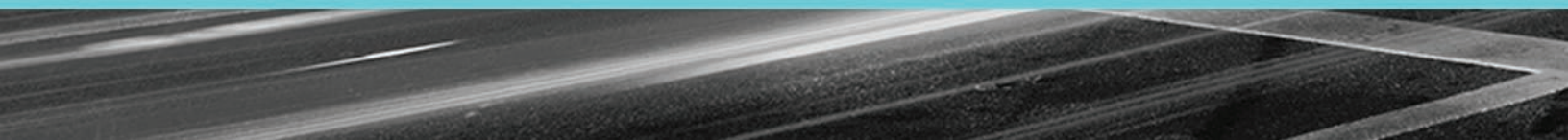
MOWATENERGY

Future Innovation in Energy Planning

A Special Session to Advise on Ontario's Long-term Energy Future

OUTCOMES REPORT



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MOWAT ENERGY

School of Public Policy & Governance
UNIVERSITY OF TORONTO

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The conference would not have been possible without the enthusiasm and expertise of the speakers, a full list of whom is available in Appendix A.

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Future Innovation in Energy Planning
A Special Session to Advise on Ontario's Long-term Energy Future

1. Overview

On September 26, 2013, Mowat*Energy* at the University of Toronto hosted the *Future Innovation in Energy Planning: A Special Session to Advise on Ontario's Long-term Energy Future* at the Toronto Reference Library.

For the conference, Mowat*Energy* brought together researchers, practitioners and decision-makers to examine the trends, best practices and policy innovations that can address Ontario's energy policy challenges. The session had four main goals:

- Convene leading energy stakeholders (academics, practitioners and policymakers) to learn about successful international approaches to specific energy policy challenges;
- Inform the development of Ontario's Long-Term Energy Plan;
- Identify promising areas for future energy policy research; and
- Establish and enhance the linkages between key stakeholders in the academic community (including international academics) and other public and private stakeholders.

The Ontario Ministry of Energy, the Ontario Power Authority (OPA) and the Independent Electricity System Operator (IESO) sponsored the conference. The proceedings were broadcast live on the internet, and the video and presentations were made available on the Mowat Centre's website after the conference.[1]

A total of 76 people were present the day of the conference, including representatives from the public sector, including the Ministry of Energy and the public agencies, the OPA and the IESO; academia; the private sector, including energy industry stakeholders, businesses and corporations; and the not-for-profit sector, including NGOs and advocacy organizations. In addition, there were 78 visits to the live webcast throughout the day.

2. Key Themes

Since Ontario's last Long-Term Energy Plan was prepared in 2010, new trends have become clear – trends that could lead to future challenges in energy planning. One of these new trends concerns the need to integrate the recent increase in new variable renewable power generation reliably and efficiently on the power grid. Flexibility is key, and new demand-side management and storage technologies are promising greater flexibility for the energy system. Also consumer and public engagement is becoming more critical, and data about energy consumption is becoming potentially more accessible. In addition, Ontario communities and the public in general have made it clear that they want to have a greater role in energy development, and that all forms of energy, such as heating and cooling, need to be included.

1 Available at www.mowatcentre.ca.

To examine these trends, and to look for innovative solutions to the challenges they pose, Mowat*Energy* organized a group of speakers that included international academics as well as representatives from international and Ontario public agencies, industry and NGOs.[2] The session consisted of four workshops organized by topic:

1. Community energy planning;

2. Conservation;

3. Future supply options; and

4. Introducing flexibility into the networks to accommodate future supply.

Each workshop featured one or two international speakers who served as principal presenters, and concluded with presentations from Ontario practitioners and academics that applied the international lessons to the Ontario context. A fifth and final session convened all of the principal presenters in order to have a holistic discussion about the issues raised throughout the session.

Across all workshops, there were six general themes that were repeated by many of the speakers in different contexts, namely:

- Government should be the **enabler** of energy innovation, not the **controller**;
- We should use the resources we have more effectively, by either using current energy infrastructure more **flexibly**, or by promoting greater **conservation**;
- There is power in **data**;
- **Public engagement** in energy policy is crucial, but there is no one singular public and effort must be made to understand how the different segments of the public relate to energy;
- All forms of **energy**, such as **heat**, need to be included in planning; and
- The future will be based on **local energy solutions**, and will be typified by a large number of small installations located close to demand centres, as opposed to our current centralized energy system.

