

SMART GRIDS

IN THE NORTH AMERICAN CONTEXT:



A POLICY LEADERSHIP CONFERENCE
A US-CANADA CLEAN ENERGY DIALOGUE EVENT

WATERLOO, ONTARIO, CANADA, JANUARY 24-25, 2011



Summary Report: April 10, 2011

SMART GRIDS IN THE NORTH AMERICAN CONTEXT: A POLICY LEADERSHIP CONFERENCE A U.S.-CANADA CLEAN ENERGY DIALOGUE EVENT

CO-HOSTED BY NATURAL RESOURCES CANADA,
THE INDEPENDENT ELECTRICITY SYSTEM OPERATOR (ONTARIO),
THE UNIVERSITY OF WATERLOO (WATERLOO INSTITUTE FOR SUSTAINABLE ENERGY)
AND THE CENTRE FOR INTERNATIONAL GOVERNANCE INNOVATION

The implementation of smart grids – however defined – is transforming electricity system planning around the world. Increased use of information and communications technologies, coupled with greater integration across different parts of the power system, present new opportunities and unique challenges. Across North America, smart grid activity has taken off over the past three years: in the United States, significant amounts of stimulus money have been channelled to support smart grid deployment; across Canada, a number of smart grid initiatives have gained momentum and are being integrated into provincial energy strategies.

Four organizations were brought together by their own particular interests in the set of issues associated with smart grids: Natural Resources Canada (NRCan), Ontario's Independent Electricity System Operator (IESO), The Centre for International Governance Innovation (CIGI) and the University of Waterloo. Working as part of the broader U.S.-Canada Clean Energy Dialogue, they convened a two-day policy leadership conference to discuss 'smart grids in the North American context.' Held in Waterloo, Ontario on January 24 and 25, 2011, the conference helped to fulfil the Dialogue's commitment to joint Canada-U.S. cooperation on key clean energy science and technology issues. More specifically, the conference responded to the Dialogue's focus on the electricity grid (one of its three working groups), contributing to the goals of advancing smart grid and clean power technologies and of enhancing bilateral cooperation.



The Hon. Christian Paradis, Canadian Minister of Natural Resources

Key speakers at the event included:

- **The Hon. Christian Paradis**, Minister of Natural Resources, Government of Canada
- **Patricia Hoffman**, Assistant Secretary for the Office of Electricity Delivery and Energy Reliability, United States Department of Energy
- **Paul Murphy**, President and CEO, Independent Electricity System Operator
- **Guido Bartels**, Immediate Past Chairman, GridWise Alliance and General Manager, Global Energy and Utilities Industry, IBM
- **Ralph G. Zucker**, Director, Smart Grid Development, BC Hydro and Executive Director, Smart Grid Canada
- **Brian Bentz**, President and CEO, PowerStream and Chair, Electricity Distributors Association
- **Pierre Guimond**, President and CEO, Canadian Electricity Association
- **John McDonald**, Chair of Smart Grid Interoperability Panel (NIST) and Technical Strategy and Policy Development Director for GE Energy
- **Thomas Homer-Dixon**, CIGI Chair of Global Systems, Balsillie School of International Affairs and Professor in the School of Environment, Enterprise and Development in the Faculty of Environment, University of Waterloo

The purpose of this report is to summarize some of the key points raised by the 30 speakers (facilitators, presenters, panellists, questioners and respondents) and the more than 50 other attendees during the conference. What follows are the key themes that emerged from this discussion.

Smart Grids and the U.S.-Canada Clean Energy Dialogue

From the start, the conference was designed to elicit a high-level perspective on the development of smart grids across the continent, supporting the overall objectives of the U.S.-Canada Clean Energy Dialogue (CED). As part of the CED Action Plan, both governments committed to host a Canada-U.S. Smart Grid Forum to focus on the role of different levels of government in creating the conditions necessary to support the transition to a smarter electricity grid. Formalizing this partnership between both countries on smart grid policy underscores their commitment to achieving a greener, more sustainable energy sector, and provides critical momentum for future progress.

