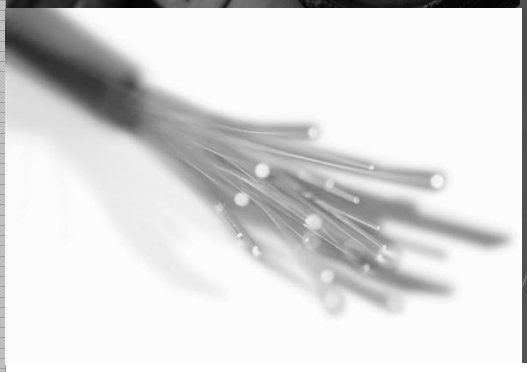

Smart Metering Initiative

Discussion Paper

Prepared for:

Working Group on Data and Communications (WGD&C)

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The primary goal of this discussion paper is to review the report of the Working Group on Data and Communications (WGD&C) and make recommendations accordingly. The basis for our review 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.

SIZING THE GAP

To put the discussion and analysis of communications and smart metering in context, a brief review of the context for the "Smart Meter Systems (SMS)" is provided below. For more detailed analysis of the market conditions see Appendix at the end of this paper.

Ontario's electricity system faces the burden of rising consumer demand at the same time that it must meet the challenges of generation shortfalls, transmission constraints, environmental concerns and billion-dollar price tags to build — or rebuild — capacity.

This year, the Ontario government estimated that it would need to "construct, refurbish ... replace or conserve" 25,000 megawatts worth of generating capacity by 2020 just to maintain current capacity of 30,500 megawatts.

In a statement April 19, Premier Dalton McGuinty said the 25,000-megawatt gap faced by the province over the next 16 years represented 11 times the generating capacity of Niagara Falls.

CLOSING THE GAP 'SMARTLY'

"But, clearly, producing more electricity is only part of the answer," the Premier said. "We are asking Ontarians to stop the spiral of demand, and we will give Ontarians the information and tools they need to save money on their bills as they save electricity."

Many large electricity consumers have already learned how to control power costs through frequent-interval demand monitoring, coupled with practices such as peak shaving to throttle back on use when energy costs would otherwise be higher. Behind such initiatives can be supervisory control and data acquisition (SCADA) systems which, even today, often take readings from mechanical meters that still require dedicated telephone lines to each remote terminal.

Throughout the 1990s, automated electric-meter reading (AMR) and related SCADA technology did advance as microprocessor technology began to permeate metering devices themselves, as well as the equipment/appliances actually using the electricity. Meanwhile, the explosive growth of the Internet and increased

penetration of home computers made the concept of conservation-smart homes on a broad scale seem a real possibility.

On April 19, Premier McGuinty said 2010 was the year by which the province would aim to have a smart meter in every home, and that 2007 was the deadline for an interim target of 800,000 meters.

But just as Ontario faces a looming gap between electricity demand and supply, so too is there a gap between current interval-metering technologies and the province's ability to take advantage of real "conservation-smart" devices on a scale that encompasses demand-side management (DSM) in each of Ontario's 4.5 million households.

It's time to close these gaps.

THE COMMUNICATIONS GAP

Some of the difficulties faced by conservation-smart technologies are the same as those faced by the entire market for home automation and Internet-connected household devices, often called, "the communications gap."

Near the end of 1999, the Italian giant Merloni Elettrodomestici claimed to be the first company to begin selling a major Internet-connected appliance — the "Margherita2000.com" washing machine. About the same time, North American manufacturers such as GE and Sunbeam were announcing plans for new lines of appliances that would plug in to smart homes.

Merloni promoted its Ariston Digital brand — which included the Margherita2000.com — with the exhortation to "phone the washing machine and practice e-cooking.'' In January of 2000, in announcing an alliance with a home computing/network connectivity standards body, the then head of GE Appliances was quoted as saying: "Imagine getting to work, turning on your desktop computer and receiving a message from your home appliance network that you left an oven burner on."

Energy-conservation has been a central theme of the home automation movement for more than a decade before the ill-fated Margherita2000.com, but even today such technology is as likely to be perceived as silly as it is impossible.

Silly, because, according to anthropologist and consumer products consultant Judy Tso of Aha Solutions Unlimited in Boston, "the bottom line is that the benefits are wimpy.'' Impossible, because we all know that only the hardest-core computer geek at the office is capable of remotely accessing his or her home network simply to retrieve a left-behind electronic document, let alone to dim the lights, turn down the heat and chat with the refrigerator. The present spate of so-called 'smart meters' fall into this category of technological wimps and impossible because they won't scale to future demands for more information from more users.