The following section will examine the lessons learned in energy planning innovation from the international experts. The final concluding section will provide recommendations based on the general themes from the conference.

2 A full list of speakers is available in Appendix A

3. Lessons from the Speakers

3.1 Community Energy Systems

Lessons from an International Perspective

MORTEN HOFMEISTER, GRØN ENERGI, DENMARK

Denmark has been a global leader in the development of district or community energy systems for more than 100 years. These community energy systems (CES) are able to efficiently produce and deliver heat, and sometimes electricity, over distances of up to 40 kilometres.

The technical challenges of implementing CES have for the most part been solved. The real challenges for communities seeking to harness the benefits of CES are political and financial. How should CES projects be financed? Given the need for density in order to make CES efficient, should residents and businesses be able to choose to participate in community energy or should it be mandatory? What kind of fuel and fuel infrastructure would best suit CES in Ontario? Several lessons emerged from Morten Hofmeister's presentation on the Danish experience:

1. CES projects require public participation and acceptance

   It has been challenging to balance the need for efficiency in investing in district heating with freedom of people to choose between district heating and individual heating systems. Therefore, discussions with communities about the prospects of developing CES projects can be sensitive and it is important to focus on the advantages for all. In Denmark, formalized socio-economic analyses are required before investment, and cost-benefit analyses for prospective CES projects have generally looked at both the impact on ratepayers and also assessments of the employment prospects that such projects can offer.

2. All forms of energy should be considered

   When developing a CES, heating, cooling and electricity should be considered. CES can supply heat only, or both heat and electricity through combined heat and power plants. The system should also integrate with other infrastructure (such as water and transportation) in the community.

3. Mandatory participation leads to higher success in implementation

   If individuals are able to choose whether to join a new CES project, the private sector is not likely to make the investment because of uncertain returns. Community energy systems are similar to water and waste management systems because they are more cost-effective when they are applied comprehensively within a given boundary. To a large extent, the systems established in Denmark have been implemented in a mandatory fashion. It has been found that, after the development of a CES, on average only 1% of ratepayers have higher energy bills. Municipalities in Denmark have tried to offset this risk.

4. CES regulatory frameworks can be local or central

   Since its first appearance in 1903, community energy in Denmark has gone through several major policy phases. The initial push for community energy was driven by individual communities without central coordination. Then in the 1970s and 80s, widespread implementation of CES in communities was led by the national government, and in the 1990s CES decision making was again de-centralized and municipalities now evaluate development on a project-by-project basis. Many systems are municipally owned, but there has been recent discussion about the challenges that municipalities face in administering large capital-intensive projects. The current regulatory framework is considered outdated, and many would prefer a new nationally led strategy or at least a clearer framework for project evaluation and financing.

5. The transition required legislation and incentives

   The Heat Supply Act, 1979, mandated the use of district heating, and later legislation also banned the use of electrical heating. Meanwhile, certain fuel types and technologies are subject to higher taxes, and these fiscal measures have remained a prominent tool in driving the public towards options desired by energy policymakers.

6. CES is flexible and modular

   District heating systems are flexible because they can be fuel agnostic and can use locally available fuels (such as biomass or biogas), which also increases local employment. Infrastructure is required to deliver fuel to a CES power plant, but this can be refurbished to adapt to changing technologies, and to local changes, much more readily than changing the system within individual residences. Furthermore, CES projects can be built in a modular fashion and hence highly centralized planning is not required. Thus, the projects are small enough to attract community investment, which can further bolster community support for projects.

Lessons from the Ontario Perspectives

RON PUSHCHAK, RYERSON UNIVERSITY

Ron Pushchak is a professor at Ryerson University and has been involved in a number of environmental planning projects. In his talk he discussed how communities can be engaged in energy planning. In terms of infrastructure development, he said that community acceptance is key as communities have an "implicit veto" over projects as they can, in the end, hold up any development. However, some communities can become willing hosts if they are presented with a planning problem and their interests are met in jointly solving it. Protests and "not-in-my-backyard" sentiments are not irrational; instead they are rational protests to perceived risks, lack of control and lack of trust with the developers or concerns about an unequal distribution of resources. Community energy planning takes a long time, communicating risks is hard and there are no good faith efforts at community-based planning that guarantee acceptance results, they merely raise the probability that collaborative planning will succeed.