The smart grid is not an end in itself; it is a means to many ends. It supports a myriad of broader objectives -- conservation, energy efficiency, the integration of renewables, greener communities, and sustainable transportation, to name just a few. It was noted that while there are already many tools available to reduce greenhouse gas emissions, few are used to support a common purpose. Smart grids facilitate a co-ordinated and accelerated use of these tools. As a result, governments must make a deep and sustained commitment to work together for smart grids to fulfill this critical, enabling function.

Each region within Canada and the U.S. is unique in terms of its existing infrastructure, supply mix and customer profiles. Participants at the workshop explored how the various strategies adopted to modernize their electricity services can be leveraged for greater efficiencies. While many smart grid initiatives share the same high-level strategic goals, the pace and character of smart grid development will ultimately differ by jurisdiction. By recognizing and building off of these regional differences, there are opportunities to improve the security, reliability and environmental performance of the North American electrical grid.



IESO President and CEO Paul Murphy and Patricia Hoffman, Assistant Secretary for the Office of Electricity Delivery and Energy Reliability, United States Department of Energy



Daniel Schwanen, Senior Fellow, The Centre for International Governance Innovation

Smart Grids and Climate Change: “Put on your running shoes.”

As one speaker noted, climate change is a race against time and smart grids help step up these efforts and yield climate change tools with skill and purpose. Participants drew attention to recent cost curve studies of carbon mitigation measures, many of which have concluded that some of the lowest cost actions involve addressing energy conservation and electricity demand-side management. Indeed, many view improved grid efficiency, combined with the gradual electrification of other sectors as an important stage on a transition pathway toward a lower carbon economy.

In jurisdictions with carbon-intensive generating peaks, load-shifting facilitated by smart grid technology could reduce greenhouse gas emissions. The improved performance of electricity supply systems will reduce also overall generation requirements.

Smart grid development aligns well with Canadian and U.S. climate change policy where there are concerted efforts afoot to begin to address carbon emissions from coal-fired generation. In the U.S., there is considerable interest in making smart grids a key platform of the evolving climate bill. Internationally, there is broad interest from organizations such as the International Energy Agency in increased collaboration and information-sharing on smart grids, such as the International Smart Grid Action Network.

The Challenges

Throughout the discussions, participants spoke to a number of challenges that must be resolved – or at least mitigated – in order to realize the promise of the smart grid. These were: customer engagement, risks and costs, and standards and interoperability.



Engaging Consumers: “A Fragile Discussion”

From one perspective, it could be said that smart grids offer the electrical equivalent of giving customers the vote, providing them with the tools to exercise greater control over the way they use electricity. However, experience throughout North America has shown that consumers are unaware of how to take advantage of these changes. Indeed, most customers fail to recognize these new tools as something they want or need. Nonetheless, as was noted, no one asked for a BlackBerry before it was invented.

Most participants agreed the goal is to move toward a more energy conscious society where consumers are open to making changes in their consumption behaviour and have the ability to make informed decisions about their energy use. What they need in order to make these informed decisions is a matter for much debate, with many workshop attendees citing increased consumer engagement and education.

A parallel can be drawn between the evolution of the telecom sector and the electricity sector. While first-generation cell phones only offered communication mobility, today they offer a myriad of applications. Smart grid capabilities will evolve in a similar way. The key will be to keep this ever-more complex system simple from the point of view of the consumer. Indeed, at some point, a consumer's conscious behaviour will be supplanted by predetermined, yet automated, interconnected devices.

Before consumers adopt in-home energy monitoring and management devices, they will need to trust that their personal information is secure. It was argued that the Privacy by Design model, as developed by Ontario's Information and Privacy Commissioner, embeds protections into the fundamental architecture of technology, strengthening customer confidence from the outset.