The authors are concerned that the 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 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 real problem was that time did not permit the members of the WGD&C to really investigate and analyze what the true base level should be but rather we were stuck with what existed today due to timing constraints. The opportunity to really innovate was lost through the time constraint. Therefore, the concept of what a Smart Meter System is was lost since the focus was on a "system' provided by a single vendor and little consideration was given to vendor consortia providing the innovative solution.

THE INFRASTRUCTURE GAP

Conservation-smart technology at the consumer end of the supply chain must first be linked to a two-way, smart network if results are to be achieved for supply producers and demand conservers. The author's concern is that is largely overlooked by the WGD&C.due to time constraints.

Significant investments in fibre-optic network infrastructure by public-sector owned (we are all private companies) players have positioned the province within reach of ubiquitous broadband. The "gap" between the current state of low bandwidth or no bandwidth connectivity and high-speed access for all, often called the "digital divide," may be less than many perceive.

Fueled in part by the Internet boom of the late 1990s and the prospect of advanced network services to come, a host of private and public organizations, including incumbent telephone companies, competitive long-haul network carriers, cable television providers, Hydro One Telecom (HOT), municipally owned utility companies and community-based user consortiums have been rapidly building and using broadband networks.

For HOT and many of the local utility companies, fibre-optic pathways would enhance critical SCADA systems. But as network operators, the utilities — "Utelcos" — were also "community builders," often working with local broadband consortiums to support economic growth and improve the lives of citizens through affordable, online access to public services such as health care and education. Some 90 per cent of the territory currently served by operational community broadband networks is supported by Utelco infrastructure.

In early 2004, we see that these publicly owned and operated network builders are increasingly working together after blanketing large swaths of Ontario with broadband capacity. When we map these networks, we see a correlation between the availability of fibre-based broadband and the location of infrastructure critical to the distribution of electric power and access to stand-by generation.

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, the opportunity — and the capacity — exists to close the "last-mile" gap between the installed network and Ontario's homes and smaller businesses. Among the technologies now available to close that gap and connect communities are fixed wireless and power line carrier, which, by its very nature, is well suited for integration with "smart" building technologies.

Electric power represents a complex system of staggering cost. Periodic — daily and seasonal — load peaks that threaten system failures burden this electricity network. It's a system that can benefit from more-responsive monitoring and from efforts to

reduce system loads during periods of peak demand. But the biggest benefit will be gained if their problems can be addressed in real time with a province-wide perspective.

The publicly accessible broadband networks already in place -(I would not suggest that they don't exist because the GO may not consider it viable if they have to wait) in communities across Ontario are uniquely positioned to transport the logic required for utility consumers of all sizes to "peak shave" and "demand shift" in concert, and to enable generators, transmitters, distributors, retailers, regulators and consumers to monitor the results of that effort.

And, because the networks of Ontario's Utelcos are already connecting consortiums of Ontario Public Service, Broader Public Service and large commercial/industrial users, and because these networks already parallel local electricity distribution infrastructure, we can begin now to enable this vision at the same time that we work to close the remaining last-mile gaps.

The broadband networks of the Utelcos are not only open to public institutions and to the data of smart meters. They are also open for business: corporate and household Internet access, private wide-area networks, telephony, and cable television, among other fee-based activities. And the Utelcos are not the only ones collecting tolls for this business: competing Internet service providers, telecom companies and cable TV companies also can play. And it's a well-known business model capable of generating revenue needed to continually invigorate the system.

More important to this discussion is that connecting communities and creating an open network providing uniform and ubiquitous high-speed access across the province creates a whole new perspective on what can be achieved with interval meters — or any network-connected conservation-smart device/appliance.

By removing the connectivity hurdle that has plagued AMR-type technology, 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 but more importantly to allow consumers real time access to information that creates the opportunity to alter consumption behaviour. And, as consumers, distributors, transmitters, and generators exchange data, these members of the supply-and-demand loop exchange and respond to aggregations of that data.

Now the effort to manage energy use from the demand side is no longer a partnership solely between a customer and his or her smart meter. Instead, the entire electricity distribution chain may participate in real time.

Central or regional portals can operate on the data generated by the connected interval meters and provide customers with the level of feedback they require, served up through whatever pathway they desire: the Web, interactive telephone, e-mail or regular mail.

The WGD&C did not fully articulate the importance of the communications component of a successful smart metering implementation and the real opportunity being afforded with this initiative. Presumably due to time constraints very little discussion and analysis of the communications options have been described with no attempt to scope the need or size the cost of closing the communications gap. 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.