FERNANDO CAROU, CITY OF TORONTO

Fernando Carou leads the community energy program at the City of Toronto. According to Carou, the city's new plan is to link growth with infrastructure development, including energy. The conventional approach, with its model of large centralized generation, can lead to increased risk for sudden events, such as flooding, opposition to development and requires a large number of stakeholders. There is also a long lead time, which may mean that any development will not be adequate for rapid growth. The new modern approach the city is following is to develop embedded solutions that address the load at the source and can provide heat and electricity. These embedded solutions are small and they grow organically as demand increases, and do not require extensive transmission or distribution grid upgrades. As they are small they attract private investment, reducing pressure on the rate base, and have short lead times. This modern approach is already being implemented in Toronto.

3.2 Conservation through the Social Dimensions of Energy Use

Lessons from an International Perspective

KAREN EHRHARDT-MARTINEZ, HUMAN DIMENSIONS RESEARCH ASSOCIATES

In energy system planning, it is not sufficient to only look at engineering and technical solutions to problems. The people who are consuming the energy have to be considered as well. In effect, people need to be put into the energy planning equation.

As conservation and other programs expect consumers to be responsible for their own energy consumption, understanding consumers is becoming more important. Social science research offers new ways that policymakers can influence consumers' energy behaviours. The key points in her talk were:

1. Energy is invisible in our society

   The energy systems in North America are so reliable that they "just work." Consumers are unaware of how their daily habits affect their energy usage because of low costs (relative to other OECD countries) and because they lack real-time feedback. Very few people are aware of their own consumption and how it compares to others.

2. Systems need to account for people just as much as technology

   The human dimensions of energy use can have a dramatic impact on consumption, regardless of the technology available. Research has shown how highly energy-efficient residences and institutional buildings (such as schools) have performed significantly worse than comparable buildings that haven't received any energy efficiency retrofits. Therefore, system planners must put people into their energy planning equation.

3. Lessons from social science research can drive cultural change and make energy visible

   Policymakers must update their analytical model from a pure "rational economic actor" model to acknowledge the often

irrational nature of decision making. Choice architecture matters. How choices are presented to consumers and which options are set as defaults will have significant impacts on outcomes. Furthermore, the framing of messages is extremely important. Research suggests that consumers are not always entirely sure themselves about their motives and research is required to discover the best methods for influencing consumers.

4. There is no one "public" that can be addressed

   There is no one group of the "public" that can be addressed. Rather, there are many segments that make up the public, and each segment has to be looked at separately to see what motivates them. In particular, this means paying greater attention to the generational, ethical, and political dispositions of individuals, as these factors play a major role in their energy usage. There is no one-size-fits-all approach that can influence the entire public.

Lessons from an International Perspective

MATTHEW THEALL, US DEPARTMENT OF ENERGY

With the rise of load-side real-time smart meters, consumers now have greater potential to use the data from these meters to inform their energy choices and behaviours. One of the main challenges, however, has been to create universal standards for the collection and availability of this data for customers. The "Green Button" initiative is a plan to ensure that consumers have standardized and reliable access to their energy data. The lessons that can be taken from Matthew Theall's talk were:

1. A single data standard is required to ensure a consistent experience across third-party platforms

   Many consumers find it difficult to understand or appreciate what benefit a smart meter can offer. Therefore, it is vital to create a consistent experience wherever consumers may want to access their data. This requires standardized data sets as well as consistent branding of the Green Button.

2. Expected benefits of the Green Button

   Making data available to consumers can be extremely valuable, yet the potential for consumer offerings has still gone largely untapped. Some potential benefits include entrepreneurial web portals, customizable heating and cooling options in order to increase comfort and savings and information on investments in new energy technologies. In addition, the Green Button can help educate consumers on their own energy consumption.

3. Ontario is leading the way

   There are many ways in which Ontario has been a model for the US effort. Ontario now has 4.7 million smart meters installed in residences and businesses and 2.6 million of those now offer access to Green Button data. Efforts to harness the benefits of this opportunity are being led by the Ontario Energy Data Access Working Group. The MaRS Centre has also been involved in the development of new software and technology that can help consumers understand, access and manage their consumption.

