Smart Meter Initiative - Further consultations
Board File No. RP-2004-0196

Comments on Relevant Issues

Prepared for:

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Attention: Peter H. O’Dell, Assistant Board Secretary

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The Ontario Energy Board received 57 submissions from stakeholders and 26 replies from individuals in response to the draft implementation plan for smart meters in Ontario prepared by the Working Group on Data and Communications (WGD&C). The Municipal Utelcos were one of the respondents.

The basis for our review of the WGD&C Report stems from our point of view that Ontario has within its grasp the foundation of a sustainable solution to the well-documented *electricity* supply and demand issues if the Government attacks the problem from the broader perspective of *energy* supply and demand. And by taking a holistic approach, it's one upon which we can simultaneously shore up other important goals defined by provincial and federal governments, including economic and social benefits of ubiquitous broadband *communications* for all citizens.

The Board has been informed by all the comments. Several organizations have asked the Board to consider two-way communication systems for the transmission of data between customers and utilities. The Board is interested in further information on the following issues:

1. What are the benefits and drawbacks of mandating a two-way communication network?
2. In the event of Province-wide two-way communication, should electricity distributors be responsible for operating the communication network?
3. If not, how should a communication operator or operators be selected?
4. How would rates for the communication operators be set and/or collected?
5. If there were a two-way communication network, would an open data protocol aid the development and availability of end-devices and services?

CONTEXT FOR OUR RESPONSE

In the authors' view, the present spate of so-called 'smart meters' fall into a category of technological dead-ends that won't scale to future demands for more information from more users.

The authors are concerned that the smart metering technology contemplated and recommended by the WGD&C won't meet present needs let alone future needs of members of the supply and demand chain and these 'legacy' meters will provide no valued added to consumers in the form of other utilities and non-utility services. In the authors' view, a "base level of functionality" should provide consumers and suppliers with the ability to access and control usage of electricity, natural gas, water, and appliances in exchange for the multi-billion dollar investment required by ratepayers in smart meters expected in the next few years.

The Municipal Utelcos have asked the OEB for clarification of your position on the following:

1. Is the OEB considering alternatives to an external meter, such as a switch located in the customer premises that could transmit and receive pricing signals and responses to all meter types, smart or dumb, for electricity, water, and natural gas?
2. If no, what functionality does the OEB expect from the Smart Meter?
3. How does the OEB see communications integrating with the energy supply loop, i.e., generator, market operator, transmitter, distributor, retailer, regulator, and customer?

The answers to these questions are germane to the responses we might provide to your questions in the request for further consultation on two-way communications. This is the case because the functional information communication and storage specifications of the edge devices/meters at each communication access point in the supply chain are critical to our providing informed answers to your questions. Otherwise we are shooting somewhat in the dark. For example, a two-way communication system capable of supporting quality of service for a multiple classes of service is an entirely different animal than one that only requires one class of information to be sent and received. At this writing, we have not received a response.

Therefore, consistent with our views expressed on several occasions to the OEB and Ministry of Energy, we will respond to your questions on two-way communications based on the following assumptions about what a Smart Meter is:

1. A device which may reside inside or outside the customer or supplier premises;
2. Is built using open standard technology;
3. Is able to support multiple industry standard communication protocols;
4. Is capable of supporting multiple streams of information for multiple utility services and other services;
5. Which is in-turn fully interoperable and integrated with similar devices at each point in the supply chain;
6. And as such, constitutes the electronic brains of choice for the communication the system.

WHAT ARE THE BENEFITS AND DRAWBACKS OF MANDATING A TWO-WAY COMMUNICATION NETWORK?

