

DRAFT - Discussion Paper:

Comparing the developing Ontario Policy Roadmap to the NIST Interoperability Framework.

REVISED following February 4th 2010 meeting of the Ontario Smart Grid Forum Working Group

Purpose of this Paper:

This paper provides a snapshot reconciliation of the Ontario smart grid policy roadmap that is currently being developed by the SGF in conjunction with the Ontario Ministry of Energy and Infrastructure (MEI) and the emerging smart grid interoperability framework of the U.S. Department of Commerce, National Institute of Standards and Technology (NIST). The purpose of this exercise is to identify areas of cohesion between the Ontario and U.S. policies currently under development, and more importantly, identify areas where these two efforts may be diverging.

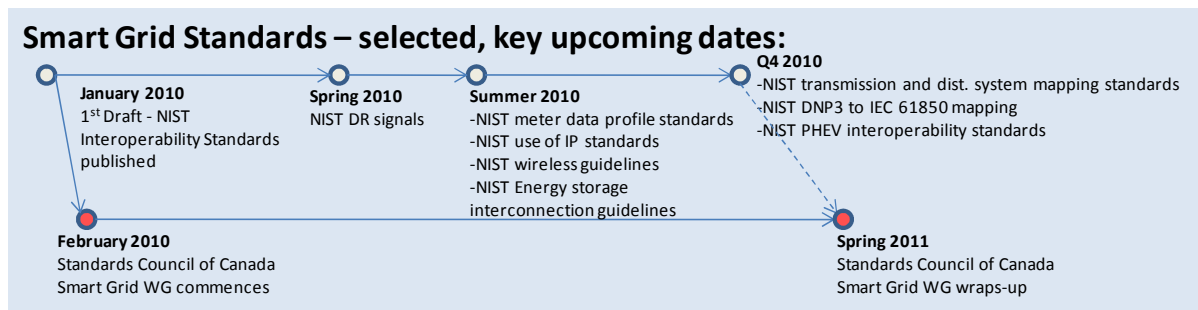
February 5th Revisions:

This paper was originally intended to support the February 4th 2010 meeting of the Ontario Smart Grid Forum Working Group and has been subsequently revised to reflect their review and input. Their feedback is now included within this paper (and marked as such where applicable) for the benefit of the members of the Ontario Smart Grid Forum.

Time Context of this Paper:

This paper has been prepared following the January 18th meeting of the Ontario Smart Grid Forum (SGF) which is continuing its ongoing discussions lead by the Ontario Ministry of Energy and Infrastructure (MEI) regarding the smart grid policy roadmap. **The policy roadmap statements were most recently revised by the Ministry working group on February 5th and those revisions are not reflected in this paper.**

In January of this year, the U.S. Department of Commerce, National Institute of Standards and Technology (NIST) published, “*NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0.*” This document is the first complete release of the interoperability framework that was originally published in draft form on September 24, 2009. The release of this latest NIST document is one of several standards development milestones which are expected for 2010. Some of the more prominent delivery dates for selected NIST “priority action plans (PAPs)” are highlighted in the diagram below:



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Comparison of Legislative Prerogatives:

Both the Ontario policy roadmap effort and the NIST interoperability framework directly stem from legislative prerogatives to realize certain benefits from the smart grid. At the core these goals are three key pieces of legislation that are summarized in the table that follows:

NIST Legislative Framework	Ontario Legislative Framework
<p><i>Energy Independence and Security Act, 2007 (EISA)</i></p> <p>Smart Grid provision:</p> <ul style="list-style-type: none"> • Puts specific meaning to the term “smart grid” and what it is intended to support – SEE APPENDIX ‘A’¹ <p>Policy Development:</p> <ul style="list-style-type: none"> • Subsequent policy development by the U.S. Department of Energy • Incorporation of policy statements into NIST Interoperability framework 	<p><i>Green Energy and Green Economy Act, 2009 (GEGA)</i></p> <p>Characteristics:</p> <ul style="list-style-type: none"> • Puts specific meaning to the term “smart grid” and what it is intended to support SEE APPENDIX ‘A’² <p>Policy Development:</p> <ul style="list-style-type: none"> • Ongoing joint policy roadmap exercise between the Ontario Smart Grid Forum and the Ontario Ministry of Energy and Infrastructure • Separate, \$50 million allocation for smart grid funding outlined in the Ontario budget.
<p><i>American Recovery and Reinvestment Act, 2009 (ARRA)</i></p> <p>Characteristics:</p> <ul style="list-style-type: none"> • Paves the way for a massive infusion of public investment in smart grid technologies, transmission system upgrades, energy efficiency and reliability. <p>Policy Development:</p> <ul style="list-style-type: none"> • Subsequent policy development by U.S. Department of Energy to • Incorporation of policy statements into NIST Interoperability framework 	