To date, information about the impact of smart meters and time-based pricing is conflicting. In some jurisdictions, outcomes from smart meters and variable pricing initiatives have been fairly muted, while others have revealed noticeable levels of price elasticity by consumers. What's needed is a consumer transition strategy to shepherd this evolution – for both Canada and the U.S. to collaborate on how best to identify and serve consumers' needs. This would involve information sharing about consumer pilot projects and the impacts of rate design.

Yet, as echoed by a number of participants, the value proposition to consumers has not yet been made effectively. The case for smart meters and smart grids is difficult to make, and one that has largely centred on encouraging people to use less electricity. This value proposition must set appropriate expectations, but also clearly outline the positive benefits of smart grid capabilities to consumers.

One participant asked whether customer engagement also includes reaching out to consumers as citizens – and fostering an approach similar to the blue box program where positive behaviours are encouraged without the need for financial incentives. Many speakers expect younger energy users to be early adopters, representing a new generation of engaged consumers. These consumers better understand networks – and see the energy system as just another network, like telecommunications or computing and can handle, and even embrace, greater levels of complexity and interaction in their daily lives.

Making the Case

Risk was a theme that permeated a number of the discussions at the conference. Even among those who are convinced that a smart grid future is assured, there is still debate as to what the constituent elements of that future will be. Information and communications technologies are poised to occupy a critical position in the future smart grid. Questions remain, however, as to how their continued development should be financed.

Consumers may be concerned that smart grid investments are going beyond what's truly needed, adding unnecessary costs to the system. At the other end of the spectrum, it was asked who is going to pay if we don't make the right smart grid investments? Sometimes taking no action may be even more costly in the end. Differences of opinion about what investments are required, and at what point they become excessive, will accompany these deliberations. Finding this balance will be a challenge for all – particularly regulators in their role in safeguarding the public interest.

A complicating factor is the fact that the benefits of smart grid investment, depending on market structure, will accrue across the electric power sector and may not be realized by any single entity. The most cost-effective initiatives, for example, may be found shared across various sectors – commercial/institutional, industrial or residential.

The question was also asked, who should provide the necessary funding to continue to move ideas along the technology development lifecycle? On the one hand, investments in the electricity supply and delivery have tended to be borne by ratepayers; on the other hand, the benefits of smart grids, particularly the potential environmental benefits, show that there is a legitimate public interest in appropriate smart grid development. Given the entrepreneurial aspects of smart grid technologies, new technology plays may require support in order to get their ideas off the ground.

A shared understanding of the risks and benefits of grid modernization has not been fully formulated, making it difficult to articulate an effective value statement for consumers. However, a better understanding is emerging of how to develop smart grid strategies to meet the specific needs of local systems. These efforts speak to the need for greater information sharing and collaboration on best practices.

Standards and Interoperability: “It’s Not Smart Unless It’s Reliable and Secure”

A 21st century electricity grid can’t be operated using 20th century technology. As the system becomes much more diffuse and distributed, smart grid projects are emerging to maximize the use of existing infrastructure by providing situational awareness about the overall state of the system. For example, smart grid capabilities enable localized responses from various devices to effect changes in voltage and power quality. In many instances, these initiatives are being undertaken by individual utilities, municipalities and/or provinces/states. Accordingly, a patchwork of experiences is emerging. For reasons of experimentation and learning (and, potentially, resiliency), this is to be welcomed.

Despite all the benefits to transmission owners and system operators, regulators and standards authorities are cautious about sanctioning new technologies on a century-old system. Unless the interoperability of smart grids is carefully designed and managed, the entire system may be susceptible to cyberattack, inadvertent errors or components becoming incompatible.

But interconnections and cross-fertilization of experiences will inevitably arise at scale. At that time, demands for interoperability standards become increasingly necessary. A challenge is to determine the ‘optimal’ time at which such standards should be introduced – too early and innovation could be stifled and inferior approaches locked-in; too late and otherwise productive assets could be left stranded. There are not only questions about such timing, but also about the scope of such standard-setting, the physical reach of what should be subject to standards and which institution(s) should be taking the lead in standard-setting.

