Creating a Culture of Conservation in Ontario: Approaches, Challenges and Opportunities

Steven J. Norrie and Peter Love

Abstract – **Ontario has a long history of affordable and reliable electric power that has supported the development of an energy-intensive industrialized society. Electricity sector restructuring, with the breakup of Ontario Hydro in 1998, followed by the re-introduction of central power system planning in 2005, has given Ontario an opportunity to reshape its electricity supply mix with conservation as a priority. However, there are many challenges to transitioning from almost 100 years of supply-side focus to demand-side planning. These challenges include overcoming barriers to resource acquisition through incentives, building capability in the market for delivery and uptake of conservation, and transforming the market so that energy-efficiency becomes the norm. These barriers can be overcome by catalyzing changes in consumer attitudes and behaviours and using incentives and regulations to support lasting cultural change. Although Ontario has made progress in advancing a culture of conservation, much more work needs to be done.**

Index Terms – **Energy conservation, energy management**

I. Introduction

IN 2006, the Canadian province of Ontario made a commitment to demand-side management (DSM)[1] as a priority for meeting Ontario's long-term electricity needs. At this time, the provincial government established electricity conservation targets to meet approximately 75% of Ontario's peak electricity demand growth through DSM by 2025. The government has also called for the establishment of a "culture of conservation" [1]-[2]. These targets are very ambitious compared to other North American jurisdictions. By comparison, a U.S. study estimates that energy-efficiency could meet 50% or more of the expected load growth over this time frame [3].

Achieving Ontario's electricity conservation targets will involve many key sector participants: government, local utilities, private enterprise, community groups and consumers. Similarly, the objective of transforming Ontario's culture into a conservation culture will entail influencing decisions and behaviours across a diverse range of electricity system constituents, and will call upon leaders to demonstrate and inspire action. This shift will require lasting changes in consumer attitudes, beliefs and behaviour with respect to energy use.[2] Ontario has made much progress in the three years since the targets were set. Ontarians of all walks of life are talking about the importance of wise energy use. But much more work needs to be done before the majority of consumers consider the consequences of energy use when making decisions about buying and using equipment, appliances and electronics.

Ontario's primary industry and commercial sectors contribute to it being one of the world's most energy-intensive jurisdictions per-capita.[3] In 2008, about 30% of electricity in Ontario was used by residential customers, 30% by industries and 40% by commercial businesses and institutions such as schools, hospitals and government buildings [4].

This paper presents some approaches undertaken in Ontario to encourage a conservation culture and identifies various challenges to achieving it. Overcoming these challenges will require progressive policies on the part of governments as well as innovations from private enterprises. Solutions will also call on individuals and corporations to change their attitudes, beliefs and behaviours so that energy-efficiency and conservation become an observable social norm. To provide context for these arguments, the paper first provides an overview of Ontario's electricity system.

II. Ontario's Electric Power System

A. Historical Overview

Ontario's electricity system is among the world's oldest integrated electricity grids. It is comprised of many mature generation assets. Most large hydroelectric generating facilities were developed prior to the 1950s. Twenty nuclear

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[1] In Ontario, demand-side management is also referred to as "conservation and demand management," and all electricity DSM resources have been collectively termed as "conservation." Categories of conservation counting toward Ontario's targets include energy-efficiency, fuel switching, customer-based generation, as well as demand response and conservation behaviour. This paper uses the term energy-efficiency to mean the use of technologies or practices to derive an energy service while using less energy. Conservation refers more generally to behavioural changes intended to reduce the use of energy.

[2] Culture refers to attitudes and behaviours that are characteristic of a particular social group and are defined by social norms.

[3] Ontario is Canada's most populous province with a population of 13 million at the end of 2008. Ontario's per-capita electricity use in 2006 was 11,889 kWh/year. By comparison, electricity use in Vermont in 2006 was 9,335 kWh/capita-year and in California was 7,213 kWh/capita-year. Ontarians consume less electricity than the Canadian average, which in 2005 was 16,717 kWh/capita-year [5]-[6].