Comparison of Policy Statements:

In the sections that follow, each of the main topic areas of the emerging Ontario policy roadmap are compared against selected, relevant citations in the NIST interoperability framework document in order to assess the overall level of cohesion between them. Each of the sections that follow are divided along the lines of the Ontario policy roadmap topic areas – namely:

- “Broad Principles of the Smart Grid”
- “Consumer Control”

¹ Energy Independence and Security Act, 2007 (EISA), Title XII, section 1301

² *Green Energy and Green Economy Act, 2009*, Schedule ‘B’, Addition of new definition of ‘smart grid’ to section 2 of the *Electricity Act*.

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- “Utility Flexibility”
- “Adaptive Infrastructure”

As comparisons are made, they are subjectively assessed as falling into three levels of cohesion as follows:

Consistent	<ul style="list-style-type: none">• Ontario roadmap policy statements seem to be directionally consistent with NIST framework - at least at a high level.
Unclear	<ul style="list-style-type: none">• Not enough information available within either the Ontario roadmap policy statements or the NIST framework to assess a level of cohesion at this time.
Divergent	<ul style="list-style-type: none">• Ontario roadmap policy statements seem to be diverging with the relevant policy direction set out in the NIST framework.

Summary of Overall Findings:

In the most general terms, there is a high degree of consistency between the overall policy objectives of the Ontario policy roadmap and the key policy drivers cited within the NIST Interoperability framework document. In areas where the level of cohesion is somewhat “unclear” this is largely due to one of the two jurisdictions making a policy statement on a particular subject not covered within by the area or an overall difference in scope. The few policy areas that fall into this category do not necessary rule out a future refinement of scope or harmonization between policies at some point in the future.

Notwithstanding the above, the Smart Grid Forum Working Group did raise concerns that while the Ontario policy roadmap and the NIST framework may have an apparently strong consistency at the **policy** level, there are areas within the Interoperability standards framework where future divergence or conflict could arise. Some early examples cited by working group members included the role of third parties, frequency spectrum allocation and security. As a result, the Smart Grid Forum Working Group has recommended a more rigorous review of the emerging standards that NIST plans to develop over the course of 2010 from an Ontario standpoint. Identifying potential areas of strategic interest from an Ontario standpoint will be the subject of future submissions to the Ontario Smart Grid Forum.

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Comparison of Policy Statements – PART 1: Broad Principles of Smart Grid

Ontario Policy Roadmap ³	Level of Cohesion	NIST Guiding Policies
<p>CUSTOMER VALUE “the smart grid should provide benefits to electricity customers while being cost effective.”</p> <p>Smart Grid Forum Working Group Input:</p> <ul style="list-style-type: none"> The group did not see a significant problem with the Ontario policy statement making specific reference to cost effectiveness as this does not contradict or hamper overall cohesion with the NIST interoperability framework. 	<p>Unclear</p>	<p>Societal and customer benefits are combined in various places in the NIST report and no explicit link to being “cost effective” appears to be made. Example:</p> <p><i>“In the United States and many other countries, modernization of the electric power grid is central to national efforts to increase energy efficiency, transition to renewable sources of energy, reduce greenhouse gas emissions, and build a sustainable economy that ensures prosperity for current and future generations”⁴</i></p>
<p>COORDINATION: Wherever practical, distributors should coordinate smart grid implementation efforts by, among other means, coordinating smart grid plans, sharing results of pilot projects, and engaging in common procurements to achieve economies of scale where practical.</p> <p>Smart Grid Forum Working Group Input:</p> <ul style="list-style-type: none"> The group was generally comfortable with leaving specific recommendations on the establishment of coordination bodies out of the Ontario policy statement. They further noted that the U.S. SGIP is specific to the issue of interoperability, while the Ontario policy statement is clearly meant to be much broader than that. 	<p>Unclear</p>	<ul style="list-style-type: none"> Current standards development activities span hundreds of agencies⁵ Standing Smart Grid Interoperability Panel (SGIP) established to oversee standards development/refinement on an ongoing basis.⁶

