed" towards greater efficiency, with the emphasis often depending on the maturity of the applicable technologies and practices.
- **Develop Capacity.** Programs should seek to increase the technical and human capacity of the energy efficiency industry to realize improvements.
- **Measure to Manage.** Measurement and evaluation are both essential to successful energy efficiency measures. Information is needed to set objectives, measure and report performance and co-benefits, understand trends, and take corrective action. Measurement approaches should balance the needs with the cost of providing the information.
- **Commit long term.** Market transformation can take time. Long term policy and program signals allow markets to transform efficiently, and contribute to institutionalizing a culture of energy efficiency and sustainability. Therefore,

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<sup>3</sup> Note also that the earlier version of these principles was used by the Council of Energy Ministers in developing the principles for *Moving Forward on Energy Efficiency in Canada: A Foundation for Action*.

governments should be prepared to sustain policy initiatives over extended periods to ensure the coherence of short term actions.

- **Learn from and Share Experience.** Policies and programs should take into account the wealth of best practice experience gained over the past thirty years. Domestic and international experience also needs to be drawn upon. As markets transform, efficiency programs need to be transformed accordingly. Similarly, jurisdictions should add to the shared body of knowledge by making available program results and evaluations.
- **Ensure Equity.** Some programs may apply differently or have different effects on different market segments. In these cases, it may be necessary to protect the interests of, or compensate those segments that stand to lose disproportionately.

## 4. CORE RECOMMENDATIONS

To support transformation of the market and enable Canada to become a leader in the efficient use of energy, the EEWG recommends that all orders of government, utilities and other appropriate entities work together and consider funding and implementing the following actions pertaining to energy efficiency policies, programs and regulations. The EEWG has identified five priority recommendations, which are interdependent and critical for an overall energy efficiency strategy in Canada. In no particular order, they are:

- **Strategy and Targets** – develop and implement comprehensive energy efficiency strategies based on research/analysis that starts from visionary goals, and considers quantified studies of energy efficiency potential. Strategies should be clearly costed include priority actions, a portfolio of key approaches, a sustainable financing and human resource plan, tactical targets with clear accountabilities, and provision for measurement and evaluation. Measurement and evaluation is key, not only for programs, but also for technologies. Evaluation results should be applied to improve, complete or sunset energy efficiency policy programs and technology initiatives and to broadly communicate progress on energy efficiency improvements. Separate but coordinated strategies should be established for different sectors given the differences in drivers for, and players in each – industry, buildings, transportation, local governments and senior government operations.
- **Price Signals** – energy prices in all sectors should reflect the cost of providing services plus the external social costs (including the environmental consequences of energy production and use). Prices for service provision should be anchored in sound economic principles and best international practices, in incorporating appropriately the incremental (or marginal) costs of capital and operations, and providing for capital replacement by methods that least distort choices among types of services. Reliable monetary estimates of external social costs should be incorporated through surcharges by governments, with prudent use of the resulting additional revenues (e.g., reducing other forms of distorting taxation). To the extent that the resulting prices exacerbate problems of energy poverty for low-income households and of competitiveness on the production side of the economy, governments are encouraged to address these concerns through other policy instruments that do not distort or dampen energy price signals.
- **Urban Design** – adequately resource a portfolio of appropriately-scaled demonstration projects across Canada that are defined around an urban space, rather than individual sectors (e.g., transport, buildings, industry), with an aim to learn what works on a community scale. This will allow multiple players to develop business cases to optimize the use of existing infrastructure, address all sector needs (housing, transportation, commerce and industry), identify cross-sectoral synergies (e.g., industrial energy waste to heat buildings) and deliver more compact and complete communities. The demonstrations need to engage local governments with energy distributors and leverage the expertise of multiple players. Since municipalities play a key role in urban design, governments need to work together to ensure that the appropriate orders of government are sufficiently resourced and accountable to ensure action.