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power plants were brought into service between the early 1970s and the early 1990s. Ontario's demand growth fluctuated between 3% and 7% annually for much of the 20th century [7].

Until 1998, Ontario's electricity generation and transmission systems were owned and operated by Ontario Hydro (previously the Hydro-electric Power Commission of Ontario) as a government-granted, vertically-integrated monopoly that sold power to consumers through municipal utilities. Within this single entity also rested the function of integrated electricity system planning, which primarily focused on building supply to meet demand.

When the Demand/Supply Plan (DSP) was produced in the late 1980s, Ontario Hydro demonstrated a shift in its long-term planning approach that considered demand-side management and supply-side resources concurrently [8]. Ontario Hydro also initiated several DSM programs during this period.

The DSP forecasted a long-term electricity demand growth that was less than the historical average. The DSP was not implemented because a deep economic recession and the effects of industrial restructuring effectively erased its projections for demand growth. At the same time, Ontario Hydro's DSM programs were largely cancelled.

Although the programs did not persist, the electricity savings from Ontario Hydro's DSM activities continued to accrue over the next several years. In addition, changes to codes and standards in the 1990s produced sustained electricity savings (Fig. 1) [9].

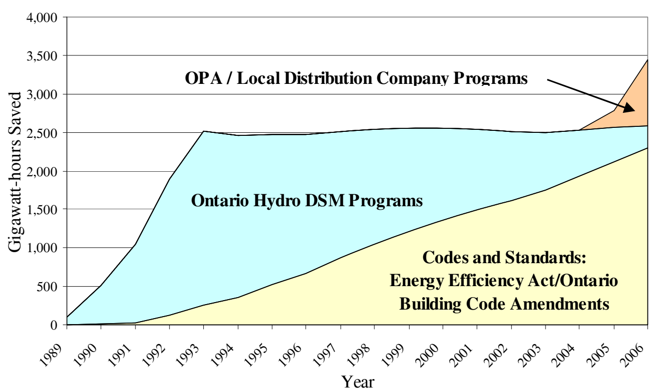

Fig. 1. Electricity Savings from Incentives and Regulations (1989-2006).

Ontario's supply mix is set to change significantly over the next ten years. The current generation mix in the province is mostly a legacy of the Ontario Hydro era, consisting of many centralized generating assets. Several nuclear reactors are projected to reach the end of their service lives between 2015 and 2020. In addition, the government is eliminating 6,434 MW of coal-fired generation by 2014 for environmental reasons.[4] In total, the province will need to replace or refurbish approximately 80% of its current electricity generating capacity by 2025. Demand-side management has emerged as a priority resource in meeting this long-term need.

B. *The Current Hybrid System Structure*

In 1998, the provincial *Electricity Act* split Ontario Hydro into separate, government-owned transmission and generation components [10]. Other agencies took on regulatory and system operation functions and later, in 2002, the retail electricity market was opened to competition. This market restructuring left a void where the central, long-term planning function previously existed and it was not until 2005 that this function was reintroduced with the creation of the Ontario Power Authority (OPA).

In the years leading up to the OPA's creation, virtually no generation or transmission resources were built. Although local electricity distribution companies began to implement DSM in 2004, no entity was responsible for coordinated, system-wide demand-side planning. This is now one of the OPA's primary functions, to conduct integrated, long-term electricity system planning for Ontario. A Conservation Bureau, headed by a Chief Energy Conservation Officer, was also created as an independent office within the OPA to lead and coordinate the establishment of a "culture of conservation" in Ontario, and to report on progress and barriers to its achievement.

The resulting "hybrid" electricity market has ensured that demand-side and supply-side planning occur within an entity that is accountable to electricity ratepayers. However, there is an immature and relatively undeveloped market for energy-efficient products and services. In addition, the capabilities that once existed under Ontario Hydro were effectively lost following the 1998 breakup.[5]

The aggressive targets for the province have called to action a range of public, private and community groups to support Ontario's massive conservation strategy. For the first time in Ontario's history, the maturation of a conservation industry is being addressed at the same time as changes to consumer behavior are being sought in order to achieve the provincial targets. Some of the strategies, challenges and opportunities related to these efforts are described below.