4. Next steps

There remains a great deal of work to be done to ensure that Americans and Ontarians reap the benefits of access to energy data. Proponents must continue to educate consumers about the benefits in order to increase adoption. A standardized testing and certification program would ensure a consistent and high-quality experience across all Green Button products. Greater consistency of branding across individual utilities will be important to ensure that consumers are aware of the programs available.

Lessons from the Ontario Perspectives

NIRAJ BHARGAVA, ENERGATE

Niraj Bhargava is co-founder and CEO of Energate, a company specializing in home energy management solutions. In his presentation, Bhargava said that there are challenges to introducing conservation and demand responses in the residential sector. He argued that there have been big changes in the Ontario energy sector with smart meters and the integration of renewables. The deployment of smart meters has led to time-of-use pricing which allows for a better integration of costs with demand. Unfortunately, most homeowners have not seen the new technologies or experienced the benefits those technologies might provide; instead, they've only observed rising electricity prices. In Oklahoma, which provides as an example of a different model, time-of-use pricing is voluntary, unlike in Ontario, and residents who opt in are shown their costs under both the time-of-use pricing and the earlier flat-rate system, paying the lower amount. In most cases time-of-use pricing means lower costs for residents through lower consumption. There is still work that needs to be done, he said, at looking into what works with consumers, and at the moment there are many pilot programs in Ontario to see what engages with consumers and provides value.

MARK SCHEMBRI, LOBLAW COMPANIES

Mark Schembri is vice president of supermarket systems and store maintenance for Loblaw Companies, Canada's largest food distributor, and which has accounts with every LDC in Ontario. According to Schembri, the company has energy reduction targets of 1% in 2011, 3% in 2012, and an additional 3% in 2013. It has met these targets through energy efficiency retrofits, and the stores now have automated-holistic energy management systems that integrate data from all the different energy-consuming equipment in the store to quickly identify any problems. Loblaw is also testing different technologies to look into new solutions to meet its energy efficiency targets. Schembri says there are a number of obstacles to continuing to improve energy conservation. First, there is a skills gaps in maintenance workers, many of whom have to be trained to work on the new equipment. Also, the "low hanging fruit" in energy efficiency have mostly been picked and it will become increasingly difficult to reduce energy consumption through retrofits. Loblaw is a participant in the OPA's demand response program, and would like to see the program expand. It is also a participant in the renewable energy FIT system, with a total of 15 MW of solar PV

in operation or under construction. Organic waste for biogas development is also an energy source that they are looking into. However, Schembri said that FIT 2 was not well received and all their applications were turned down. It was believed that the preferential point system consideration was only given to institutions, and that not enough attention was paid to technical issues. Nevertheless, if technical concerns were included in the determination, that would benefit a company like Loblaw. There is the fear that this problem will also affect FIT 3.

3.3 Changing Energy Supply Trends

Lessons from an International Perspective

ROGER GALE, GF ENERGY

Roger Gale has practiced as an energy and environmental policy consultant with some of North America's largest companies over the past two decades and has been CEO of GF Energy since 2005. 2013 is an inflection year, he argues, as change starts to greatly affect the energy sector in North America. Examining the trends in energy generation, the key points that can be taken from his talk were:

1. Demand will finally enter the spotlight

   While the focus of system operators over the last several decades has been primarily on ensuring sufficient supply, the focus is expected to shift in the near future to demand. The changing paradigm for measuring energy consumption was established by new smart metering and demand-side management technologies. This shift in focus has the potential to enable more efficient use of existing supply resources.

2. Decentralized generation will grow in importance

   It seems that the age of large centralized nuclear and coal-fired generation is coming to a close, and that small decentralized generation will increasingly take its place. The move towards more decentralized generation will be driven by the more accessible capital costs of smaller energy systems and by the desire of residential consumers and communities for more affordable and secure energy sources. As a result planning decisions will need to become more localized.

3. The backbone will still be needed, for now

   Existing large generation, and perhaps more gas-fired generation, will be required in the interim to provide the backbone of the energy system, but most new investment will be in decentralized generation.