There was discussion of the current dialogue between the National Institute of Standards and Technology and the Federal Energy Regulatory Commission regarding recommendations on the first five “foundational” interoperability standards. In Canada, the Canadian National Committee of the International Electro-technical Commission (IEC) will be making recommendations on interoperability standards, but as energy policy largely rests with provincial governments, provincial regulators are being handed a major part of the responsibility in ensuring the use of interoperability standards.



Professor Jatin Nathwani, Waterloo Institute for Sustainable Energy, University of Waterloo

The addition of significant new resources to the distribution system, coupled with the changing nature of the distribution system, will have significant impacts on transmission owners and system operators. This requires close co-ordination on almost all fronts: modelling, simulations, tools and planning. System operators will need to develop the tools and approaches to manage the volume of data that will be collected as part of a modernized system.

The Roles of Governments and Other Stakeholders

In the debate around who does what, governments were often seen as important coordinating bodies – bringing together utilities, regulators, businesses, consumers, civil society organizations and potentially others in order to share experiences, voice preferences and debate priorities. Such discussions could serve to produce smart grid plans or smart grid road-maps of some sort. It was argued that smart grid policy needs to be integrated into long-term electricity planning – particularly as it supports the renewables. In any case, government could serve as a clearinghouse of activities, perspectives and positions.

There are instances in which government could catalyze action on smart grids, encouraging development in particular ways without wholly committing to a particular path. Investments in training a new generation of workers on smart grids, new concepts in regulatory design, support for high-risk technologies, green procurement and public education are examples of roles that governments could consider pursuing.

Beyond the public sector role, it is clear that the divergent groups that contribute to smart grids are coming together. GridWise Alliance and its newly-formed Canadian counterpart – Smart Grid Canada – are starting to develop broad consensus around smart grid issues. These groups will play an integral role in advancing the issues and stimulating action from both the private and public sectors.

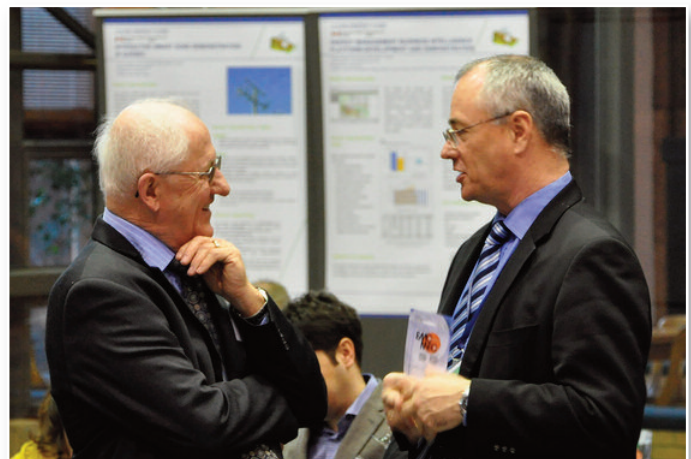
Continental-Level Action on Smart Grids

One of the unique contributions of this conference was the participation of senior stakeholders from both Canada and the United States. Experiences could be shared, priorities compared and respective countries' action items noted. Indeed, numerous speakers highlighted both the physical interconnections between the two countries' electricity grids and the links between Canada and the United States (e.g., in the North American Electric Reliability Corporation). The ways in which these – and other – transnational connections could serve to advance the smart grid agenda were highlighted in at least three different ways.

First, experiences from one country could be illustrative to the other. Indeed, Ontario's Smart Grid Forum brings together utilities, government, regulators and the private sector, leading to the development of core principles for the development of smart grids. The United States Smart Grid Consumer Collaborative is also a model of efforts to improve stakeholder consultations on smart grid issues. It was noted that in some cases, there are some greater similarities across the two countries than within either individual country. For example, rural Alberta may have more in common in terms of their infrastructure and electricity needs with Montana than it does with Vancouver.

Second, it is valuable to compare and contrast the motivations for smart grid activity in each country. The question was asked: considering the importance of smart grids as an economic driver, are Canada and the U.S. competitors or collaborators? Close comparison and analysis of the respective smart grid agendas in both countries could serve to maximize the prospects of future success on both sides of the border, even as companies on both sides of the border compete to serve this burgeoning market.