The following are the benefits and drawbacks of mandating a two-way communication network:

BENEFITS

Comments on Relevant Issues

1. Communications may occur in real time, which optimizes users and suppliers ability to respond to pricing signals, and other event oriented supply and demand activities of the energy marketplace.
2. A system which can be trunked, to support multiple types of two-way information flow will *scale* to meet the needs of all users and suppliers.
3. A trunked two-way system enables for quality control management of the communications and energy grid. These control protocols can run simultaneously over the same communications pathway that supports supply and demand information flow. Today, these systems run on separate communications infrastructure and are not integrated.
4. The lack of two-way communications has plagued AMR-type technology, but once in place it becomes easier for data from conservation-smart devices to be queried by or transmitted to aggregation points that include the local distribution companies whose billings need to reflect customers' real-time usage patterns.
5. Two-way communications allow consumers real time access to information that creates the opportunity to alter consumption behaviour.
6. As consumers, distributors, transmitters, generators, and regulators exchange data, these members of the supply-and-demand loop may exchange and respond to aggregations of that data at faster and faster rates, i.e., in real time.
7. As supply and demand responses speed up lower energy costs and less energy consumption is achieved. This is accomplished by enabling minute, but virtually infinitely repeated shavings off the peak demand by every participating consumer.
8. Without a scalable, two-way communications system connecting the various smart metering and reporting devices in the supply-and-demand-loop, the opportunities for better management and cost savings are severely limited.
9. As the authors envision it, a two-way communication system will enable the implementation of systems such as Supervisory Control and Data Acquisition (SCADA), Automated Meter Reading (AMR), Demand Side Management (DSM), Demand Response (DR), billing, settlement, Ethernet services, IP services, and HDTV broadcast in a controlled and secure environment. These systems provide interactive content to consumers and savings for distribution companies, whether they distribute electricity, water, power, natural gas, interactive content or other commercial services. These rate-based revenue overlays in turn will free up utility rate revenue for much needed capital investment in core infrastructure.
10. Simply having 4.5 million Ontario households independently poised to switch on dishwashers, washing machines and other appliances at 3 a.m. will not make for true DSM. Instead, a coordinated, cooperative approach is needed that can track ever-changing peaks in demand, incorporate responses from central command and control entities and harness the stand-by generation capacity in each of Ontario's municipalities, providing power and moderating demand closest to where it is consumed, just as the Electricity

and Conservation Task Force recommended. This can only be achieved with a scalable two-way communication system as a starting point.

11. The infrastructure for two-way communication to all members of supply chain, consumers and suppliers alike, is largely in place today. So the incremental investment is relatively small to close the communications gap. With the vast majority of Ontario's population living and working near high-speed network infrastructure already installed by Utelcos and related community broadband network initiatives, cable companies, and telephone companies, the opportunity — and the capacity — exists to close the "last-mile" gap between the installed network and Ontario's homes and smaller businesses.
12. Readily available new and legacy technologies can be employed to close the gap. Among the new technologies now available to close that gap and connect communities are fixed wireless and power line carrier. Power line carrier, by its very nature, is well suited for integration with "smart" building technologies and provides end-to-end line loss diagnostic capability for the electricity grid. But existing copper and coaxial infrastructure is also capable of filling the gap. All of these technologies can be harnessed and meshed into a grid to close the communications gaps with a reliable and scalable multifaceted communication system.
13. Solving the last mile bottleneck in broadband will enable the Province of Ontario to "achieve the desired sustainable future state" in energy conservation sooner than later.
14. A mix of central and decentralized generation, transmission, and distribution, connected in a fully-meshed 'smart system' is the optimal solution – significantly reducing the need for large investments in centralized generation and long distance transmission while creating a culture and economy of continuously lowering costs and independence.
15. By making any electrical device in any location capable of being turned on and off and any embedded chip device capable of receiving market signals and other content dynamically – the smarter, faster, cheaper province is assured.
16. By harnessing the province-wide potential of available emergency generation and new generation we achieve speed-of-light responsiveness through a 'distributed' generation model that can be managed and respond with mouse-click quickness from strategic locations.
17. When connected in real time communities with distributed generation capacity will perform like the centralized model, capturing those efficiencies across the board. At the same time the distributed system has the advantages of enhanced redundancy, reduced capital requirement, and sharply reduced risk profiles, thereby increasing the potential to attract cash-rich investors to keep much of this job off the backs of taxpayers. As each community gets connected, it can leverage third-party financiers need to scale up their commitments while mitigating the associated risks, i.e., achieve the fully self-funded model.