- **Training, Knowledge and Skills** – develop and deliver capacity-building efforts that:
  - build and maintain a qualified labour pool across the value chain (e.g. building designers, trades, building operators, energy managers),
  - establish a network of centres of excellence in energy efficiency technology/R&D (key component is knowledge transfer), and
  - build capacity for smart program and policy design within governments, utilities and other agencies (including key program design consideration such as social marketing methods, permanent market transformation toward efficient products and services, free drivers and riders, etc).
- **Minimum and Enhanced Standards** – accelerate progress in the cycle from voluntary/enhanced standards to regulated minimum requirements and the establishment of new more aggressive enhanced standards. In doing so, governments should consider expanding the use of regulated minimum standards in buildings, industry, equipment and transportation (including fleets) supported as necessary by information, leadership, capacity building and incentive programs that support increased market momentum and transformation.

The following recommendations, in no particular order, were also identified by the EEWG as important areas to consider when designing energy efficiency policies, programs and resources:

- **Energy Poverty and Equity** – undertake energy efficiency initiatives targeted towards low-income populations that are generally not able to participate in current demand-side management programs due to lack of capital, rental housing and other reasons. These initiatives should be developed jointly with housing, health and welfare organizations, in recognition of potential co-benefits, and should also support the generation and publication of statistics on energy costs and income.
- **Demand-Side Management (DSM) Delivery** – support or regulate the goal to achieve the upper DSM potential over a period of time (e.g., 10 years) by establishing performance-based policy by governments and providing the necessary tools and resources to improve energy efficiency by utilities or appropriate agencies in each province and territory.
- **Coordinated Policies and Programs** – use a comprehensive approach to energy efficiency strategy that accelerates energy efficiency market transformation, combining identification, reward and preferential procurement of best practice with capability building – followed up by ratcheting up standards and codes. Establish a cross-jurisdictional inter-agency mechanism, to share learning and best practices, and encourage partnerships, to best use limited resources. The results of monitoring these coordinated policies and programs need to be evaluated frequently, to adjust program design and terminate ineffective programs.
- **Financing** – support innovative financing mechanisms such as revolving funds, green credit instruments, etc. to increase access to capital for energy efficiency. This support

could include direct financial contributions, analytical support, raising awareness and providing education about the use of such instruments. It would involve work with the financial sector, industry associations, utilities and others to develop mechanisms that are well aligned with the marketplace and consumer needs.

## 5. ENERGY EFFICIENCY TARGETS

The use of goals, objectives and targets has been a part of modern performance management practices of business for many years, and is increasingly being used by governments.

In today's discourse, the word "target" has several different connotations, leading to misunderstanding or misapplication. Sometimes a descriptive word is added such as "visionary", "long- or short-term", "strategic or tactical", "voluntary or mandatory", "hard or soft", "internal", "stretch" or "management" to better explain the nature of the target which often leads to further misunderstanding. Furthermore, the use of targets has been criticized in some instances.

The purpose of the paper *Energy efficiency targets* was to review why targets are used, define the different types of targets, the appropriate use of these target types and the nature of the target setting process with the belief that, with a better understanding, the use of targets can be improved.

### Conclusions

- Targets are set by an organization to motivate, challenge, and direct the effort of participants (employees, citizens). They are also used increasingly by governments to improve the accountability and effectiveness of departments and agencies.
- Tactical (short-term) and visionary (long-term) targets are not substitutes; rather, they are complements and both should be part of any energy efficiency initiative.
- Absolute and intensity targets can be equally stringent. The difference is that the former implies certainty of outcome, whereas the later implies certainty of effort.
- Development of an implementation strategy provides the link between a visionary target and a tactical target.
- To be credible, tactical targets need accountability (i.e. need to be owned by someone).

### Recommendations

- Visionary targets should guide the development of comprehensive sectoral and multi-sectoral strategies that will meet these targets, and which in turn should lead to a selection of programs with tactical targets that are practical, short-term, "stretch" but achievable. Specific organizations and individuals should be accountable for achieving these tactical targets.
- Tactical targets should be reviewed at regular intervals in order to take into account the accumulation of experience and new knowledge.
- When targets are expressed in terms of intensity the "denominator" must be provided - that is, an answer to the question: per unit of what?