THE DATA STORAGE AND ACQUISITION GAP

Clearly, increasing interval metering benefits to consumers will help reverse the growing electricity demands of Ontario consumers because the Ontario government's commitment to ensuring better pricing for off-peak usage and other pricing signals are dramatic steps in that direction. However, delivering on that promise effectively, on a scale encompassing millions of households and businesses, will require a communications infrastructure that allows automated, conervation-smart systems belonging to consumers, electricity distributors and stand-by generators to detect — and adjust to — new and constantly moving peaks created by DSM on such a scale.

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.

As well, WGD&C has done very little analysis of the data storage and acquisition requirements of such a 'smart system,' and without this element in the network well understood and implemented, the benefits of smart metered data collected at the end points of the network will be reduced or lost. For example, the WGD&C state in their report that, "the LDC may be required to reconfigure the TOU/CPP schedule 32, 108 or 226 times per year (assuming worst case scenarios). Limitations of the SMS must be carefully considered for either an interval data collection or TOU SMS. Performance specifications must be developed in the RFP to ensure functionality requirements can be met regardless of the SMS selected." In the authors' opinion this frequency of reconfiguration on a province-wide scale will require sophisticated and well integrated data acquisition, aggregation, communication, and storage capability for the entire supply chain . Moreover, interpretation of the data by the consumer as the basis for behaviour modification required for conservation will mean two-way communication through a easy to understand interface will be paramount to achieving demand reduction.

THE SMART METERING GAP

The WGD&C in their report have specified only, "Base Level Functionality," for smart meters to achieve notification of Critical Peak Pricing (CPP).

According to the WGD&C, "base level functionality" as defined by WGD&C does not necessarily infer that the systems that provide only this functionality are more cost effective. Utilities and other entities implementing these Smart Meter Systems must assess the business merits and financial pay back in relation to the functionality that each system is able to deliver now or in the foreseeable future." Worse still, the WGD&G states, "Note: Business cases and justification of SMS may be stronger

when including enhanced features found in various vendors' SMS. Selection will be determined by LDC customer base, demographics and geographic constraints found in each utility's service territory."

The problem with this hands-off approach to standards for meters 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 GO 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.

Moreover, electricity consumption is inextricably tied to natural gas, water, and waste water supply and demand. A metering solution needs to encompass all of these utilities in order to optimize control the energy supply and demand mix. This conclusion repeatedly made by the Electricity and Conservation Task Force has been completely overlooked by the WGD&G. Which means a 'smarter' meter capable of storing and communicating this information should be the "base level of functionality" specified by WGD&G. Indeed, this base level of functionality should be scalable to support greater frequency of readings, as well as other types of data content, so the device is capable of meeting needs in the near future, not dead-ended at yesterdays minimal requirements.

THE STANDARDS GAP

Reducing the cost of interval-metering technology and supporting systems is the flipside of reversing the cost/benefit gap. But current barriers include a surfeit of proprietary technology, the lack of a cohesive approach to open standards and the ongoing expense of connecting smart meters to communications networks.

In the AMR industry, for example, pressure for open standards and interoperability among devices and software has been relatively weak. By and large, vendors have competed to sell end-to-end systems to utility companies and large consumers — with a victor thus owning all of a customer's business. AMR-vendor solutions also often include a proprietary communications infrastructure to connect remote meters to head-end systems.

A dramatic increase in the adoption of Internet connectivity by typical AMR customers is clearly reflected in many of the vendors' offerings today — particularly among those who have staked out the "smart meter" space. However, 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.

The WGD&C have specified XML as a standard, which should be supported by smart meter vendors. However, they have overlooked other important standards necessary to successfully implement smart metering from end-to-end.

MINIMUM STANDARDS

We propose to 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 WGD&C should be urging the province to 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

WGD&C 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, these authors 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 required wholesale replacement by standards-based equipment.

The authors recommend, after consultation with industry experts, the WGD&C and 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 scheme to the required SOAP requests and responses. Vendors whose technology already supports SOAP or other XML-based exchanges may find compliance significantly easier.

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 communities 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.

CLOSING THE GAPS

The authors recommend that the GO entertain a more-detailed plan for a pilot project that could put into practice the principles and technologies articulated in this paper in at least five municipalities which have contributed to this discussion paper and are well positioned to provide pervasive broadband connectivity via Utelcos — Kingston, Hamilton, Guelph, Ottawa and Windsor — along with Hydro One. Others are possible participants, including excellent candidates such as Milton and Sault Ste. Marie.

The pilots would be designed to demonstrate the value of the fully integrated system at all layers of a Utelco-based province-wide network — including generation, transmission, and distribution through fibre optic and power line carrier, and last-mile connectivity provided by fixed wireless, power line carrier, telephone copper, and coaxial cable — and applications of smart metering technology that can see the LDCs or the customers initiate responses to energy demands at individual customer sites.