III. Ontario's Integrated Approach to Conservation

A. *Three-Pronged Approach*

Three overlapping approaches have been adopted to support the achievement of Ontario's long-term targets. While these approaches are not mutually exclusive, they are distinct in that they address three important aspects of an energy-efficient economy: investment in energy-efficient goods and services, capability within the marketplace to support both the delivery and practice of conservation, and the need to address market barriers and behaviour so that energy-efficient choices begin to become the norm. The approaches are:

1. **Resource acquisition**. The procurement of energy and/or

[4] Ontario's total installed generation capacity almost 32,000 MW.

[5] These capabilities include human resources and expertise, data, information and knowledge about electricity end-use, and experience in program delivery capability.

demand savings through such tools as payments to customers for demand management, incentives for energy-efficient building retrofits and new construction upgrades, or rebates for energy-efficient appliances.

2. **Capability building**. The enhancement of tools, skills and knowledge necessary to deliver energy-efficiency and effective conservation, increase the number of products, services and service providers available, and provide customers with information to improve their ability to manage consumption.

3. **Market transformation**. Achieving a substantial and sustainable increase in the market share of energy-efficient technologies, buildings and production processes through codes and standards or by changing the behaviour of consumers.

Resource acquisition programs are expected to make the most significant contribution to electricity savings in the near-term. Capability-building efforts target the development of skilled professionals to satisfy demand for energy-efficient products and services, as well as lead to more informed consumers who consider the energy-use implications of their decisions. Supply chains and markets to support these activities will also need to be developed. These approaches will contribute to increasing the market penetration of energy-efficient goods and services and help pave the way to enacting more stringent energy-efficiency codes and standards [11]. This conceptual three-pronged approach to delivering conservation is illustrated in Fig. 2.

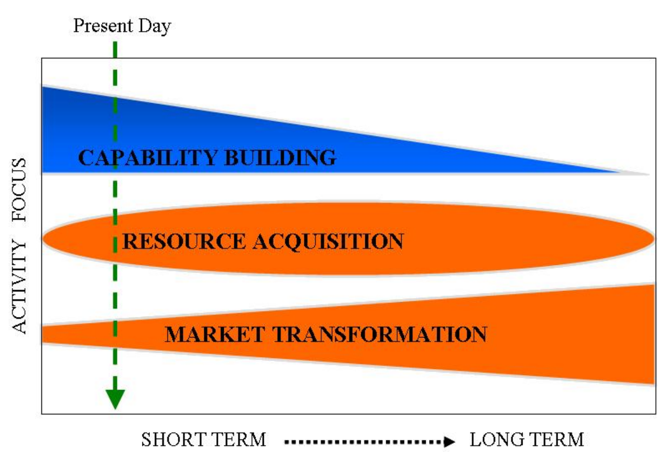

Fig. 2. Ontario's Conceptual Approach to Delivering Conservation.

Energy awareness programs and campaigns support all three approaches making up this long-term strategy. Over time, it is anticipated that the need for direct market intervention through paid incentives will decrease as energy-efficient choices become social norms.

This approach is intended to accelerate the impact of energy-efficiency as a system resource on par with new forms and modes of supply. This is in contrast to past practices in Ontario. It not only represents a shift in the traditional practice of power system planning, but achieving success implies that changes in the attitudes and behaviours of consumers will occur.

IV. Challenges and Opportunities

Following a century of affordable and reliable electricity supply, certain attitudes of Ontarians toward energy use are deeply ingrained. For example, consumers tend to disregard the scale and cost of infrastructure needed to produce, transport and deliver high-quality electricity to its point of use. In other words, the environmental consequences of the energy chain have traditionally been overlooked by end-users.

Even though energy and environmental awareness among the public have recently been on the rise, reversing attitudes of energy consumers in different market segments is expected to take time and persistent effort. Financial incentives for energy-efficient technologies have been the focus of the OPA's first generation of resource acquisition programs, but economic rationale alone does not drive many consumers to participate. In fact, many consumers still do not connect their energy use in the present with economic and environmental impacts in the future. Addressing the cultural roots of consumption by promoting social norms is also important – a normative approach that has been shown to be effective at changing behaviour [12].