18. By ensuring that the connectivity is provided through the creation of an open-access, standards based infrastructure that any provider and any user can transact whenever a user chooses, each consumer's browser becomes a place to get equitably priced energy service around the clock. An interface where all providers and all users can choose what they want.
19. By achieving ubiquitous broadband deployment and sequentially overlaying the power and water systems, energy suppliers gain "micro-chip and Internet" style economics.
20. A student attending Amherstburg Public School south of Windsor hankering to become an animator can take a much heralded animation course online delivered by Kingston Collegiate Vocational Institute 1,230 kilometers away as if he were in the remote class room in person, and with less than 8 milliseconds round trip latency.
21. All 24,000 Ontario Public Service sites in the province could be connected at 100 Mbps or 1 Gbps and virtual LAN (VLAN) trunking could be quickly and easily implemented to provide guaranteed quality of service for every user and every application on the system while another VLAN handles supply and demand reporting such that the OPS becomes a gigantic power demand aggregator. Another VLAN makes this capacity or load shedding view available in real time to the Independent Market Operator (IMO).
22. This next generation Integrated Network System (INS) Province of Ontario network would translate into 90% of remote site server capital and recurring over head costs could shed by consolidating servers to two or three or five server-farm data centres while yielding improved security and throughput. And new Voice-over-Internet Protocol (VoIP) planned for implementation by the Government could, in this scalable configuration, eliminate 100% of inter-office long distance charges and 80% of recurring business line costs, drastically reducing moves, adds and changes (MAC) costs as each IP phone may be self-provisioned by the user through DHCP just like any laptop computer user routinely does today. Voice and data could not be integrated at the desktop of 50,000 online OPS employees so every civil servant is capable of "citizen engagement".
23. By creating a smart system, the Government of Ontario can practice real "citizen engagement" through a two-way interactive medium capable of infinite scaling to the needs of millions and millions of concurrent and simultaneous users – the connected communities creates the connected province – always open for business.

DRAWBACKS

1. A two-way communication system as the authors have described it will require moving off of the status quo. This is problematic to grossly understate the obvious.

2. There is a cost to close the last mile communications gap that the authors estimate around $400 - $600 million for physical infrastructure construction and upgrades.
3. There is a lack of standards-based approaches to metering and related communications today. Current barriers include a surfeit of proprietary technology and there is a lack of a cohesive approach to open standards and the ongoing expense of connecting smart meters to communications networks. The current state of standards and interoperability would seem to force the province to choose between a single-vendor approach and an alternative that sees disparate technologies sprouting in isolated islands defined, perhaps, by the footprints of individual utility companies.
4. Agreeing upon standards will take too long for the province to achieve their conservation targets. The province needs to mandate communications standards, which may be difficult to accomplish.
5. The security of standards based system become more vulnerable to security breaches as the number of users of a particular protocol or format grow.

SHOULD ELECTRICITY DISTRIBUTORS BE RESPONSIBLE FOR OPERATING THE COMMUNICATION NETWORK?

In the author's view, with conflicts of interest accepted up front in answering this question, the electricity distributors are the logical entities to operate the communication network since we deliver the energy to the consumer and we are physically closest to them. However, Hydro One Telecom and the municipal Utelcos have working relationships with cable and telephone companies throughout Ontario today, and these organizations should play a key role in providing the two-way communications system. All of these companies interoperate at present, so the contractual agreements, physical interconnections, and communications standards are in place now. Furthermore, the gap in the two-way communications system that exists today between providers and a portion of Ontario citizens and businesses can be much more quickly and effectively closed if all communications providers work together to do so. If achieved as envisioned by the authors, all providers benefit from delivery of a scalable-two way communications infrastructure grid as it enables the online delivery of an infinite variety of energy and other services to consumers in their premises around the clock.

IF NOT, HOW SHOULD A COMMUNICATIONS OPERATOR OR OPERATORS BE SELECTED?

In the authors' view, the Government should specify standards that operators are required to meet in order to qualify as a "communications operator" for the two-way communications system contemplated. We elaborate on those standards in answer to your last question further below.

The standards would apply to hardware, software, and communications service providers for each and every component of the two-way communications system. Request For Proposals is perhaps the best way to select providers of the various components of the communications network. Additionally, consumers could choose from a list of government approved suppliers for these components and services once established which would lead to lower costs and better goods and services through competition.