Third, the coordinated use of the continent's variable renewable resources, for instance, might allow for more efficient use of solar energy in different locations. Alternatively, parallel development of incompatible standards for smart appliances in the home and office could serve to fragment the market and thus reduce potentially valuable economies of scale. Workshop attendees noted the potential value of coordinated efforts in many ways.





RECOMMENDATIONS

A number of key themes were reiterated by speakers and participants over the course of the conference. There was consensus that several existing government-sponsored activities had ongoing merit for enabling the development of smart grids. Some participants recommended that additional measures be considered for collaborative action by government, industry and other stakeholders in the future. Some possible next steps include:

1. **Continuing stakeholder consultation on standards development for the smart grid.**

Attendees discussed the consultation process being led by the U.S. Smart Grid Interoperability Panel and reinforced the idea that Canadian stakeholder views need to be heard in that process. Initiatives such as the NRCan-led Smart Grid Standards Task Force will be important for ensuring that Canadian interests are appropriately represented. Later in 2011, this task force will release a Smart Grid Standards Roadmap for Canada that will incorporate input from key Canadian stakeholders.

This roadmap will recommend standards for implementation by regulators, describe their relative significance and importance for smart grid development, and identify remaining gaps. Options for enhancing the profile and impact of this work vis-à-vis regulators could be explored.

2. **Strengthening investment in R&D and demonstration to share the risk of smart grid technology development and deployment.** The U.S., through the Recovery Act, has made very significant investments in the demonstration of smart grid technologies. Similar investments are being made in Ontario, in BC through its Innovative Clean Energy (ICE) Fund, and by the Government of Canada's Clean Energy Fund (CEF). Participants expressed support for the continuation of such activities, as well as the dissemination of project-derived knowledge and learnings as these initiatives reach maturity. The International Smart Grid Action Network (ISGAN), an initiative announced as part of the Clean Energy Ministerial in summer 2010, provides a potential multilateral mechanism. The Clean Energy Dialogue could potentially offer a similar platform for the sharing of such learnings bilaterally between Canada and the U.S.

3. **Exploration of a Canadian national consumer initiative to promote citizen awareness of smart grid benefits, drawing on studies and experiences in Canada and the US.** Conference participants characterized effective consumer engagement as fundamental to smart grid development. To that end, the Ontario IESO and NRCan could consider collaborating to establish a customer awareness survey that would gauge Ontario consumers' current understanding of smart grids as well as their appetite for future offerings. This pilot project could serve as a benchmark for tracking customer engagement and, using lessons learned through the survey, could potentially be adapted for other provinces to create a national perspective on electricity customer needs. Such an effort would require buy-in and close coordination with other provincial governments.
4. **A further elaboration of a jurisdictional scan or smart grid repository of information that would describe and catalogue the activities now being undertaken on smart grid implementation in jurisdictions across North America.** This effort is already well-advanced in the U.S., where the Department of Energy (DOE) hosts a Smart Grid Clearinghouse web portal. A similar effort by a Canadian entity, in conjunction with, or independent of, the Clearinghouse, could complement this work. Options could be explored for the design of such a tool through discussions with Smart Grid Canada.

Looking ahead, these ideas could be brought forward for consideration as part of a second round of Clean Energy Dialogue projects. The aim of this exercise will be to develop a second work plan for joint Canada-U.S. collaboration on projects to be carried out over the coming years.

We seek your feedback on the workshop and this report.
Please contact us at IESO.SmartGrid@ieso.ca with your thoughts and suggestions.

The sponsors of the workshop would like to thank Professor Ian Rowlands of the Waterloo Institute for Sustainable Energy at the University of Waterloo, for the initial development of the concept of this conference, bringing together the partners, and supporting it through to completion. Professor Rowlands, with the aid of graduate students from the University of Waterloo also supported the drafting this summary report.



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