Some of the more specific challenges that Ontario faces in transitioning its society toward a culture of energy conservation are described below. Overcoming each of these challenges also presents an opportunity to advance the state of energy-efficiency in Ontario. These issues are not only limited to Ontario – they are similarly faced in other jurisdictions, such as California and British Colombia, where energy systems are under pressure to adapt to the modern realities of resource constraints, the need for infrastructure renewal and environmental pressures.

A. *Challenges to Resource Acquisition*

Attitudes, behaviours and social norms. The number of electricity conservation initiatives delivered by the OPA and other organizations across Ontario has increased dramatically since 2005. Ontarians representing every market segment have options to participate. Despite this reach, many individuals, businesses and institutions still do not partake in these incentives. This finding is supported by the OPA's consumer research, which indicates that while many people are taking action to conserve, there remains a significant percentage of the population that is resistant to change [13]. These results are based on information about consumers' electricity conservation behaviour, opinions about the cost and environmental impact of electricity use and assessment of their own and others' performance at using electricity wisely.

The fact that many conservation behaviours are not readily visible to others presents a challenge for increasing participation in resource acquisition initiatives. Incentive-based initiatives promote injunctive norms – behaviours that others think one ought to do based on perceptions of what is approved or disapproved. Generally missing from this approach is the use of descriptive norms – observable behaviours in which others are actually engaged. If people see others doing it, they might feel that their own actions are participating in the development of a social norm. This, in turn, can encourage and motivate others to change.

It is possible to use existing social norms to promote energy-efficient choices and conservation behaviour. In Ontario, most energy-efficiency incentives have been structured around influencing discrete choices related to energy-efficiency, rather than packaged as incremental to decisions that consumers would make anyway [14]. Such an approach would take advantage of existing human desires for home amenity and comfort, for example. Supply chains such as the home renovation industry are already present and support these human wants. Selling higher energy-efficiency (insulation and appliances) to customers already considering a home renovation is one way that existing norms could be used to promote the desired behaviour.[6]

The establishment of social norms around energy use can be a powerful motivator for behavioural change [15]. Current prevailing attitudes and behaviours are a barrier to widespread participation in energy-efficiency and conservation programs. Changing these behaviours by promoting descriptive norms is a virtually untapped opportunity in Ontario.

Plug loads and phantom loads. These loads describe the power draw of consumer electronics and appliances that are plugged into an electrical outlet, rather than hard-wired into a building's internal circuits. Plug load is the total electricity draw of a device and phantom load is its energy consumed while in standby or powered-off modes. Plug loads are growing rapidly and already account for up to 20% of residential energy use and 10% to 15% of commercial energy use [16].

Residential plug loads are dominated by the use of entertainment products, whereas commercial plug loads are primarily due to the use of computers and monitors. Since there are so many of these loads in homes and commercial businesses, reducing their consumption is feasible through simple technologies, changes in habits, or informed purchasing decisions. Nevertheless, the diversity and high turnover of plug loads makes this category extremely challenging to address through consumer resource acquisition programs.

The relatively small size of Ontario's market is another obstacle to Ontario setting its own minimum energy standards. This barrier could be overcome by working co-operatively with other jurisdictions and developing longer-term strategies to educate consumers, retailers and manufacturers and by collaborating on the development of more stringent energy-efficiency standards.

Incentives could be offered to manufacturers to produce more energy-efficient goods, but the challenge of overcoming the consumer demand for energy using devices still remains. Similar to other challenges to increasing energy-efficiency in Ontario, the solution points toward cultural change and influencing, in the case of growing plug loads, consumer and lifestyle choices.

B. Challenges to Capability Building

Electricity use data and statistics (addressing gaps in knowledge). Traditional analyses done from a supply-side perspective have been relatively straightforward in terms of system planning. Starting with evaluations of available energy resources, the expansion of supply is planned with the objective of meeting assumptions of ever-increasing demand. This approach tends to downplay the importance of details regarding consumer needs and uses. Conservation is treated as a deprivation, rather than as a means of optimizing the energy chain for the provision of services to the consumer.