## 6. PERSONAL DRIVERS FOR ENERGY EFFICIENCY

Surveys and case studies show that personal decisions around energy efficiency are not solely based on financial considerations. Most people do not estimate discounted cash flow or payback in arriving at their decisions, or even consider energy efficiency to be a financial investment. The evidence also suggests that factual information is in itself of relatively little effect, and that individuals' attitudes about environmental and social aspects of energy use are only weakly correlated to behaviour: concern alone does not result in conservation activity.

The purpose of the paper *Personal drivers for energy efficiency* was to explore the complex set of drivers that motivate people to make decisions about energy efficiency and the ways that they can be harnessed to affect behaviour.

### Conclusions

- Energy is consumed not for its own sake but for the provision of valuable services. To understand how and why individuals consume energy we must understand human nature, personal values, and cultural, geographic and legal context.
- Personal energy-efficient behaviours function at different scales: they involve big-ticket purchases such as housing retrofits or vehicle acquisitions, that cannot easily be reversed, but also minor purchases such as CFL bulbs, and daily use decisions such as thermostat settings or taking a motor vehicle to a nearby convenience store. If energy-efficiency is to be linked to life-style and social values, then an integrated appreciation of both large and small personal actions is essential.
- The direct benefits of particular energy-efficiency “messages”, be they explicit (e.g. from public information) or implicit (e.g. from incentive programs or opinion leaders), may sometimes be difficult to demonstrate. However, a critical mass of such messages may yield indirect benefits on related current behaviours and on future behaviours, especially through the shifting of social norms.
- Isolated policies that governments and utilities use to motivate individuals to adopt energy efficiency, such as incentives and information, and exhortation, may not always work effectively.

### Recommendations

- To promote energy efficiency, proponents should adopt a more sophisticated approach. This means linking energy efficiency with other social values such as aversion to waste, status, technological sophistication, environmental stewardship and/or energy security.
- Proponents need well-designed, multi-faceted programs that make use of the full array of policy instruments to nurture changes in behaviour over the long term.

- Proponents should use social marketing techniques to build consensus on the need for more coercive approaches in the future (e.g. follow the example of the anti-smoking strategy). Energy efficiency efforts should also be integrated with broader social change initiatives (e.g., tackling climate change); energy issues on their own often are of insufficient profile to sway the public toward conservation.
- Organizations responsible for program design need resources to study target audiences in order to find out what drives their behaviour in relation to energy efficiency, what messages to use, and how to deliver them.

## 7. ENERGY EFFICIENCY DECISION-MAKING IN THE CORPORATE SECTOR

Conventional financial models are considered more applicable to energy-related decisions by commercial interests such as manufacturers, property owners, service providers and retailers, than those of individuals. However, corporate decisions regarding investment choices, whether energy related or not, are based on a number of factors such as capital availability/allocation and strategic priorities, as well as financial payback. These factors appear as barriers to the implementation of some energy investments with apparent high financial returns.

The paper *Energy efficiency decision-making in the corporate sector* looked at the context for energy management decisions in the corporate sector, including the criteria, constraints and drivers for these decisions, and the barriers that prevent optimal investment in energy management. For the purposes of this paper, the corporate sector included industry and commerce but these were examined separately.

### Conclusions

- Although it is unrealistic to expect companies to adopt all the available best practices instantly, many energy efficiency opportunities remain untapped.
- The split incentive between tenants and owners is a serious barrier that stands in the way of energy management initiatives. For example, the building owner and/or manager is responsible for capital improvements that could improve energy efficiency, but the tenant/lessee pays the energy bills and would thus benefit from efficiency improvements.
- Energy projects do not differ much from other improvement projects. Budgets are limited and only those with the best business case are selected.
- In Industry, many initiatives are implemented by operations staff and not necessarily at the senior management level. This should be recognized in choosing mechanisms to trigger interest in energy management programs.

### Recommendations

- Approaches and tools (e.g. new standard lease agreements, mandatory energy labelling of buildings and/or possibly regulations) should be developed to overcome the split incentive and provide incentives for both tenants and owners to undertake energy management initiatives in commercial buildings.
- Tools (e.g. training, models, examples, templates, etc.) should be developed to make it easier to present compelling business cases for energy management investments.
- Greater use of energy management systems should be encouraged, including measurement and reporting of energy performance.