4. Storage will come into the mainstream

   A large proportion of decentralized generation will come from wind and solar. These renewable generation sources will require greater storage to balance the intermittent nature of their power; therefore, the storage industry will boom.

5. Cities will struggle to meet their own energy needs

Urbanization will continue and existing urban centres will become more densely populated to the point where they may struggle to meet their energy needs within their own boundaries. Political and policy challenges may arise as cities try to negotiate how to guarantee their energy security, especially as the energy infrastructure that feeds the cities may be in outlying locations that do not directly benefit from the infrastructure.

6. Government as an enabler

Decisions about decentralized generation will be made at the local level. There will also be greater private sector participation, increasingly moving the investment risk from the public to the private sector.

Lessons from the Ontario Perspectives

ALEXANDER MCISAAC, NRSTOR

Alexander McIsaac works at NRStor, a start-up company that is accelerating the commercialization of energy storage technologies through project development and ownership. According to McIsaac, storage is unique in that it can serve as both load and generation, and in addition different technologies, such as flywheels, compressed air and batteries, offer different characteristics and benefits. The main benefit, he says, is that storage provides flexibility, and it also has the potential to increase the overall efficiency of existing assets operating on the grid. Current challenges faced by the storage industry in Ontario, McIsaac argues, include quantifying the benefits, educating stakeholders and improving the regulatory and procurement environment for investment in storage. Internationally, such as in PJM in the US, the benefits of fast-responding storage have been recognized. Also, in California, there are proposed targets for storage, and in Germany there is a subsidy for new energy storage projects. In Ontario, business cases for storage can be made for certain applications, such as for backup power where a fast-responding battery can be used at a manufacturing plant to avoid voltage sags and assembly line interruptions. The IESO has procured 10 MW of alternative sources of frequency regulation from technologies including flywheels, batteries and demand response. Various groups have set out to model and value the benefits of energy storage on the Ontario grid. One step forward for Ontario would be to define energy storage targets, but allow for a flexible procurement process that ensures that only those projects that have a strong business case are selected. Planning needs to be regional so that storage can meet local needs. On the regulatory side, storage should be recognized as both load and generation, and storage should not be forced to fit into the market as only a generator or only a load. There is an opportunity right now in Ontario to create an innovation hub for energy storage that spurs project development, increased investment, skilled jobs and ultimately a more stable, flexible and lower cost electricity grid.

MEL YDREOS, INTERNATIONAL GAS UNION

Mel Ydreos is vice-chairman of the coordination committee of the International Gas Union. In his presentation Ydreos said that one concern in the gas sector is that dialogue about energy in Ontario tends to focus on electricity, despite gas having a larger share of primary energy consumption. Developments in gas, particularly around shale gas, need to be considered in an energy plan for Ontario. There is real concern about future uncertainty, particularly in demand growth, and as a result the energy system needs to be flexible. As a result the government should not be picking winners and losers, but rather, these decisions should be left to the market. If, for example, employment is the only category looked at, there may be other broader costs and benefits that are missed, such as driving business out of the province as a result of high energy costs. According to Ydreos, the advantages of natural gas is that it has great flexibility of use – such as for power generation, industry, heating and transport – and gas has lower emissions than many comparable energy sources. Carbon capture and storage can also be used to further reduce emissions. In addition, gas has low costs, and complements wind and solar generation because it can ramp up and down quickly.

3.4 Integrating Flexibility

Lessons from an International Perspective

ANDREW FORD, PROFESSOR OF ENVIRONMENTAL SCIENCE, WASHINGTON STATE UNIVERSITY

In regions where renewables such as wind have the potential to feed large amounts of power into the grid, there can be challenges in integrating this variable generation. In these situations, storage may be an attractive and cost-effective way to enhance grid reliability and to provide peak demand and surplus supply. The challenge, however, is in analyzing the business case for flexible services, such as what storage technologies can provide, in order to determine investment potential.

Andrew Ford has done electric power systems modeling for the western USA, with a particular focus on the power system in the Pacific Northwest. His talk summarized results of a recent study on the Ontario power system. Here are several findings from his presentation:

1. The value of flexibility needs to be quantified

One of the challenges in assessing the business case for investment in flexible services is that it can play a variety of roles on the grid. Researchers have

identified at least 14 qualitative aspects that offer economic value in different contexts. The California Public Utilities Commission has cited a lack of methods to evaluate cost-effectiveness of flexibility as a major barrier to the adoption of emerging energy storage technologies.