In this traditional model, cost-effectiveness tends to be the single criterion to be optimized as long as the system can supply enough energy to meet demand and reserve requirements. Save for the occasional mishap such as the catastrophic northeastern blackout occurrences of 1965 and 2003, this approach has yielded an extremely reliable supply of electricity to meet the needs of end-users.

New models of energy planning represent an evolution of the traditional planning paradigm because they consider the needs of the consumer first. Consumers are highly heterogeneous and consumer needs are diverse. Planning the 21st century energy system from the perspective of consumer needs means evaluating all feasible opportunities to be more intelligent with the use of energy and providing the same or similar services more efficiently. But the demand-side perspective requires gathering information and knowledge on a seemingly endless array of technologies, services and end-use patterns.

Ontario is only beginning to compile end-use data with the level of granularity and certainty needed to understand how plan for a next-generation energy system from the perspective of end-user needs. This could improve the quality and convenience of energy services, maximize the economic and energy-efficiency of the systems needed to deliver the services and minimize the environmental intrusions they create [17]. It can also enable better choices by giving consumers information and benchmarks to compare their performance to others and for sharing best practices for managing energy use.

Measurement and verification of conservation. Planning for conservation as a resource on par with supply requires knowing, with certainty, that investments in energy-efficiency will deliver the expected savings. Measurement and verification activities can increase this certainty and reduce planning risks associated with a heavier reliance on conservation resources.

The OPA has developed robust measurement and verification systems to evaluate its programs and these evaluations have started to generate reliable results on energy and demand savings, as well as learnings for program design

[6] Instead of offering incentives to end-users, this approach would target home renovators to encourage customers to increase insulation or install more energy-efficient appliances as part of a home renovation.

and continuous improvement. However, unevenness in the measurement and reporting of activities of the broader energy-efficiency community has been identified as an issue that needs to be addressed [18].

Electricity system planners need to count on the delivery of conservation savings with an equivalent level of certainty to that of a supply resource. Additional planning risk is created when parties delivering conservation and efficiency fail to document their activities and report accurately on savings so that system planners can effectively account for these results.

The OPA is encouraging others engaged in delivering energy-efficiency programs to adopt a measurement and verification framework. This is an area in which local, regional and national governments need to lead by example to measure, monitor and manage energy use and evaluate the savings from energy-efficiency activities.

C. Challenges to Market Transformation

Pricing schemes and electricity use feedback. Electricity usage information provided in a timely fashion to the consumer can be used to modify choices and behaviours. In the case of electricity, feedback instruments, listed from one-time events to continuous feedback, include energy audits, advice or counseling, bills, smart meters and in-home or interactive displays. Coupled with performance benchmarking, time-of-use rates, critical peak pricing and/or critical peak rebates, electricity use feedback mechanisms can be a significant driver of conservation.

Consultations with large business customers indicate that electricity pricing information and transparency are two main barriers to conservation action [19]. By providing appropriate information to help electricity users conserve electricity and shift their time of use, electricity bills can be an important tool in developing a culture of conservation. Examples of data that could be included are the relation between time-of-use and peak system demand, comparisons to previous billing periods, or comparisons of usage against similar customer classes.

Time-of-use, or “smart” meters are an enabling technology expected to equip consumers with information that will allow them to make better choices. As of September 2008, more than 1.6 million smart meters had been installed in homes and small businesses across the province [20].[7] These smart meters, once activated, will make the cost implications of electricity use more readily available and transparent. In addition, with recent policy development on pricing carbon emissions, it will be important to further explore the implications of carbon pricing on electricity rates – and how this could help promote a culture of conservation [21].

Sub-metering in multi-unit buildings. Occupants in multi-unit buildings typically do not have access to their individual in-suite electricity usage. Most suites in these buildings are metered in bulk, where the tenant is charged a monthly lump sum for electricity bundled with rent or lease payments. In both residential and commercial buildings, bulk-metering can create disincentives for landlords to invest in energy-efficiency and for tenant to take actions to conserve.