Such a pilot would likely see a staged approach to the growth of each community, beginning with the use of the local broadband loop better monitor and control LDC

infrastructure, then extending the analysis of and response to real-time supply and demand to larger customers, then to smaller customers ... until all residential consumers are included.
The focus of a comprehensive pilot would be to demonstrate the likely effects of ubiquitous DSM CDM in communities buffered from dependency on the grid, as suggested by Figure 1 below.

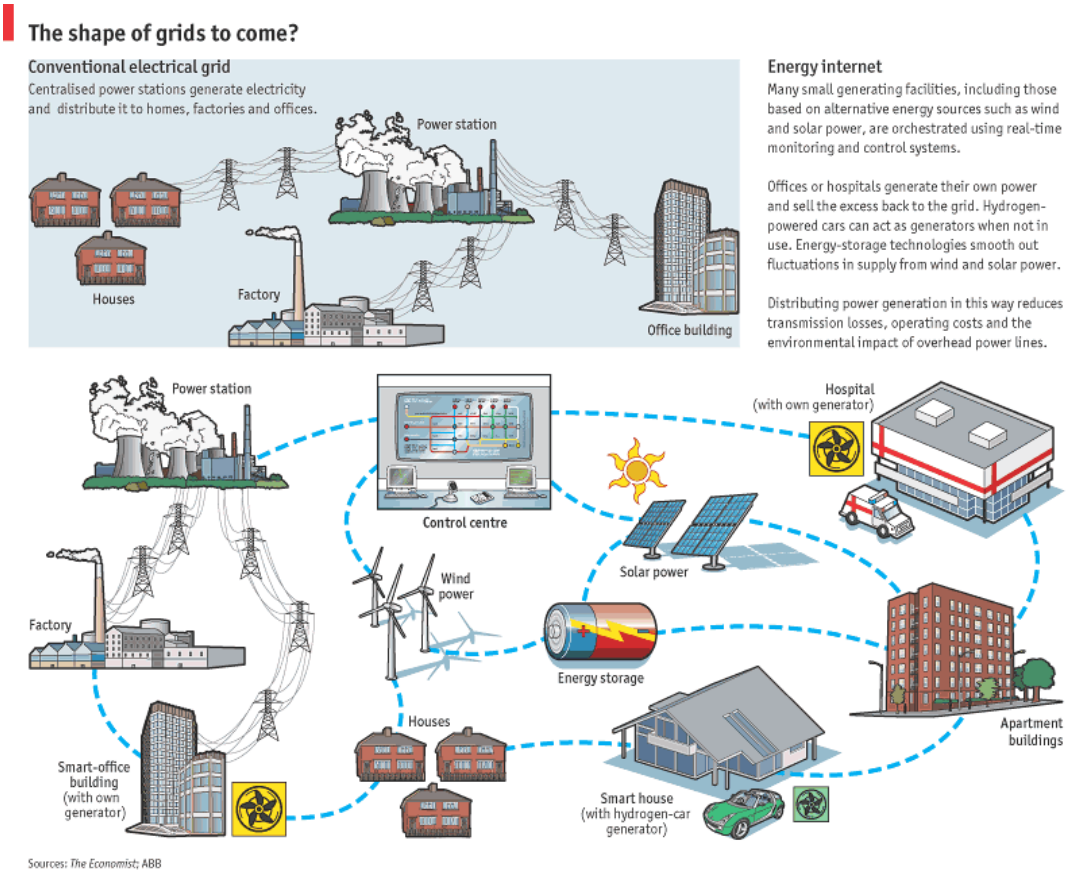

Figure 1

BEYOND THE GAP

The authors contend that once we close the gaps between these providers and users, that the sum is greater than the total of the parts:

- 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.
- 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.
- 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.
- 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 a strategic locations.
- 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-rich0 investors to keep 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.
- 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 community becomes an equitably priced and always-available meet-me-point. An interface where all providers and all users can choose what they want.
- By achieving ubiquitous broadband deployment and sequentially overlaying the power and water systems, energy suppliers gain “micro-chip and Internet” style economics.
- 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 class room with less than 8 milliseconds round trip latency.
- 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). This next generation Integrated Network Project (INP) provincial 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 DHCP0 just like any laptop computer user routinely does today. Voice and data could not be integrated at the desktop of 50,0000 online OPS employees so every civil servant is capable of “citizen engagement”.

- All these savings and functionalities could be had while gaining better command and control of the voice system through strategically located voice Public Switched Telephone Network (PSTN) gateways.
- 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.