- Programs should be designed and targeted carefully to specific audiences (e.g. ranging from the sophisticated energy manager in large energy consuming companies, to the relatively uninitiated small business owner). Governments and/or utilities need to understand the nature of the barriers that are preventing optimal investments and tailor programs accordingly.

## 8. LONG-TERM ENERGY EFFICIENCY POTENTIAL OF URBAN DESIGN

It is widely accepted that the form of cities – including land uses, zoning, densities and infrastructure design – is one of the key parameters in defining a sustainable society. Recent energy price increases have led to speculation about a rapid, even abrupt reversal of the flight to suburbs that has dominated the post World-War II period. However energy planning is notably absent from almost all municipal and regional plans in Canada, even though local governments could, in many cases, be the most effective delivery agents of energy efficiency programs. This presents a special challenge because Canada's population is growing, and Canada is one of the most urbanized countries in the world.

The paper *Long-term potential in urban design* reviewed current research on the relationship between urban form and energy consumption, emphasizing long term possibilities and short term constraints. It examined how decisions in the coming decades could alter that form. The paper considered the potential for improved design, densification, mixed use and integrated policies, as well as the barriers to such approaches and potential elements of a strategy to overcome them. It also identified areas for further exploration and development.

### Conclusions

- Canada over the course of the latter part of the 20th century became a predominately urban society. The shift in population is likely to continue into the 21st century with most of the growth in population coming from immigrants who primarily want to live in our major urban centres.
- Despite demographic changes, demand for detached houses remains strong. This comes with increasing automobile dependency and increased suburb to suburb travel.
- The urban design that we are creating has a complex but significant impact on the energy efficiency of our growing society and the associated emissions. The potential for greater energy efficiency is substantial, because of the high proportion of the built environment that will be newly constructed or renovated in the coming decades. The design choices made, good or bad, will have enduring consequences because of the long lifetimes of infrastructure and buildings. In addition, a cross-sectoral approach to urban energy efficiency planning could unleash profitable synergies that are currently untapped – e.g., using industrial waste heat for space heating of adjacent buildings.
- There are good examples in Canada of complete communities that have higher density, use mixed zoning, provide good public and alternative transportation, and use an integrated approach to energy supply and use, but these examples are not widespread.
- Changing urban design in a way that will radically reduce energy consumption is itself a long term proposition. This is because of the limited windows of opportunity that occur for initial construction or replacement, as well as entrenched consumer preferences expectations and desires, constraints caused by existing infrastructures, and inherited habits and lifestyles.

- Many stakeholders will have to work together for changes to be implemented, including: planners, property developers, engineers, energy distributors, politicians, etc. Solutions also need to be integrated across systems and sectors (i.e. energy, water, wastewater, transportation, communications, housing, commercial and institutional).
- While the situation varies throughout Canada, the mix of federal, provincial/territorial and municipal jurisdictions over urban infrastructure (including energy distribution systems) is often incompatible with cohesive approaches to energy efficiency. The paper identified, in particular, the need to rationalise provincial and municipal powers, requiring provinces to adopt strategic directions that encourage a “culture change” favouring integrated energy planning at the community level.

## Recommendations

- Local governments (Municipalities, Regional Districts, First Nations) need a minimum set of legal tools to undertake energy planning at the community level. Where necessary, this involves providing municipalities with the option, but not the obligation, to regulate areas of traditional provincial responsibility.
- Since municipalities play a key role in urban design, governments need to work together to ensure that the appropriate orders of government are sufficiently resourced and accountable to ensure action for the shifting demographics and the changing and growing energy, service and transportation needs of urban populations.
- The different orders of government should collaborate more, agree on the most appropriate planning/design approaches and means to facilitate them, primarily for implementation at the urban community level, where the complexities of energy-efficient urban design are best tackled.
- Decision makers, planners and the general public should be made more aware and be educated about the potential for urban design to either drive energy efficiency or to lead to ever growing energy demand.
- Governments at all levels should highlight and promote the co-benefits of good planning: liveability, environmental protection, efficient land-use, safety and health benefits for citizens, accident reduction, cost-savings, etc.
- In order to progress on design, density and integration, governments need to promote behavioural change and build support for difficult policies. Additional funding of research directed at these issues, should be one element of the approach.
- Change will require appropriate price signals, incentives, a reduced emphasis on capital versus on-going costs and the resolution of split jurisdictions.