2. Including the costs of carbon will future-proof economic analyses

Many policy analysts believe that we can expect carbon pricing or taxation regimes to become much more robust in the future. Because physical energy infrastructure consists of long-term assets, it is prudent to evaluate how future carbon pricing might affect the business case for investments in flexibility that will operate for 30 years or more. The social cost of carbon emissions needs to be included in addition to the economic costs.

3. The benefits of bulk energy storage merit further investigation

Analysis from the western USA suggests that an extra 1,000 MW of balancing reserves will be needed for every 10,000 MW of wind capacity added to a power system. The balancing reserves could be provided by investment in fuel-free bulk storage. Bulk storage could also provide services such as load leveling and capacity deferrals. Recent analysis of a 1,000 MW of storage facility was conducted for the Ontario power system, and the total value to Ontario ratepayers was estimated $7.7 billion over the 20-year life of the storage facility. This substantial value indicates the need for further analysis on the role of storage technologies in Ontario

Lessons from the Ontario Perspectives

BRUCE ORLOFF, IBM

Bruce Orloff is the Canadian smart grid solution leader in IBM's Energy and Utilities practise. In his presentation, Orloff argued that an important part of energy modelling is the use of data, the ability to use data to ensure that new technology is properly integrated, and to understand consumers' behaviours. There are four key areas where data can be useful, he says: grid operations, portfolio planning (location of infrastructure development), demand management, behavioural modelling and consumer engagement. Another issue is understanding how to integrate renewables and other generation sources into the distribution grid while ensuring grid reliability. One way to do this is to use data (including historical, current, and predicted) to better forecast renewable power output, which would allow Ontario to use current capacity more effectively.

RON DIZY, ENBALA

Ron Dizy is president and CEO of ENBALA Power Networks, a technology company supplying real-time demand management services. According to Dizy, because of changes in generation mix- the introduction of higher levels of renewables and changes in demand patterns- acquiring 'flexibility' to manage the real time operation of the grid is becoming a key concern for grid operators. Real-time demand management can provide this flexibility at a reasonable cost by integrating IT technology with the existing supply and demand infrastructure. In effect, there is already a lot of storage available in the grid, he says – it is in

HVAC systems in buildings, in the reservoirs from our water plants, in thermal mass in cold storage facilities. The challenge is in integrating these forms of storage reliably, while respecting the operating constraints of the demand side. Advances and cost reductions in computing, communications approaches and the increased willingness of demand-side resources to participate in the grid, allow for much more efficient ways to integrate existing supply and demand resources in grid operations. This is already happening in some jurisdictions, and most observers believe this trend will continue. Demand management can also be used for wind and other renewable power integration. For such services to grow, Dizy says, it needs to be included in energy policy and planning framework and markets needs to evolve to treat demand side resources on a level playing field with incumbent resources.

4. Conclusion and Recommendations

The following are recommendations made by the presenters and the audience based on the six key themes.

1. Government should be the enabler of energy innovation, not the controller

The Ontario government is seen by many as too controlling of the energy sector and too prescriptive in its energy plans. While government clearly has an important role in the energy sector, it should see itself as the enabler, facilitating discussion and deliberation, and setting the goals, frameworks and conditions for others to implement. This enabling role will become more important as energy planning increasingly moves to private companies, municipalities and communities.

2. We should use the resources we have more effectively, by either using current energy infrastructure more flexibly, or by promoting greater conservation

Before building new energy infrastructure, it is necessary to see if the current infrastructure can be used more efficiently. This could involve integrating storage or demand management systems using IT and communication technology. A less centralized generation system, where energy production is distributed, will likewise require a more flexible approach to system operation.

Promoting conservation measures is a key element of this, and could involve more use of smart meters and providing consumers with access to their consumption data.

3. There is power in data

The recent installation of almost 4.7 million smart meters in Ontario has created new possibilities for both system operators and consumers. Consumers are now able to access their own consumption data (historical and real time), allowing them to better understand their energy needs and make more informed decisions about consumption. The end result will be a much larger role for consumers to actively respond to energy prices in the best way for them.