HOW WOULD RATES FOR THE COMMUNICATION OPERATORS BE SET AND/OR COLLECTED?

Rates would be set as they are today, by the OEB, or Ministry of Energy as you wish. These rates could be specified as a schedule to an RFP for goods and services of communications system components, so that respondents can properly assess their business cases and provide informed responses that are actually operable. However, coming up with rates may be difficult for a system that is not in place today and where all costs are not known. So, another approach could be to issue RFIs to communications vendors and solicit their views on rates as part of the development process for the RFPs.

In terms of the rate itself, the authors foresee that rates for communications are recovered through the general tariffs charged to consumers for electricity. However, as suggested above, these electricity communications rates could be offset, or possibly eliminated, through rate recoveries for other energy and non-energy services delivered over same communications infrastructure.

IF THERE WERE A TWO-WAY COMMUNICATION NETWORK, WOULD AN OPEN DATA PROTOCOL AID THE DEVELOPMENT AND AVAILABILITY OF END-DEVICES AND SERVICES?

The short answer is yes. The problem with a hands-off approach to standards for meters and communications as recommend by the WGD&C is that it will lead to an exacerbation of the problem we have today, but on a much broader scale, which is where a lack of standards results in our inability to scale and interoperate proprietary systems. Were the Government of Ontario to follow this recommendation we could quite predictably see the billions in new metering investment be squandered from the outset and yet more dollars stranded in legacy technology that will need to be replaced again in near term.

The author's believe the ideal and appropriate role for the Government in this scenario, it to specify standards rather than picking horses (vendors). Information technology and the Internet is proof positive that once standards are specified they act as a starter's pistol shot, triggering a flat out race of competing technological advances for the ongoing betterment of the system and consumers alike.

In the case of the two-way communications system contemplated, most, if not all of the standards, exist today. So the Government can be fast to market on communications if they adopt and mandate compliance on the following standards:

MINIMUM STANDARDS

We propose these overarching approaches to standards for successful data acquisition and communications:

1. Communications – ubiquitous two-way connectivity is provided over an open Ethernet standard communications network that frees conservation-smart devices from the tyranny of proprietary communications networks.
2. Smart device – in place of smart meter installed outside the premises, instead, a 'smarter meter' – an Ethernet-based smart switch/router, similar to today's cable/DSL modems and wireless routers installed inside the premises. This multiple Ethernet port device capable of communicating with any type of meter and any chip-based appliance in the home or business will provide the any-to-any functional scalability to meet today and tomorrow's needs.
3. Information – sophisticated analysis of data generated by remotely read interval meters and other conservation-smart devices can be provided by central portals using Extensible Markup Language (XML) formats such as Web Services Description Language (WSDL) to expose services and Simple Object Access Protocol (SOAP) for the transmission of messages between interval meters (or related systems) and aggregation portals.

Ethernet-based communications

With an open-standards Ethernet port being the only required communication interface and no need for proprietary data-query, presentation and analysis software, the minimum specification for a suitable smart meter for the vision described above can be relatively Spartan. But that would not prevent competitive vendors who meet the minimum standards from providing advanced software extensions and management and control applications to customers who would appreciate such features.

Such a ubiquitous communications platform also opens the door for an expanded vision of DSM and "smart metering" — marrying the SCADA approach long practiced by LDCs and larger energy consumers with the microprocessor-embedded world of home automation. Now, low-cost conservation-smart devices with Ethernet connectivity can turn even existing meters into network-connected "smart meters," while the network's two-way communication pathways allow consumers to see — *and gives them the tools to react to* — usage and cost information.

It is the opinion of these authors that the Government of Ontario should foster a competitive marketplace for this technology — and thus further drive down its costs

— by ensuring compliance with data structures and communications protocols at a level high enough to be rise above the quagmire of vendor-specific applications.

The Ontario government is in a position to mandate common “data dictionaries” for these smart devices — a layer of open protocols and standards through which all vendors’ hardware and software must exchange information, no matter what their underlying technologies might be.

Between the open Ethernet communication layer and the mandated *lingua franca* of province-wide, conservation-smart SCADA, vendors are free to compete in developing the best and lowest-cost technologies.

