December 23, 2009

Smart Grid Policies and Principles

Smart Grid Focus Areas

1. Consumer Control
2. Utility Flexibility
3. Adaptive Infrastructure

Submission 1

Consumer Control

Objectives - increase the level of conservation culture and demand side management at the single family/small account level.

Principles

- In order to increase the level of conservation, I don't believe we should be mandating a specific device or system. It needs to be consumer driven in the 1st instance and as it gains momentum, it may roll over to a more mandatory approach.
- Gov't should not specify a specific product or technology
- ensure costumer choice is available and guide consumers by way of incentives or rebates vs enforcement in the initial stages
- While I know job creation is top of mind for the current administration, I have a personal problem with specifying local content as it breeds a lack of competitiveness and complacency in the local economy.

Implementation
- Gov't needs to provide industry with functional specifications around data that can be delivered and methods of delivery of data from the meter including, consumption data, load profile, current pricing and ability to control various devices (ie smart fridge, A/C units, dryers, dishwashers etc) as well as ability for device to provide feedback to LDC in a specific format(s). I like the forecasting concept but really see that as an industry initiative where the IHD is smart enough to learn your profile and apply the correct rates and provide a forecast based on current consumption patterns.
- Gov't should state the date by which they wish to see a specified level of penetration into the market place.

Utility flexibility

Objectives- ensure each LDC is managing their resources efficiently and enabling both DG and demand management

Principles
- I don't believe all LDCs can be treated the same. The issues faced by Toronto Hydro are vastly different than a rural LDC or Hydro 1.
- All LDCs should be required to provide a baseline level of data to customers such that the demand management devices should be able to function anywhere in the Province
- I don't see us setting new standards but think we have the ability to set trends in how electricity consumption is managed.

Implementation
- With the standing offer to connect, I think the LDCs have already made strides towards the first part of this objective.

- The next step in realizing the ability to effectively take a role in demand management will be when consumers start installing devices that permit load shedding as outlined above.

Adaptive Infrastructure

Using EV as storage seems to be offside with warranties being provided by manufacturers. In terms of charging stations etc, my view is industry will respond if there is sufficient uptake in the market place, however, the gov't may need to establish incentives or rebates to offset some of the cost for at home charging stations etc to assist in increasing consumer acceptance.

Submission 2

General policies that span all three of the Smart Grid focus areas

1. **Open, internationally recognized standards are essential to Ontario smart grid deployment.** To date a comprehensive smart grids standards development effort is underway by such organizations as the U.S. National Institute of Standards and Technology (NIST), the International Electrotechnical Commission (IEC) and the Institute of Electrical and Electronics Engineers (IEEE) to name a few. These efforts span the full range of interoperability from the definition of commercial products to specific communications protocols. Ontario should take maximum advantage of this extensive work. The Ontario government can be most effective in the realm of economic and regulatory policies that facilitate the GEA objectives. Lower in the details of smart grid interoperability, the province of Ontario would do well to make use of the emerging international standards for technological interoperability that are current already under development:

NIST – Eight Layers of Smart Grid Interoperability:	Relative ability for Ontario Government to influence industry direction:
1. Economic/Regulatory Policy	HIGH ↓ LOW
2. Business Objectives	
3. Business Procedures	
4. Business Context	
5. Semantic Understanding	
6. Syntactic Interoperability	
7. Network Interoperability	
8. Basic Connectivity	

The Government of Ontario needs to definitively go through this problem space and clearly delineate the areas where it intends to regulate, the areas left to the other Ontario electricity sector agencies, and the areas which will be left to broader, international standards.

2. **Maximize consumer choice to the greatest extent allowable under the overall objectives.** The most powerful tool to bring about an abundance of "consumer control" technologies is to increase the value proposition of "consumer control" itself. "Control" leads to consumer empowerment, which will inevitably lead to new, sophisticated commercial products that make the best use of demand response and distributed generation technologies that may be at hand. This would conceivably improve overall demand responsiveness of the load base in Ontario and create an economic value proposition for consumers to invest in the necessary technologies.

3. **Create the right financial incentives**. From a strategic policy standpoint, various levels of government around the world are committing public funds to research and sector development in all facets of smart grid technologies and services. Job creation, economic development and

providing a competitive advantage to a given region are the common reasons cited for such initiatives.

Equally important however, is to ensure that these technologies are ultimately used in an economically-viable context which creates value for investors, utilities and ultimately, for the consumers that use them. One of the greatest areas of potential is to ensure that smart grid technologies providing demand response, storage capacity and distributed generation are utilized in a competitive, open market context. In this regard, the ISO/RTO Council (IRC) is currently developing a framework that would allow new classes of market participants known as "designated dispatch entities" and "scheduling service providers" to offer consumer-driven capacity into wholesale markets.