## 9. ENERGY EFFICIENCY AND ENERGY AFFORDABILITY

Many low-income households in Canada pay a large proportion of their budget in energy bills and are vulnerable to financial hardship and adverse comfort and health outcomes as rates increase. At the same time, low-income households are a highly cost-effective target audience for energy efficiency investment by governments and utilities. Furthermore there are a host of economic and social co-benefits to be gained from energy efficiency investments in low-income housing, provided that programs and objectives are coordinated.

The paper *Energy efficiency and energy affordability for low-income households* examined different perspectives on the issue and different program examples to develop key considerations for program design and implementation.

### Conclusions

- The lack of energy affordability creates serious hardships and health risks for low income families. Energy efficiency can play a vital role in eliminating energy poverty and improving the social and economic well-being of these families at risk.
- Energy efficiency programs directed at low-income households can deliver multiple benefits, including energy conservation and improved social welfare.
- This creates opportunities for collaboration and opportunities for greater program leverage, but it complicates the assignment of accountability and makes it harder to identify a clear lead organization.
- Low-income households are less likely to undertake energy efficiency investments in the absence of programs and are therefore less likely to be free riders.

### Recommendations

- Energy departments at the federal and provincial levels should develop a joint strategy with agencies focused on housing, health and welfare.
- Elements to include in an energy affordability strategy include:
  - A review of existing social programs to identify opportunities for energy efficiency
  - Energy efficiency standards for affordable housing
  - Joint funding from ratepayers and taxpayers for energy efficiency investments
  - A particular focus on the opportunities from improving housing stock in First Nations communities, especially in regions of extreme climate.

## 10. INSTITUTIONAL AND REGULATORY BARRIERS TO UTILITY DEMAND-SIDE MANAGEMENT

The current structure of electricity and natural gas markets in most Canadian jurisdictions creates disincentives for the implementation of energy Demand-Side Management (DSM) programs. In simple terms, when utility revenues are linked to the amount of energy sold, it is difficult to justify programs that reduce sales of energy, even when this is in the interest of consumers and society as a whole. Fortunately, there are a number of ways that governments, regulators and utilities themselves can overcome these barriers.

The paper *Institutional and regulatory barriers to utility demand-side management in Canada* examined the nature of the regulatory frameworks and institutional structures in place in three representative Canadian jurisdictions (British Columbia, Alberta and Ontario) in order to identify a series of barriers and opportunities. The list of barriers to utility demand-side management is long and varied, and is explored in detail in the issue paper.

### Conclusions

- Demand-side management programs of utilities, government or other parties can play an important role in both resource acquisition and market transformation.
- In many instances, choosing conservation and demand-side management is much less expensive than building new generation facilities, and is even more appealing when societal costs are factored in.
- Given the right framework, DSM programs can serve multiple interests, including those of customers, utilities, and governments.
- Realization of the benefits requires a consistent and predictable policy framework.
- DSM programs will face political and/or regulatory opposition to higher rates (despite lower ratepayer costs on average) unless they address the energy demand of consumers who are unable to participate in traditional rebate-type programs (e.g., low-income and rental housing).
- Many jurisdictions have found ways to overcome barriers, by introducing regulatory incentives or mandating publicly-owned utilities to take an integrated approach to planning.
- If utilities are to play a significant role, there needs to be a mechanism to sustainably fund the programs, to compensate for lost revenue and to reward performance.

**Recommendations**

- To achieve their DSM potential, each province and territory needs to establish a supportive regulatory environment for utilities and others to invest in programs and/or establish long-term investments in third party driven programs.
- Governments can facilitate continuity of DSM programs and alleviate many barriers by setting or supporting long-term targets, coordinating efforts among multiple players and ensuring that utilities can recover program costs and compensate for lost revenues, while being rewarded for minimizing costs and maximizing performance.
- Governments should support the use of partnership-oriented, multi-faceted delivery mechanisms that vary by location or target audience, to ensure that performance results are market driven, and therefore innovation and competitiveness result.
- Alternatives to funding utility DSM from distribution rates should be considered, including levies on the energy commodities themselves.
- A broad measure of cost effectiveness should be used (including the Total Resource Cost test (TRC) that incorporates externalities). However the selection of DSM programs should also consider equity concerns and the impacts on various classes of ratepayers.
- The Federal government could facilitate the realization of DSM opportunities by working with provinces to disseminate best practices and to further evaluate the potential mechanisms and delivery agents.