³ Draft MEI statements as of **January 28, 2010**

⁴ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 23

⁵ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 7

⁶ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 75

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Ontario Policy Roadmap ³	Level of Cohesion	NIST Guiding Policies
<p>INTEROPERABILITY: Adopt recognized industry standards that support the exchange of meaningful and actionable information between and among smart grid systems and enable common protocols for operation. Where no standards exist, actively support the development of new recognized standards.</p>	Consistent	<p>NIST priority areas for standards development⁷:</p> <ul style="list-style-type: none"> • Demand Response and Consumer Energy Efficiency • Wide-Area Situational Awareness • Energy Storage • Electric Transportation • Advanced Metering Infrastructure • Distribution Grid Management • Cyber Security • Network Communications
<p>SECURITY: Ensure both cyber and physical security are implemented to protect data, access points, and the overall electricity grid from unauthorized access and malicious attacks.</p>	Consistent	<ul style="list-style-type: none"> • Focus on incorporating security at an architectural level • Draft standard: NISTIR 7628 to be further revised in early 2010
<p>PRIVACY: respect and protect the privacy of customers. Integrate privacy requirements into smart grid planning and design from an early stage, as part of the grid planning process.</p>	Consistent	<p>“The Smart Grid architecture should follow developments that enable fair information practices in a meaningful and transparent way. A potential additional measure of protection for consumers’ privacy would be in the design of Smart Grid applications and devices that allows consumers to have control of their personal information to the greatest extent possible. The Cyber Security Coordination Task Group CSCTG Privacy Subgroup will continue researching and addressing Smart Grid privacy issues and will document them as they relate to:</p> <ul style="list-style-type: none"> • Information collected by all entities involved with the Smart Grid; • Identified privacy concerns and risks; • Best privacy practices; and • Existing laws, regulations and standards.”⁸
<p>SAFETY: Under all circumstances maintain health and safety protection for customers and utility employees alike, and improve electrical safety wherever practical.</p>	Consistent	<ul style="list-style-type: none"> • “The safe operation of the Smart Grid is of primary importance to all stakeholders; thus it is critical to incorporate appropriate safety procedures, criteria, and considerations into the relevant Smart Grid standards.”⁹

⁷ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 8

⁸ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 120

⁹ ibid.

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Ontario Policy Roadmap ³	Level of Cohesion	NIST Guiding Policies
ECONOMIC DEVELOPMENT: encourage economic growth and job creation within the province of Ontario. Wherever practical, actively encourage the adoption of smart grid products, solutions, and services from Ontario-based sources.	Consistent	<ul style="list-style-type: none"> NIST anticipates global market for smart grid equipment and services to grow to more than \$171 billion by 2014 Direct link between smart grids policy and economic stimulus strategy under ARRA
ENVIRONMENTAL BENEFITS: Promote the integration of cleaner technologies, conservation, and more efficient use of existing technologies to reduce the environmental footprint of the electricity and transportation sectors.	Unclear	<p>Potential benefits cited within the NIST report as follows:</p> <ul style="list-style-type: none"> Displacement of about half of our nation's net oil imports; Reduction in U.S. carbon dioxide emissions by about 25 percent; and Reductions in emissions of urban air pollutants of 40 percent to 90 percent.
EFFICIENCY: Maximize utilization of the existing grid infrastructure, and improve efficiency of grid operation, including operations and maintenance activities associated with distribution system.	Consistent	<ul style="list-style-type: none"> "Optimizes asset utilization and operating efficiently;"

Comparison of Policy Statements – PART 2: "Customer Control"

Ontario Policy Roadmap ¹⁰	Level of Cohesion	NIST Guiding Policies
<p>ACCESS: Improve secure access to data by authorized parties who can provide customer value and enhance a customer's ability to manage consumption and home energy systems.</p> <ul style="list-style-type: none"> Role of third parties in providing access not clear in the Ontario roadmap. <p>Smart Grid Forum Working Group Input:</p> <ul style="list-style-type: none"> <i>The group was generally comfortable with leaving specific references to third parties out of this particular Ontario policy statement for the time being. Lack of mention at the policy level does not necessarily preclude them from being included within the</i> 	Unclear	<ul style="list-style-type: none"> Third party service providers recognized as one of the 7 domains in the NIST architectural framework