The underlying issues and potential solutions differ between the residential and commercial sectors, but the resulting barrier is similar. Installing sub-meters in multi-unit buildings gives tenants responsibility over energy use in their own units, but tenants do not have control over non-discretionary equipment because landlords own the appliances. Furthermore, new administrative and hardware costs associated with individual metering may challenge the tenant’s ability to benefit financially from conservation.

Removing this barrier will require equitable conditions where both landlords and tenants can benefit from conservation [18]. Landlords should be required to meet in-suite energy-efficiency obligations and adhere to rent reduction formulas when transferring the costs of electricity over to tenants.

Although there are many challenges associated with the practice of sub-metering, the energy-efficiency and conservation opportunities are also great. Approximately 90% of tenants in multi-unit buildings in Ontario are bulk metered and receive no information about their electricity use. Moving ahead with sub-metering in these buildings could facilitate the necessary behavioural changes to bring about sustained electricity savings.

Life-cycle costing. Traditionally, capital budgets have been separate from operating budgets. This is especially true in the public sector. Decision makers acting with the objective of minimizing capital costs typically favour less energy-efficient designs regardless of whether they increase energy use and operating costs. Even as the cost premiums associated with energy-efficiency are reduced, constrained capital budgets continue to favour the least first cost. This affects energy use over the entire life-cycle of buildings and equipment.

At the same time, the lifetime savings of energy-efficient designs are often significant and as building to higher energy-efficiency becomes the norm, the capital premium should be reduced. A 2003 report to California’s Sustainable Building Task Force found that the initial cost premium associated with building to a Leadership in Energy and Environmental Design (LEED) green building rating is justified based on energy cost savings alone [22].[8] This study also concluded that LEED buildings reduce both a building’s demand for and consumption of electricity and water.

Like many other barriers to energy-efficiency, the adoption of life-cycle costing requires a change in behaviour and a break from the traditional practice of considering only the initial cost. This applies not only to buildings and energy consuming infrastructure, but also to consumer purchases of appliances and equipment.

[7] Ontario is on track to achieve full smart meter rollout in homes and small businesses by the end of 2010.

[8] This study reviewed the construction costs of 33 “green” buildings across the United States.

V. Culture and Energy Use

Resolving the challenges described above will require regional and local governments to create supportive policies and regulations as well as private enterprises to deliver technologies and services that give consumers energy-efficient options. The solutions also depend on more fundamental changes to consumer behaviour, such that energy awareness becomes a factor in decision-making and energy-efficient choices are socially visible and become the norm.

Ontario is at its present state of cultural development, in part, as a result of early advancements in its electricity infrastructure that have supported energy-intensive primary and secondary industries. This has, in turn, supported a high standard of living. Readily available energy that was once described as "too cheap to meter" has also contributed to complacent attitudes toward the consequences of the infrastructure required to produce, transport and deliver energy to end users. For much of the population, these attitudes are firmly entrenched.

Energy and cultural development are inextricably linked. While energy-related factors, such as affordable and reliable electricity, contribute to cultural development, the social norms that drive cultural development can influence energy choices [23]. This phenomenon is evidenced in Ontario by the historically complacent attitudes of energy users, especially with respect to the environmental consequences of inefficient energy use.

Policies that adjust prices or provide information and incentives are needed – but these measures alone may be ineffective because contextual factors can act as constraints on the potential for behavioural change. Some of these factors, including social norms, lifestyles and technologies, limit the effectiveness of purely economic or technical approaches because cultural factors are such powerful drivers of human behaviour [24].

Ontario is moving in the right direction, yet there is much more that can be done to remove barriers to conservation and promote opportunities to increase the energy-efficiency in all sectors of the provincial economy. To secure more energy-efficiency and conservation resources, it will be necessary to continue to:

- Influence customer attitudes and behaviours by providing information and increasing awareness about the importance of energy-efficiency.
- Use various market channels to deploy programs and initiatives.
- Enhance delivery capabilities by improving training, encouraging business networks, supporting research and development, supporting the diffusion of viable new energy-saving products and services, and improving the capability to evaluate projects and target new markets across the energy-efficiency sector.
- Secure improvements in the codes and standards that establish minimum energy-efficiency standards for appliances, equipment and buildings.
- Reduce or remove legal and economic barriers that unreasonably inhibit the adoption of energy-saving practices or unreasonably restrain the expansion of efficiency-related businesses.
- Achieve continuous improvement in how well Ontarians do all of the above through data collection and better sharing of information and experiences, through the development of a robust evaluation, measurement and verification process.
- Make energy, its use and conservation, more socially visible so that consumers can observe the efficient behaviours of their neighbours and peers and individuals and businesses can benchmark their performance.