## 11. VOLUNTARY ADVANCED STANDARDS AND LABELS

While regulated minimum energy performance standards "push" the market towards better energy efficiency, voluntary advanced energy performance standards (and associated labels, known as endorsement labels) "pull" the market towards better energy efficiency. The utilization of advanced standards and labelling is increasingly seen as a cost-effective and flexible policy instrument that can promote energy efficiency outcomes, prior to or in place of additional regulations.

The paper *Voluntary advanced standards and labels* examined the characteristics of advanced standards and labelling and the key players in their development and use. It explored some examples of their application in the equipment, buildings and transportation sectors (e.g. Energy Star and LEED) and identified some lessons for the planning of energy efficiency program portfolios, for the design of energy efficiency programs, for their implementation and evaluation. The focus was on the use of voluntary standards and endorsement labels, however the paper also examined mandatory comparative labelling, associated with endorsement labels.

### Conclusions

- Voluntary advanced standards and associated labels (known as endorsement labels such as Energy Star) are potentially important components of a complete portfolio of policy instruments to promote energy efficiency, as they provide a simple mechanism for consumers to choose the most efficiency option within a class of energy using products or services.
- There are a variety of options available in designing certification standards and labelling programs.
- The effectiveness of these programs can be measured in various ways but the incremental impact on energy consumption is ultimately what matters. In some cases, this impact can be indirect as opposed to direct.
- Brand names are important in establishing the value of a label.

### Recommendations

- Voluntary advanced standards and associated labels should be considered for all sectors to allow for early adoption of the most efficient products and services by consumers.
- For voluntary programs, it is important to use a participative and consensus-based approach for establishing efficiency benchmarks, involving key stakeholders in the design process.
- The stringency of advanced standards needs to be determined carefully. Such standards need to confer a "seal of approval" of best practices that is meaningful but they also need

to be achievable at a reasonable cost. They should be updated on a regular basis to reflect changing technology and markets.

- Standards and labels must be accompanied by a credible conformity assessment system. The system should be as simple and cost-effective as possible and provide early feedback to applicants on eligibility. If there is already a compliance system for regulated minimum standards, it may be helpful to leverage this system to assess conformity to the advanced standard.
- Standards and labels should be supported by targeted, consistent and sustained marketing and education. This should recognise the stages of product search at which labels and efficiency branding can be influential, and should be leveraged by other incentive programs.

## 12. FACTORS AFFECTING THE IMPACTS OF ENERGY EFFICIENCY INCENTIVES

The effectiveness of energy efficiency programs and policies can be, influenced by a number of economic and behavioural factors, including:

- Free rider effect: where some participants were already planning to improve efficiency without the program
- Spill-over effect: where others not targeted by the program take action on energy efficiency because of the program
- Rebound effect: where a participant might increase energy-consuming activity after acquiring equipment with improved energy-efficiency, or go back to non-efficient practices or products when the program is over
- Leakage effect: where energy savings may be used to increase energy use in other areas

Developing an understanding of these factors will increase the likelihood of designing better programs and implementing better policies.

The paper *Factors affecting the impact of energy efficiency incentives* examined the different manifestations of these effects in different sectors and attempted to identify lessons for portfolio planning, for the planning, design and implementation of energy efficiency programs, and for their evaluation.

### Conclusions

- Free ridership is likely to occur in most programs, with the possible exception of those targeting low-income consumers, but its magnitude will vary.
- Spill-over is a real effect that can often offset some free ridership. Ultimately, enough spill-over means that the market is transformed and minimum standards and codes can be ratcheted up to the next level. Spill-over is also highly variable.
- Rebound and leakage effects will erode some of the energy savings from energy efficiency programs, but most of the savings are likely to remain. Accelerated improvements in minimum standards and codes can eliminate the rebound effect.
- Measurement of these effects is difficult and costly, however, the effectiveness claims of energy efficiency programs depends on the completion of credible evaluations, or design features that ensure they are not an issue.
- Program objectives, measurement and reporting techniques, parameters included and analytical depth vary widely; however jurisdictional comparisons of policy / program effectiveness can be informative, if done carefully.