¹⁰ Draft MEI statements as of January 28, 2010

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Ontario Policy Roadmap ¹⁰	Level of Cohesion	NIST Guiding Policies
<i>Ontario framework at a later juncture.</i>		
VISIBILITY: Improve visibility of information, to and by customers, that can benefit the customer and the electricity system at large. This information should include, but is not limited to electricity consumption, generation and commodity price.	Consistent	<ul style="list-style-type: none"> • “Provision to consumers of timely information and control options” • “Deployment of “smart” technologies for metering, communications concerning grid operations and status, and distribution automation;” • “Integration of “smart” appliances and consumer devices;”
CONTROL: Enable consumers to better understand and control their level of consumption, generation, and cost in order to facilitate active, simple, and consumer-friendly participation in conservation.	Consistent	<ul style="list-style-type: none"> • “Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning;”¹¹
PARTICIPATION IN RENEWABLE GENERATION: provide consumers with opportunities to provide services back to the electricity grid such as generation and storage.	Consistent	<ul style="list-style-type: none"> • “Deployment and integration of distributed resources and generation, including renewable resource”¹²
CUSTOMER CHOICE: enable more and improved channels through which customers can interact with electricity service providers..	Consistent	<ul style="list-style-type: none"> • Third party service providers recognized as one of the 7 domains in the NIST architectural framework • “Enables informed participation by customers;”¹³
<p>EDUCATION: Actively educate consumers about opportunities for their involvement in generation and conservation associated with a smarter grid, and present customers with easily understood material that explains how to increase their participation in the smart grid and the benefits thereof.</p> <p>Smart Grid Forum Working Group Input:</p> <ul style="list-style-type: none"> • <i>The group recognized that the Ontario policy statement appears to go beyond the policy framework directly relevant to the NIST</i> 	Unclear	{ identification of responsibilities for customer education do not appear to be cited}

¹¹ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 23, citation from Energy Independence and Security Act of 2007

¹² NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 23, citation from Energy Independence and Security Act of 2007

¹³ U.S. Department of Energy, *Smart Grid System Report*, July 2009 cited in NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 24

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Ontario Policy Roadmap ¹⁰	Level of Cohesion	NIST Guiding Policies
<i>interoperability framework and they were generally comfortable with this.</i>		

Comparison of Policy Statements – PART 3: “Utility Flexibility”

Ontario Policy Roadmap ¹⁴	Level of Cohesion	NIST Guiding Policies
DISTRIBUTED RENEWABLE GENERATION: enable a flexible distribution infrastructure that facilitates increased levels of distributed renewable generation.	Consistent	<ul style="list-style-type: none"> • “Deployment and integration of distributed resources and generation, including renewable resource”¹⁵
VISIBILITY: Improve network visibility of grid conditions for grid operators where a demonstrated need exists, including the enablement of distributed renewable generation.	Consistent	<ul style="list-style-type: none"> • “Deployment of “smart” technologies for metering, communications concerning grid operations and status, and distribution automation;”¹⁶
RELIABILITY: Maintain reliability of electricity grid and improve it wherever practical. Maintain or improve the ability of the grid to reduce unforeseen outages.	Consistent	<ul style="list-style-type: none"> • “Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid;”¹⁷
CONTROL AND AUTOMATION – to the extent practical, develop the ability of smart grid infrastructure to automatically anticipate and respond to system disturbances.	Consistent	<ul style="list-style-type: none"> • “Dynamic optimization of grid operations and resources, with full cyber security;”¹⁸

¹⁴ Draft MEI statements as of **January 28, 2010**

¹⁵ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 23, citation from Energy Independence and Security Act of 2007

¹⁶ *Ibid.*

¹⁷ *Ibid.*

¹⁸ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 23, citation from Energy Independence and Security Act of 2007

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Ontario Policy Roadmap ¹⁴	Level of Cohesion	NIST Guiding Policies
<p>QUALITY: Maintain or improve the quality of power delivered by the grid, and improve it wherever practical.</p> <p>Smart Grid Forum Working Group Input:</p> <ul style="list-style-type: none"> <i>The group understood that while these two policy statements are indeed divergent, this is not necessarily problematic or contradictory to overall interoperability objectives. Recommend that this issue continue to be monitored from a standards standpoint as it evolves.</i> 	Divergent	<p>Policy statement not explicit about “maintain or improve” objective:</p> <ul style="list-style-type: none"> “Provides the power quality for the range of needs;”¹⁹
<p>OPERATIONAL SECURITY – ensure security of information systems and distribution systems in accordance with recognized standards.</p>	Consistent	<ul style="list-style-type: none"> “Operates resiliently to disturbances, attacks, and natural disasters.”²⁰