It is important that this data is accessible and useful for consumers. The Green Button initiative, and other smart grid projects, theoretically make a lot of data available to consumers. However, work needs to be done to ensure that the data is useful for consumers and allows them to make informed decisions.

4. Public engagement in energy policy is crucial, but there is no one singular public and effort must be made to understand how the different segments of the public relate to energy

In order for any energy plan to be successful, the public must be engaged, and they must be engaged throughout the entire process, from devising the plan to actual implementation: people need to be engineered into the equation. However, there is no one "public," and we don't fully understand the different segments of the public. This is important when looking at promoting conservation measures, as different segments of the public will need to be approached in different ways.

5. All forms of energy need to be included in planning

Energy policy in Ontario has generally focussed on electricity. While electricity is of course crucial, other forms of energy, such as heating, cooling and transportation, also need to be included in energy planning.

6. The future will be based on local energy solutions, and will be typified by a large number of small installations located close to demand centres, as opposed to our current centralized energy system.

The future of new generation is seen to be with distributed energy projects, which can include heat and electricity, and are small and can be located near demand centres. The ability to use combined heat and power installations means that overall efficiency is higher, and in many cases the cost of the heating is lower than alternative methods. It also allows for the organic development of energy services as new infrastructure can be built quickly when it is needed, instead of trying to predict 30 years in the future.

Distributed energy sources can also be built with private capital, and as they are small and meet local needs, public opposition is generally lower than for larger centralized generation.

Municipalities are generally involved in the development of these distributed energy projects, and it is important to link municipal energy development with other infrastructure, such as transportation, waste and housing. Distributed energy projects also increase the energy resilience of the municipality as they are not entirely reliant on transmission, and so are able to provide energy in emergencies, such as in flooding and storms.

Appendix A

Speakers at the Future Innovation in Energy Planning: A Special Session to Advise on Ontario's Long-term Energy Future

Workshop 1: Community Energy Planning: Best Practices for Integrating Land Use, Transportation and Energy Planning		
MODERATOR	Sean Conway	Distinguished Research Fellow, Ryerson University's Centre for Urban Energy
SPEAKER	Morten Hofmeister	Morten Hofmeister has worked with district heating in Denmark and other countries since 1998 with emphasis on a planning perspective. Morten previously managed heat sales contracts at DONG Energy before becoming director of the District Energy Development Center, which has now merged into Grøn Energi, an association closely related to the Danish District Heating Association. Grøn Energi is co-financed by the Danish District Heating Association and other companies.
ONTARIO RESPONSES	Ron Pushchak	Dr. Ronald Pushchak is a professor in the School of Occupational and Public Health with a joint appointment in the School of Urban and Regional Planning at Ryerson University. In addition to his academic and research activities, he has been involved in a number of professional environmental planning projects including the Ontario efforts to develop legislation to protect municipal drinking water sources, the disposal of nuclear fuel waste, and the government's efforts to locate municipal waste landfills in the GTA.
	Fernando Carou	Fernando Carou is Senior Engineer for Community Energy Planning and District Energy Systems for the City of Toronto. He leads the Community Energy Planning (CEP) program and is also in charge of assembling the technical, corporate, and policy framework for new district energy systems. Fernando focuses on integrating energy planning into community growth plans.
Workshop 2: Conservation First: Future Opportunities and Challenges for Conservation		
MODERATOR	Ian Rowlands	Professor and Associate Director (Global Initiatives) of Waterloo Institute for Sustainable Energy, University of Waterloo.
SPEAKER	Karen Ehrhardt-Martinez	Karen serves as Principal for Human Dimensions Research Associates, an organization which researches innovative energy initiatives. She is also associated with the University of Colorado Renewable and Sustainable Energy Institute. Her research projects include work on the social dimensions of energy consumption, energy efficiency, and climate change.
	Matthew Theall	Matthew Theall is a Presidential Innovation Fellow working on MyData Initiatives (Green Button) at the US Department of Energy. Before joining the DOE, Matthew was a Technology Strategist at Intel Corporation, where he focused on networking and Smart Grid technologies. He was also previously a member of the Board of Directors of the Smart Grid Interoperability Panel and was president of several industry trade groups focused on home networking and smart grids.
ONTARIO RESPONSES	Niraj Bhargava	Niraj Bhargava is co-founder and CEO of Energate Inc., a company specializing in home energy management solutions.
	Mark Schembri	Mark Schembri is Vice President, Supermarket Systems and Store Maintenance for Loblaw Companies.
Workshop 3: Emerging Generation Technologies: A 20-Year Prognosis		
MODERATOR	Jatin Nathwani	Jatin Nathwani is the Ontario Research Chair in Public Policy for Sustainable Energy at the University of Waterloo. He is also Executive Director of the Waterloo Institute for Sustainable Energy.