APPENDICES

ELECTRICITY

The following is an analysis of major electricity utility market trends:

Supply and demand

- Due to the failed attempt to deregulate and restructure the electricity market, electricity demand will outstrip supply as a long-term systemic trend. According to the Electricity Conservation & Supply Task Force (ECSTF) established by the Government the circumstances have reached crises levels requiring both short-term actions and sustainable long-term approaches. And this time the Government has to get it right.
- By about 2020, according to the ECSTF report virtually all of the Province's existing nuclear plants will reach the end of their planned operating lives, and need to be refurbished, replaced, or retired. Adjusting the IMO forecast with this information shows a projected shortfall in 2007 of 5000-7000 MW. If no new capacity or demand reduction measures are taken, the Province will be critically dependent on external sources of electricity, energy costs will be higher and more volatile, and reliability could be reduced.
- Beyond 2007, the need continues to grow. Other than waterpower assets, the entire generation asset base will have to be rebuilt the Task Force concluded.
- The size of the energy use market in Ontario today peak demand at 24,000 Megawatts (MW) for 2004. By 2013 peak demand is expected to be close to 27,000 MW, based on an annual average demand growth rate of 1.4% and annual peak demand growth rate of 1.7%. By 2013 summer peak demand will exceed winter. Including reserve requirements capacity required to service demand rises from 28,000 MW to over 30,000 MW. By 2020 the ECSTF predicts Ontario will require nearly 37,000 MW of reserve capacity.
- The demand for energy will outstrip supply in Ontario by 2006 with generating capacity declining from 30,000 MW today to 25,000 MW by 2006. Further supply declines are expected to reach 15,000 MW by 2013 based on current trending.
- The Government is committed to phasing out coal-fired generators in Ontario by 2007, which account for 23% or 6,900 MW of energy produced in Ontario today.
- Nuclear generation capacity has declined by 5,100 MWs or 8% of capacity since 1997 from 48% of total generation to 40%.
- Currently Ontario imports 4,000 MW of power to serve peak demand accounting for 8% of total power.
- Funding for new generation is stymied by uncertainty in Ontario market stemming from previous government unpredictable management of marketplace. Previous government power supply forecasts were extremely

optimistic creating an actual shortfall of 5,000 to 7,000 MWs against forecast due to no new capacity coming on stream since deregulation was enacted.

- Ontario's transmission system is one of the largest transmission systems in North America. The system, owned and operated primarily by Hydro One (H1), is a high voltage integrated network with 29,000-circuit km of line across the entire province operated in concert with the rest of the Northeast and Midwest electricity grid. Although the existing power delivery infrastructure is adequate to meet today's basic needs, the Task Force concluded that it will not satisfy our needs over the coming decades without expansion and improvement. Hydro One Telecom (HOT) has an optical broadband network of 4,000 route kms that follows the H1 transmission infrastructure in Southern Ontario only and used for SCADA of H1 transmission stations and communications between OPG plants. HOT are also connected to Utilities Kingston as well as virtually all of the other municipal utelcos in Ontario today.
- According to the Task Force report, Ontario's transmission system requires upgrading and reinforcement. Approximately $4 billion in system upgrades and expansion may be required over the next 10 years.
- The ECSTF identifies the centralization of power generation and the inherent requirement for long distance distribution as a weakness in the power grid system, which must be overcome. The August 14, 2003 Blackout has further focused the public interest on the reliability question and the need for robust connections with neighbouring markets, but also the vulnerability of such interdependency.
- The ECSTF recommends that the Government pursues policies which will lead to putting more power generation closer to the consumer of the power or what is commonly known as a "distributed" model of power supply.
- ECSTF concludes that Hydro One and the local distribution companies should help facilitate distributed generation. Any negative impacts caused by accommodating the increased market share of distributed generation or the potential stranding of transmission and distribution assets, should be taken into account by the OEB when considering rate applications.
- Distributed generation facilities should be able to compete on a level playing field with other supply and demand side initiatives according to the ECSTF. The level playing field should include consideration of system benefits including security of local supply, energy efficiency and emission reductions, and local commercial and industrial competitiveness.
- The construction of distributed generation facilities should not reduce the entitlement of a consumer to its share of any heritage power from existing OPG facilities available at stable, regulated rates states the Task Force. Similarly heritage power should not impede distributed generation projects where they provide positive public benefits.
- With respect to grid connection to distributed generation, the Task Force concludes, that the OEB should issue guidelines that encourage the timely and economic connection of distributed generation facilities. Any resulting

stranded transmission and distribution costs should be recovered from ratepayers.