- The appropriate interpretation of the effects depends on the frame of reference and the objectives of the program, which may include: energy conservation, energy efficiency, equity, and/or market transformation.

## **Recommendations**

- Programs should be targeted to products that are less susceptible to free riders and should be designed to minimize the effect. Free ridership should be accounted for in ex-ante and ex-post evaluations.
- The rebound effect and any associated social cost should be considered in portfolio planning.
- An alternative approach to address such challenges would be to design incentive programs to be adaptable – as free ridership/rebound/leakage effects increase, programs can be adapted to lower such effects.
- To minimize leakage, programs should be harmonized between jurisdictions and a life-cycle approach to portfolio planning should be adopted.
- Organizations and jurisdictions should collaborate in developing evaluation best practices and in researching the impact of indirect, economy-wide and longer-term cumulative effects including shifts in social norms.
- Judicious and informed consideration of results from evaluations is required. It is important to distinguish contextual factors, over which there is little control, from program design factors that may be improved.
- Behavioural and market factors should be considered in the context of the overall policy / program objectives and evaluation framework. Consideration should be given to multiple societal goals, including:
  - Increasing energy efficiency
  - Reducing energy end-use consumption
  - Promoting equity
  - Market transformation.

### 13. AREAS OF FUTURE RESEARCH

In the course of its work, the EEWG identified a number of areas of research that could not be pursued within the available time and resources. The members recommend that governments examine these areas further:

- **Energy Efficiency Industry Definition and Potential.** The EEWG considered evidence that investments in energy efficiency are good for the economy as well as the environment. In particular, the group noted the potential gains in productivity and competitiveness and the potential birth of a new "energy efficiency industry" with a number of professions, trades, companies, and key associations. However, the group was not able to investigate in any detail the nature and scale of this new industry. An industry "Roadmap" is needed. Using as a starting point the energy efficiency potential, it should be possible to develop estimates of the size of the energy efficiency effort and the resulting cost savings to businesses and consumers. This should allow the development of a profile of the needs and estimates of the potential size of the industry, its revenue generating potential, and the overall effect on GDP and employment. Following that, monitoring of the health of the industry should be feasible.
- **DSM Regulatory Models.** The EEWG examined DSM regulatory and institutional frameworks in three provinces. However, it would be instructive to examine and compare the practice and experience in other Canadian jurisdictions (e.g. Québec) and internationally (e.g. California, Vermont and the U.K.).
- **Transportation – Energy Efficiency Potential.** The EEWG was able to draw on numerous studies of the energy efficiency potential for buildings, residences and industry. However, there is no equivalent body of knowledge concerning the potential in the transportation sector. The work of the Climate Change Transportation Table in the late 1990s provides the most relevant information, but its focus was on reducing greenhouse gases and the information is becoming dated. It should be possible to use the approaches developed by the other sectors, together with the transportation information being gathered by the federal and provincial governments, to estimate the technical, economic and achievable potential under various scenarios.
- **Evaluation Methodologies and Criteria.** The EEWG observed that there is a lively debate about the true impact of energy efficiency programs, and that frameworks, approaches and estimates for the effect of free ridership, spill-over, rebound and leakage vary enormously. As a foundation for good public policy, it is important that the methodologies and criteria used for evaluation be improved, be made more systematic and be standardized to a greater degree. Various agencies and jurisdictions in Canada are already investing significant resources and effort in this respect; however the EEWG believes that all governments should take a bigger stake in assuring the availability and credibility of information on energy efficiency program results. And in view of the emphasis we would like to place on learning from the experience of others, the EEWG believes it is crucial that governments commit to the publication of evaluation results.