SPEAKER	Roger Gale	Roger Gale is the CEO of GF Energy, which specializes in managing emerging, innovative issues in the electricity and gas industries. He has been a leader in promoting competition in the electricity industry and working with entrepreneurial companies committed to innovative technologies, price-driven solutions and regional synergies. He has provided consulting services to a number of major Western US energy companies. Previously, he held senior positions at the US Department of Energy, the Environmental Protection Agency, and the Federal Energy Regulatory Commission. Roger sits on the boards of Adams Express and Petroleum and Energy Resources.
ONTARIO RESPONSES	Alexander McIsaac	Alexander McIsaac works at NRStor, a start-up company led by Annette Verschuren, whose primary mandate is to accelerate the commercialization of energy storage technologies through project development and ownership. Previously, Alexander worked in the venture capital industry investing in growth companies and assessing business plans. He holds a Bachelor of Science Honours from Queen's University and an HBA from the Richard Ivey School of Business.
	Mel Ydreos	Mel Ydreos is the Executive Director of EnergyVantage. Mel is also the Vice-Chairman, Coordination Committee, of the International Gas Union.
Workshop 4: Introducing Network Flexibility: Smart Grids and Demand Reduction		
MODERATOR	Paul Murphy	Paul Murphy is Chair of the Ontario Smart Grid Forum and former CEO of the Independent Electricity System Operator of Ontario.
SPEAKER	Andrew Ford	Andrew Ford is a professor in the School of the Environment at Washington State University. Andy's research has concentrated on planning and environmental problems in the energy industry, especially the impact of incentives to increase renewable generation and to reduce carbon dioxide emissions. His work on the "California electricity crises" explained the boom and bust in power plant construction that followed the deregulation of the power system. His most recent research uses modeling to better understand the value of energy storage to enable power systems to make a swift transition to greater renewable generation.
ONTARIO RESPONSES	Bruce Orloff	Bruce Orloff is the Canadian Smart Grid Solution Leader in IBM's Energy and Utilities practice with over 25 years of experience in the utilities and telecommunications industries. He has extensive knowledge and experience managing, developing and implementing advanced solutions in competitive de-regulated electricity and telecommunications markets in North America, Sweden and Australia. Some of his main achievements include implementation of leading edge advanced metering and smart grid solutions in Ontario and overall project management and technical leadership on the deployment of a multi-million dollar optical fiber network across North America. Bruce is also one of the founding members and past board member of SmartGrid Canada.
	Ron Dizy	Ron Dizy is President and CEO of ENBALA Power Networks. ENBALA is a smart grid technology company that continuously connects large electricity users to deliver grid operational flexibility to electricity system operators and utilities. ENBALA's GOFlex platform captures and then aggregates inherent demand-side storage from connected loads, to respond to the real-time needs of the power system in order to increase reliability, efficiency and reduce greenhouse gases.
Summary	**Summary Discussion: A Roundup of New Ideas**	
MODERATOR	Jose Etcheverry	Associate Professor and Co-Chair, Sustainable Energy Initiative (SEI), York University
SPEAKERS	Morten Hofmeister Karen Ehrhardt-Martinez Roger Gale Andrew Ford	

About the Mowat Centre

The Mowat Centre is an independent public policy research centre located at the School of Public Policy and Governance at the University of Toronto. The Mowat Centre is Ontario's non-partisan, evidence-based voice on public policy. It undertakes collaborative applied policy research, proposes innovative research-driven recommendations, and engages in public dialogue on Canada's most important national issues.

About Mowat*Energy*

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