- Furthermore, the ECSTF strongly supports the need for a "diversified" and "fully meshed" system of supply based on a combination of "heritage power" (legacy power generation, transmission, and distribution such as coal, gas, and nuclear) with next generation and renewable energy production. The newer sources of power include: cogeneration gas fired turbines, district heating, biomass, fuel cell, solar, and wind power. According to the ESCTF report, in order to achieve the 2007 target of an additional 5% of the province's power from renewable resources (1350 MW), and its 10% target for 2010 (2700 MW), the Government should move quickly to implement its, "Renewable Portfolio Standard."
- In order for distributed generation to work effectively there needs to be significant upgrades to communications and information technology systems. The Task Force concluded that, recent investments made by the IMO and Hydro One is the beginning of a system-wide move needed for communications and control systems to digital technologies. However, much of the core system is based on "legacy" technologies, as is also true for North America in general. This was adequate for the historical model, where generation, transmission and distribution in a given region was centrally planned and controlled by a single "vertically-integrated" utility, local load was primarily served by local generation, and transfers between systems were relatively limited.
- Conservation through peak shaving and demand reduction approaches are strongly advocated by the ECSTF. Notwithstanding these efficiency improvements, as Ontario remains a high per-capita energy-consuming province versus other jurisdictions. This includes the use of a variety of technologies, including "smart meters" for automated meter reading (AMR), demand side management (DSM) or now called Conservation Demand Management CDM, through statistical control and data acquisition (SCADA) systems, demand reduction energy efficient technology embedded in energy consuming appliances, demand reduction incentives for electricity consumers and use of renewable energy sources. The ECSTF is looking to energy reduction (ER) through conservation programs to save some of 5% of peak demand or 1,350 MW per year.
- The Task Force concluded that local distribution companies are favourably positioned to provide conservation programs. They are close to their customers, understand their local market conditions and may be able to better target certain programs. Goodwill exists and utilities are generally considered to enjoy strong customer trust, loyalty and brand recognition. LDCs have existing marketing relationships with delivery partners, for example, with builders or HVAC (heating, ventilation and air conditioning) contractors. In the case of some of the larger commercial and industrial customers, LDCs may provide important technical expertise.

- However, the ECSTF concludes, although local distribution companies have a central role to play in conservation, private firms will often be better-positioned and have the necessary expertise to provide front-line delivery (for example: meter retrofits or insulation programs). In addition, Ontario's 93 LDCs differ in their capability to deliver conservation. Smaller LDCs in particular may prefer to contract out the provision of much of their conservation activities to other LDCs, private firms or the non-profit sector. In some instances, a delivery structure involving several organizations may be the best route. Local distribution companies, which in most cases have the strong relationship with consumers, could act as facilitators to develop leads and subcontract detailed implementation to the private sector. The Task Force looks forward to the development of innovative business relationships and a sustainable competitive demand management industry that would lead to greater innovation, continuous improvement and more cost-effective delivery of conservation in Ontario.
- The U.S. National Association of Regulated Utility Commissioners has estimated that up to 40-50% of peak load growth over the next 20 years could be met by energy efficiency, price-response, and load management measures.

Price

The following are the pricing characteristics of the market:

- The Task Force concluded that price caps or freezes do not work in the consumer's best interest, since such solutions tend to discourage conservation and investment in new generation. As a result, the true price of electricity will rise and be absorbed by the either the taxpayers or, after the freeze is lifted, ratepayers.
- The price cap of 4.3 cents on approximately 50% of electricity used actually lead to increased demand for power by consumers as they had no incentive to conserve. Wholesale spot prices generally floated above the cap of $43 per MWh, peaking in March 2003 at $90 per MWh exacerbating the Government's energy deficit by $2 to $3 billion dollars.
- The Task Force believes that this price has discouraged conservation by understating the true cost of electricity. A new interim retail price plan for residential, small business and other designated customers will go into effect on April 1, 2004. Under this plan the price for electricity will increase on April 1, 2004 to 4.7 cents/kWh for the first 750 kWh of electricity consumed each month and 5.5 cents/KWh for monthly consumption beyond 750 KWh. The Government has indicated that this pricing plan will stay in place until the Ontario Energy Board develops new mechanisms for setting prices in the future. The Board's new pricing structure must be put in place no later than May 1, 2005.
- The ECSTF recognized that greater price stability could be achieved by reducing the importance of the hourly spot market price in the calculation of final customer bills.