Comparison of Policy Statements – PART 4: “Adaptive Infrastructure”

Ontario Policy Roadmap ²¹	Level of Cohesion	NIST Guiding Policies
<p>FLEXIBILITY – provide flexibility within smart grid infrastructure to support future smart grid applications, such as electric vehicles and energy storage.</p>	Consistent	<ul style="list-style-type: none"> “Deployment and integration of distributed resources and generation, including renewable resource” “Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning;”²²

¹⁹ U.S. Department of Energy, *Smart Grid System Report*, July 2009 cited in NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 24

²⁰ ibid.

²¹ Draft MEI statements as of **January 28, 2010**

²² NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 23, citation from Energy Independence and Security Act of 2007

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Ontario Policy Roadmap ²¹	Level of Cohesion	NIST Guiding Policies
<p>FORWARD COMPATIBILITY, MODULARITY, AND SCALABILITY – protect against technical lock-in wherever practical to reduce stranded assets and investments</p>	Consistent	<ul style="list-style-type: none"> • “Enables new products, services, and markets;”²³ • “that the framework be “flexible, uniform and technology neutral, including but not limited to technologies for managing smart grid information;”²⁴
<p>ENCOURAGE INNOVATION – Nest within smart grid infrastructure planning and development the ability to adapt to and actively encourage innovation in Consistent technologies, energy services and investment / business models.</p>	Consistent	<ul style="list-style-type: none"> • “Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid;”²⁵
<p>MAINTAIN PULSE ON INNOVATION – establish programs to encourage innovation in the smart grid and information sharing, including cross-agency, cross-distributor, and government coordination of information and programming.</p> <p><i>Smart Grid Forum Working Group Input:</i></p> <p><i>The group understood that the ARRA policy lies somewhat outside the NIST interoperability framework and therefore this is not a critical comparison.</i></p>	Unclear	<p>ARRA programs include \$3.4 billion in programs and \$4.7 billion in matching funds to support manufacturing, purchasing, and installation of existing smart grid technologies.</p>

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²³ U.S. Department of Energy, *Smart Grid System Report*, July 2009 cited in NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 24

²⁴ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 24, citation from Energy Independence and Security Act of 2007

²⁵ NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0 , page 23, citation from Energy Independence and Security Act of 2007

APPENDIX 'A' – Legislative Smart Grid Definitions

(as set out in THE U.S. *Energy Independence and Security Act, 2007* (EISA) and the *Ontario Green Energy and Green Economy Act, 2009*)

Smart Grid definition set out in the *Energy Independence and Security Act, 2007* (EISA), Title XIII, section 1301

“It is the policy of the United States to support the modernization of the Nation’s electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth and to achieve each of the following, which together characterize a Smart Grid:

- (1) Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid.
- (2) Dynamic optimization of grid operations and resources, with full cyber-security.
- (3) Deployment and integration of distributed resources and generation, including renewable resources.
- (4) Development and incorporation of demand response, demand-side resources, and energy-efficiency resources.
- (5) Deployment of “smart” technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation.
- (6) Integration of “smart” appliances and consumer devices.
- (7) Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning.
- (8) Provision to consumers of timely information and control options.
- (9) Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.
- (10) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.”

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Smart Grid definition set out in the *Ontario Green Energy and Green Economy Act, 2009*, Schedule 'B', Amendment # 5 to section 2 of the *Electricity Act*:

- “(1.3) For the purposes of this Act, the smart grid means the advanced information exchange systems and equipment that when utilized together improve the flexibility, security, reliability, efficiency and safety of the integrated power system and distribution systems, particularly for the purposes of,
- (a) enabling the increased use of renewable energy sources and technology, including generation facilities connected to the distribution system;
 - (b) expanding opportunities to provide demand response, price information and load control to electricity customers;
 - (c) accommodating the use of emerging, innovative and energy-saving technologies and system control applications; or
 - (d) supporting other objectives that may be prescribed by regulation.”