Ethernet-based switch

The development and deployment of chip technologies connected over fibre optic cable, power line carrier copper, fixed wireless, mobile wireless, telephone copper, TV coaxial cable are mediums of communications which make it possible to unlock power and broadband bottlenecks. Every day examples of this type of switching technology include DSL and cable modems or wireless routers routinely purchased and installed by consumers themselves. Supervisory Control and Data Acquisition (SCADA) and Ethernet applications would operate just like they do today through these Ethernet devices to offer the choice for consumer self-management and/or LDC managed services.

The rapid maturation of this technology tool set, along with robust yet easy-to-use HTML and XML interfaces for end-users will mean that all consumers of the province can make informed and timely purchase and consumption decisions. In combination with financial incentives and pricing signals to consumers and providers, such as time of use rates, behaviour will change and the real potential of conservation programs will be realized for gas and electricity power and water consumption.

These technologies will enable the implementation of systems such as Supervisory Control and Data Acquisition (SCADA), Automated Meter Reading (AMR), Demand Side Management (DSM), Demand Response (DR), billing, settlement, Ethernet services, IP services, and HDTV broadcast in a controlled and secure environment. These systems provide interactive content to consumers and savings for distribution companies, whether they distribute water, power, natural gas, interactive content or other commercial services. These rate-based revenue overlays in turn will free up utility rate revenue for much needed capital investment in core infrastructure.

And while these devices add tremendous value to the consumer they also avoid the spending of billions of dollars in single purpose technology that will fast become obsolete.

Extensible information

The WGD&C Report states, that it, "believes that the XML standard built to support the EBT Hub data transfer process for market opening is an option to consider for data transfer of SMS information to the retailers. SMS Vendors are reviewing their data formats to determine the timeframe and ability of their systems to interface to the EBT Hub. If the EBT is capable of providing this level of increased data transfer, retailers may use this current mechanism to acquire customer data. If the EBT Hub is not ready by December 2006 then the retailer must have the option of securing alternative options including direct data connections to specific/various meter data repositories."

However, while these authors agree with the standard identified by the WGD&C, we suggest that without the standard *mandated*, and vendors given the option not to comply, the standard will fall by the wayside in the headlong rush to install 800,000 meters by 2008. Without standards in place, the system will not scale and at some time in the future will require wholesale replacement by standards-based equipment.

The authors recommend, after consultation with industry experts, the provincial government might mandate and define methods for using open Extensible Markup Language (XML) formats such as Web Services Description Language (WSDL) to expose services and Simple Object Access Protocol (SOAP) for the transmission of messages between interval meters (or related systems) and aggregation portals. Ontario's LDCs are already familiar with similar approaches, such as the XML data formats for electronic business transactions (EBT) mandated by the Ontario Energy Board to enable settlement in the electric retail open access industry. Moreover, these are standards already in use in the Government's "Integrated Network Services" (INS) and "Smart Systems for Health" (SSH) networks today.

Under such a scenario, the marketplace could be open to any interval meter and conservation-smart device for which its vendor or a third party was at least able to supply a translation layer converting an otherwise proprietary communications schema to the required SOAP requests and responses. Vendors whose technology already supports SOAP or other XML-based exchanges may find compliance significantly easier.

IN SUMMARY

A recently completed analysis conducted by these authors for the Government of Ontario estimated the cost of closing the final gaps to create the underlying ubiquitous broadband network connecting all consumers at $400 million to $600 million.

The most dramatic overshadowing of cost may be by the benefits gained by such an investment — ranging from traditional drivers for broadband networking (such as economic development, public safety and security, improved access to health care, and education) to such a network's ability to help protect critical infrastructure at the same time that it drives down the costs of doing so.

It is these authors' view that the electricity crisis is an opportunity disguised as a problem. One of the great benefits of having such a big problem is that it creates a greater willingness to consider far reaching and lasting solutions.

The world could suffer from 'energy envy' if the Government of Ontario chooses to solve the *electricity* crises by taking the broader perspective that we have *energy* supply and demand problem.

Electricity is the engine that powers our computer-driven knowledge-based economy. By solving the broadband bottleneck in Ontario, with a scalable two-way communications system, the Government creates the connected province – *always on, always open for business*.