- The Government has establish a transitional approach to market-based pricing or the "true cost of power," that will give generators and consumers a more predictable environment in which to make investment and purchasing decisions respectively.
- The Task Force sees a strong correlation between demand response activities and the lowering of system load when the supply-demand balance is tight, to help moderate energy prices. They cite recent U.S. studies that have estimated that a 2-5% reduction in demand on days when peaking generation would otherwise be needed can reduce prices by as much as 50%.
- The Task Force recognizes that private initiative, driven by clear price signals, must play a central role in addressing Ontario's power needs and the importance of making those signals clearer and more effective.
- Rate stability is expected to be achieved by setting fixed rates for purchase of power by the IMO as the purchasing authority or "load serving entity" (LSE). A contract with the IMO at fixed rates is seen by the Government as giving supplier and investors the basis to fund the building of new generation capacity.
- Local rates will be set by the LDCs for their default supply. The Government anticipates LDCs will be the default supplier for about 95% of consumers going forward based on the experience of deregulated markets in the US and Alberta.
- The Government expects, over time, that LDCs will purchase directly from suppliers as LSEs, with the IMO taking on a reduced role as the purchasing authority.
- Retailers, energy service companies and local distribution companies should be given benefit-sharing opportunities to encourage them to invest in and market new technologies and services in order to help consumers reduce consumption and shift their power use from periods of high demand and high prices according to the ECSTF report.
- In the current market, Ontario's local distribution companies have little incentive to promote conservation and face financial barriers to doing so. LDCs face the risk of delivering conservation programs and losing revenue because of lower volume throughput. In the natural gas industry, where conservation is delivered by Ontario's gas distributors, financial incentives for example, funding to deliver programs, compensation for lost volume revenues, variance accounts to manage under-or-overspending, and sharing in the cost savings are provided and recovered through rates. Similar mechanisms are used to encourage conservation by electric utilities in the United States.
- The current regulatory structure which requires that LDCs and transmitters act as wires companies whose core business is to distribute electricity, earning revenues on the amount of electricity flowing through their system, does not allow for the provision of conservation programs. This is instead included with retailing electricity and other services assigned to their retail affiliate companies or the private sector.

- Local distribution companies and transmitters should be compensated under appropriate regulatory oversight whenever they invest directly in demand side management, or work with private sector companies to facilitate it. They should also be compensated for revenue loss resulting from conservation as is currently done in the natural gas industry according to the Task Force.
- The ECSTF concluded that antiquated and poorly integrated communications systems in the supply chain are largely responsible for inadequate management of the system and confusion in the marketplace. Among the problems identified by the Task Force are: a lack of coordination among organizations involved, a lack of resource commitment, a lack of transparency, and complicated and even contradictory messages.
- Overall, the Government sees low power rates and stable supply as inextricably tied to Ontario's economic competitiveness.

THE GOVERNMENT'S PLAN TO CLOSE THE GAP

- The Government, has developed a plan based on the ECSTF report, "that works for consumers." The highlights of the plan are as follows:

- The desired outcomes of the Government's plan are ensured reliable and adequate supply. The plan has a two key support mechanisms, which allow for predictable and stable rates. In the medium and longer term this translates into a fixed rate, determined through a centrally run auction and local rates, determined by the load serving entities' costs of procuring their default supply. The expected outcome of this approach is, as the buy-side of the market becomes more organized, and are able to sign longer term contracts, there are new generation suppliers who will step up to the plate.
- Over time, the Government believes there is an opportunity for other entities (load serving entities) to emerge to take on the responsibility for default supply, leaving the central agency as the default supplier of last resort. These load serving entities could be local distribution companies, energy wholesalers or new commercial partnerships.
- Based on the experience of similar jurisdictions, the ECSTF concludes only a minority of residential consumers is likely to choose retail electricity marketers in the near term. Even so, they believe that choice is an important principle and should be retained as part of the Ontario market design.
- To be effective, a communication program must be developed to provide the information consumers need in order to make effective purchasing and consumption decisions, such as; rates based on the true cost of power, easily understood options they have, such as choosing an independent electricity retailer, or investing in smart meters, a better understanding of how their own consumption and different pricing arrangements would affect their bills, the importance of conservation, and who they can go to for help, if needed.
- In addition, electricity suppliers (retailers or default suppliers) must develop simple and easy-to-understand bills, as recommended by the Review of

Ontario Electricity Bills (March, 2003). Such a program must involve, and be supported by, all stakeholders. That said Local Distribution Companies should play a leading role in delivering this kind of program. Consumers who invest in smart meters should be offered rates that reflect differences in the cost of power between peak and off-peak periods. That the power network provides a full flow of information to users of electricity.