VI. Conclusion

To achieve the long-term objective of an energy-efficient economy, Ontario's cultural attitudes toward energy will need to change. While the challenges facing this transition are great, many opportunities could result from persistent efforts to drive changes in attitudes, behaviours and social norms.

Each of the challenges and opportunity areas presented in this paper is being addressed by the Ontario Power Authority, Conservation Bureau and the Government of Ontario. Local governments and businesses are also rising to the challenge. The three-pronged approach aims ultimately to transform the market in favour of energy-efficient products and conservation behaviour so that they become the norm. Government policy on pricing and codes and standards are tools that can secure long-term savings and promote the benefits of energy-efficiency.

The challenges and opportunities described in this paper represent only some examples that are of importance for Ontario. The Chief Energy Conservation Officer reports annually on barriers to the implementation of energy-efficiency and conservation. More information on these and other barriers and opportunities for advancing a conservation culture can be found at www.conservationbureau.on.ca.

VII. Acknowledgment

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VIII. References

[1] Ontario Minister of Energy. (2006, Jun. 13). Directive to the Ontario Power Authority on the Integrated Power System Plan. [Online]. Available: www.powerauthority.on.ca/Storage/23/1870_IPSP-June13%2C2006.pdf

[2] Ontario Power Authority (2007). Integrated Power System Plan. Exhibit B, Tab 1, Schedule 1, Page 7 of 34. [Online]. Available: www.powerauthority.on.ca/Storage/82/7763_B-1-1_updated_ 2008-09-04.pdf

[3] National Action Plan for Energy Efficiency. (2008). Vision for 2025: A Framework for Change. [Online]. Available: www.epa.gov/eeactionplan

[4] Statistics Canada. (2009). Report on Energy Supply and Demand in Canada, 2006 Revision. Catalogue no. 57-003-X.

[5] Energy Information Administration. (2008). International Energy Annual 2006. [Online]. Available: www.eia.doe.gov/iea

[6] Energy Information Administration. (2008). State Electricity Profiles. [Online]. Available: www.eia.doe.gov/fuelelectric.html

[7] Ontario Power Authority. (2005, Dec.). Supply Mix Background Reports, Volume 3 – December 2005. p. 5. [Online]. Available: www.powerauthority.on.ca

[8] Ontario Hydro. (1989, Dec.). Demand/Supply Plan Report: Providing the Balance of Power, Ontario Hydro's Plan to Serve Customers' Electricity Needs.

[9] Chief Energy Conservation Officer. (2007, Dec.). Appendices to 2007 Annual Report: Taking Action. [Online]. Available: www.conservationbureau.on.ca/Storage/18/2373_Appendices_to_2007_CECO_AR_updated_Dec__14_(2).pdf

[10] Electricity Act. (1998). S.O. 1998, c. 15, Sched. A. [Online]. Available: www.search.e-laws.gov.on.ca

[11] Ontario Power Authority. (2007). Integrated Power System Plan. Conservation Resources. Exhibit D, Tab 4, Schedule 1, Page 3 of 58. [Online]. Available: www.powerauthority.on.ca/Storage/53/4870 _D-4-1_corrected_ 071019.pdf

[12] B. Ceniceros. (2008, Jan.). Do They Care How Much Their Neighbors Use? Lessons Learned from SMUD's Normative Messaging Pilot. Sacramento Municipal Utility District. January 15, 2008.

[13] Ontario Power Authority. (2007). Consumer Segments. [Online]. Available: www.powerauthority.on.ca/Page.asp?PageID=122&ContentID=6269&SiteNodeID=316

[14] C. Wilson. Personal communication. (January 14, 2009).