- **Feedback to Individual Energy Users.** The EEWG observed and applauds trends towards the provision of more detailed information on energy use to individuals and firms. On the one hand these include direct feedback on energy consumption through technologies like multi-sector smart metering. On the other, they include feedback on energy embedded in products and services consumed, through product labelling or information provided by companies in annual reports. Such trends might accelerate naturally in a marketplace more concerned about energy consumption, or might be promoted by government action. The EEWG was not able to examine the implications of these developments, but believes that governments should develop a more complete understanding of their potential to drive energy decision-making and the associated opportunities and threats.
- **Implementing Price Changes.** The EEWG identified the primary importance of prices in driving energy efficiency (e.g. using step rates, marginal cost pricing). At the same time, the group has also noted the difficulties that governments face in finding practical and politically acceptable ways to affect prices (e.g. how to overcome concerns about additional taxation and how to utilize the windfall revenues generated through revised fees or new taxes). The EEWG believes that governments would benefit from a comprehensive examination of the appropriate methods for pricing, based on full costs of service provision and externalities, and influencing energy demand, best practices internationally, and approaches to build a broad societal consensus on how this can be implemented while avoiding (or compensating for) disproportionate adverse impacts on particular segments of industry or society.
- **Energy Poverty.** The EEWG examined the issue of energy poverty but was hampered by the lack of a clear definition of the phenomenon and a good assessment of its social, economic and environmental implications. In particular, there is a paucity of information on how lower income households make decisions about energy use and how their situation would be affected by different energy efficiency policies.
- **Urban Design.** The EEWG debated various models of urban design and the links between models and the energy efficiency of buildings, industry and transportation. While recommending that governments invest in demonstration projects of integrated community design (see Section 4), the group also noted the need to back this up with a better understanding of the potential energy efficiency gains (e.g. from specific urban forms or community features). In particular, the group noted a need for a better understanding of the potential for integrated community energy systems and the implications of greater use of plug-in hybrid, electric, hydrogen or fuel-cell vehicles in urban settings.
- **Market Oriented Regulations to Drive Energy Efficiency in the Built Environment.** Research suggests that market-oriented regulations (e.g. niche market regulations, portfolio standards and trading) can be powerful tools for market transformation. For example, evidence indicates that the California low emission car regulation, a niche market regulation, has resulted in a significant growth in the hybrid car market. The EEWG believes that further study should be undertaken to determine if market-oriented

regulations could be used to increase energy efficiency in the built environment (e.g., low-emission niche market regulation for new buildings, a super-high efficiency niche market regulation for appliances, or an energy efficiency portfolio standard with trading regime).

**APPENDIX A**  
**Membership of EEWG**

### Energy Efficiency Working Group Membership List

Name	Affiliation to ESST	Organization	Type of Organization	Region
Marlo Reynolds - Co-chair	Member	Executive Director Pembina Institute	Civil Society	Alberta
Michael Cleland - Co-chair (resigned in January 2007)	Member	President and CEO Canadian Gas Association	Industry	Ontario
Suzanne Leblanc - Co-chair	Member	Vice-President SNC-Lavalin	Industry	Quebec
Peter Cooke	Other	Senior Advisor Lafarge Canada, Inc.	Industry	Quebec
Darwin Curtis	Other	Director, Energy Demand Management Government of New Brunswick	Government	N.B.
Martin Lee-Gosselin	Other	Professor Université Laval	Civil Society	Quebec
Simon Knight	Other	President and CEO Climate Change Central	Government/Civil Society	Alberta
John Lawson	Other	Research Associate Centre for Transportation Studies University of British Columbia	Civil Society	Ontario
Peter Love (replaced by Julia McNally in May 2007)	Member's Representative	Chief Energy Conservation Officer Ontario Power Authority	Government	Ontario
Margaret McCuaig-Johnston	Member's Representative	Assistant Deputy Minister Natural Resources Canada	Government	National
Thomas Mueller	Other	President Green Building Council	Industry/Civil Society	B.C.
Peter Ormond	Other	Conservator Society of Hamilton and District	Civil Society	Ontario
Andrew Pape-Salmon	Other	Electricity & Alternative Energy Division Government of British Columbia	Government	B.C.
André Plourde	Member	Chair, Department of Economics University of Alberta	Civil Society	Alberta