- The plan would include a strong emphasis on conservation, including a range of activities that can be undertaken by consumers, utilities and others to reduce electricity consumption use electricity more efficiently, or shift usage to other times. The plan for conservation includes both demand-side management and demand response. These strategies are differentiated as follows:
  - Demand-Side Management (DSM) results in using less energy and using energy more efficiently.
  - Demand Response (DR) results in shift timing of energy use without reducing overall consumption in order to move usage from peak to off-peak times.
- DSM and DR can best be achieved through fully integrated two-way communications systems from consumer to LDC through IMO to power generators.
- Effective DR approaches include the IMO's current, "Hour Ahead Disptachable Load Program," to address the needs of wholesale consumers. The IMO is investigating implementing a, "day ahead," and "economic demand response," programs to provide more stability and financial incentives to the wholesale market.
- The Task Force believes that over the longer-term demand response should be aggressively pursued in the retail market as well as the wholesale market, through such measures as economic DR programs, time-of-use rates, smart meters and load control devices. Demand response at the retail level may take longer to achieve because of the number of consumers, the need to aggregate to achieve meaningful reductions in demand, and the need to retrofit old meters or install new metering technology.
- A new interim retail price plan for residential, small business and other designated customers will go into effect on April 1, 2004. Under this plan the price for electricity will increase on April 1, 2004 to 4.7 cents/kWh for the first 750 kWh of electricity consumed each month and 5.5 cents/KWh for monthly consumption beyond 750 KWh. The Government has indicated that this pricing plan will stay in place until the Ontario Energy Board develops new mechanisms for setting prices in the future. The Board's new pricing structure must be put in place no later than May 1, 2005. All electricity customers with an average peak monthly demand of over 1 MW and all new customers with an average peak monthly demand of over 500 KW must install interval meters.
- Smart meters (which note the time of consumption) are the primary enabling tool for customers to respond to time of use price. Moving to smart meters

will require significant investment from local distribution companies in Ontario. Mechanisms will need to be put in place to encourage these investments. Without communication to the consumer in near real time this will not work. In addition, action by the Government, local distribution companies and the private sector will be required to inform electricity consumers of the benefits of managing their usage patterns.

- The Ontario Energy Board has been directed by the Minister of Energy to identify and review options for the delivery of conservation activities in the electricity sector, and to include in this review the role that local distribution companies could play in providing these activities. The Board established an advisory group with expertise in conservation, and will deliver a report in early spring 2004.
- The Task Force believes that action should be taken to help LDCs overcome financial and technical barriers to encouraging consumer conservation. This is because LDCs are the best positioned member of the supply chain to affect, support, and communicate with consumers regarding conservation since they are 'closest' to the consumer. The conservation plan should include local distribution companies giving them a central role to play, and that they can act as a hub for the delivery of conservation activities in partnership with private firms and the voluntary sector.
- The Task Force believes that a balanced approach with new gas-fired peaking and intermediate capacity, expansion of renewable power where economic, and new base-load nuclear and hydro capacity additions, combined with aggressive measures to conserve energy, are all likely to be part of a competitive energy supply for Ontario.
- The Task Force views the transmission network as a shared use network that enables customers access to economic and diverse sources of generation, and provides assurance and flexibility in supply. Generation embedded within the distribution systems (emergency power generation with peak shaving capacity) can contribute to meeting the province's supply needs, and should be encouraged where economic.
- In light of the urgent need to develop new provincial power supply, transmission should not be a barrier to and, indeed, should facilitate new generation. Costs for transmission enhancements to incorporate new generation should be recovered through the market or through rates to the extent justified by public interest benefit.
- The OEB should consider the public interest benefits of distributed generation facilities, balanced by the need to recover investments in existing transmission assets, and update its guidelines for the timely and economic connection of distributed generation facilities accordingly.
- Over time, the plan is for the market to move toward a position where load serving entities take over the responsibility for selling power to customers who are not wholesale market participants and who do not choose to contract with competitive retailers. As the market matures, these LSEs could increasingly contract with generators and wholesalers directly for longer-

term power supply, potentially providing a basis for financing investment in new supply. Companies who could potentially fill this role as LSEs include wholesalers, retailers, subsidiaries of Local Distribution Companies and others. As new load serving entities develop, the IMO should transfer energy contracting responsibility to them to as great a degree as possible, while still ensuring adequate power supply, in accord with the Province's desired supply and demand mix.

- The Task Force recommends that Hydro One should develop a comprehensive long-term transmission development plan through consultation with generation developers, load customers, the IMO, local transmitters and other interested parties, extending out at least 10 years and should update that plan annually.
- New technologies must be deployed to achieve a "smart, self healing grid" (automated and redundant" with the ability to, control power flows across the network, resulting in improved asset utilization and improved protection against major outages; ensure delivery of higher quality power to meet customer needs; provide more timely and comprehensive information to customers; and connect an increasing number and variety of generators to LDCs
- The transmission grid should be treated as, "essential public infrastructure." Ontario's electricity system faces the burden of rising consumer demand at the same time that it must meet the challenges of generation shortfalls, transmission constraints, environmental concerns and billion-dollar price tags to build — or rebuild — capacity.
- This year, the Ontario government estimated that it would need to "construct, refurbish ... replace or conserve" 25,000 megawatts worth of generating capacity by 2020 just to maintain current capacity of 30,500 megawatts.