[15] P.W. Shultz, J. Nolan, R.B. Cialdini, N. Goldstein and V. Griskevicius. (2007). The Constructive, Destructive, and Reconstructive Power of Social Norms. *Psychological Science*. 18, pp. 429-33.

[16] C. Calwell. (2008). Plugging the Savings Gap: How Efficient Plug Loads can Contribute to Your Program Portfolio. Ecos Consulting. Presentation to 21st Annual E-Source Forum and Exhibit. Sept. 21-25, 2008.

[17] D. S. Scott. (2008). *Smelling Land: The Hydrogen Defense Against Climate Catastrophe*. Queen's Printer Publications.

[18] Chief Energy Conservation Officer. (2008, Jun.). Taking Action Supplement: Conservation Results 2005-2007 [Online]. Available: www.conservationbureau.on.ca/Page.asp?PageID= 122&ContentID=1805&SiteNodeID=156&BL_ExpandID=142

[19] Energy @ Work. (2007, Oct.). Energy Efficiency Barriers in Ontario: Listening to the "Interval Meter Customer" View. Toronto, Ontario. Prepared for the Conservation Bureau. [Online]. Available: www.conservationbureau.on.ca

[20] J. Douglas. Personal communication. (2008, Oct. 16). Util-Assist Inc., Newmarket, Ontario.

[21] Government of Ontario and Government of Quebec. Memorandum of Understanding. Provincial – Territorial Cap and Trade Initiative. (2008, Jun.). [Online]. Available: www.premier.gov.on.ca/news/Product.asp? ProductID=2281

[22] G. Kats. (2003). The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force. (2003, Oct.). [Online]. Available: www.usgbc.org/Docs/News/News477.pdf

[23] M.A. Rosen. (2002). Energy, Culture and Standard of Life. Topic Introduction in Theme Energy Education, ed. J.T. McMullan, *Encyclopedia of Energy Sciences, Engineering and Technology Resources*, within *Encyclopedia of Life Support Systems*, EOLSS Publishers, Oxford, U.K. [Online]. Available: www.eolss.net

[24] C. Wilson and H. Dowlatabadi. (2007). Models of Decision Making and Residential Energy Use. *Annual Review of Environment and Resources*. 32: 2.1-2.35.

IX. Biographies

Steven J. Norrie is Manager, Operations of Ontario's Conservation Bureau, a provincial government agency mandated with leadership and co-ordination of Ontario's electricity conservation agenda. Prior to joining the bureau, Steven was a planner in the Ontario Power Authority's Power System Planning Division, where he was responsible for the assessment of environmental performance in the development of Ontario's 20-year Integrated Power System Plan. His previous experience is with an environmental engineering firm working primarily in environmental and regulatory compliance in the Province of Alberta's energy sector.

Steven was born in Lethbridge, Alberta in 1974. He graduated from Royal Roads University in Victoria, British Columbia in 1998 with a Bachelor of Environmental Science degree and was awarded a Master of Applied Science degree from Ryerson University in 2006. His Master's degree research applied a novel values-based multi-criteria decision-making approach to long-term electricity system planning.

Peter Love was appointed Ontario's first Chief Energy Conservation Officer in 2005 and currently heads the Conservation Bureau. He has enjoyed a long and distinguished career in the area of energy-efficiency. As the Executive Director of the Canadian Energy Efficiency Alliance, Peter was a leading advocate for energy-efficiency and promoting its related benefits for the economy and the environment. In prior roles, he was responsible for managing programs in support of the R-2000 and ENERGY STAR® standards for homes and he was a member of the team responsible for creating the "Three Rs" campaign – Reduce, Reuse, Recycle. An active volunteer and community activist, Peter has served as director of the Canadian Coalition on Acid Rain and is a member of the National Advisory Committee on Energy Efficiency.

Mr. Love's commitment to sustainable buildings and energy-efficiency earned him a Lifetime Achievement Award from Sustainable Buildings Canada. He received his M.B.A. and B.A. from the University of Toronto.