4. **Make use of the information that smart grids provide, but remember to protect the consumer.** As recently noted by the Privacy Commissioner of Ontario, NIST and various other standards bodies, privacy and security must be part of smart grids conceptual model. In the near future, a comprehensive array of privacy and security standards will be available to choose from. Ontario's smart grid policy should include the formal adoption of those standards where they are consistent with Ontario privacy laws and the societal objectives of the smart grid in general. In addition to security and privacy, a comprehensive information policy should address the types of information that might support other objectives. For example, net metering data and environmental tracking of carbon content for all electricity transactions could support both societal policy objectives for environmental sustainability and further empower consumer choice.
5. **"Future-proof" the system by maximizing flexibility in all areas of policy, public spending and technological selection.** Many smart grid technologies and ancillary devices are in their infancy. While Ontario smart grid policies should foster development and economic growth in this area, policies should allow consumers and the marketplace to provide the principal signals for long-term technology selection. To do otherwise poses significant risk to the Ontario rate base, particularly at this early stage of technological development.
6. **The timing of investments should include an awareness of the technology lifecycle.** Automobiles, semiconductors and cellular telephones are just a few historic examples of how economies of scale and sustained research and development activities will bring down the cost of a new technology even as its capability increases. The financial implications for smart grid policies are no different. They raise the question as to how much importance should be placed on being an early adopter of the latest technologies. The timing of public sector investment should balance the need for early advantage in this area with the prudence demanded by cost optimization. In the near term, consumers have a growing range of relatively immature technologies to choose from – many of which are not economically viable without some form of government subsidy or floor price (e.g. FIT, microFIT). However, one should fully expect that the cost of these technologies will drop over the coming decades as their relative efficiency and efficacy correspondingly increases. Given this rate of change, the Government of Ontario should have a dynamic plan in which subsidies give way to other supportive policies which proportionately reduce the public finance risk of such technologies as their cost viability improves over time.

Policy Statements Specific to the Consumer Control Focus Area

1. **Consumer control should serve to maximize consumer choice.** Smart Grid technologies will yield an unprecedented ability for consumers to gather, synthesize and act upon information stemming from their own consumption, generation and storage capabilities along with those of the broader power grid. Maximizing consumer choice with respect to the commercial products that make use of that information will in turn add to the economic value of smart grids in general. This of course needs to be balanced with the various societal objectives that the government has set for itself through the Green Energy Act and other policies.
2. **Consumer choice equates to technological choice.** In the most general terms, a "policy" towards consumer control, does not necessarily have to prescribe a specific technology. In addition, the MEI should regard "consumer control" in a broader context of consumer-owned devices responding to price and demand response signals. The next generation of smart grid technologies will increasingly rely upon automated response by systems and technological artefacts using parameters pre-set by consumers. Indeed consumer should be able to choose their level of choice and control across a spectrum of options ranging from fully automated response to purely manual responses and informational signalling. This choice extends to the expanding types and breadth of technologies that a consumer will be able to select from.

Policy Statements Specific to the "Utility Flexibility" Focus Area

1. **Ontario should critically examine the overall structure of the electricity industry with respect to its ability to foster, accommodate, and embrace the benefits of smart grid technologies.** A crucial learning experience from the smart metering initiative is that there are structural challenges to the adoption of new technologies in the Ontario electricity industry. Some of these challenges can be overcome within the ambit of a flexible regulatory framework. Structural reforms to the industry and the introduction of a framework to address new types of players also would go a long way to giving the government new policy options for addressing these issues.
2. **The role of new types of players needs to be considered before they begin to have an impact on reliability and other facets of the smart grid.** An important first-order question is to determine which types of entities will be operating in the smart grids space. In Ontario, we have already seen examples of where the Ontario Power Authority has made use of third party providers administering some of its demand response programs.[1] If there is a space for "designated dispatch entities" and "scheduling service providers" in Ontario this needs to be signalled to the marketplace as soon as possible. Equally important, is the question of regulation of these entities. Do they need to be licensed? What jurisdiction will Ontario have over them, if their control centres are located outside of the province? How will their security and operating practices be assured? A pro-active policy stance would be to establish the appropriate regulatory mechanisms before these new entities begin operating on a large scale in this province.
3. **Commercial products making use of smart grid information need to be treated within a flexible regulatory framework that makes use of open standards.** Despite the presence of an open retail market, much of Ontario's retail sector is currently exposed to uniform,

[1] EnerNOC Press Release, "*EnerNOC Signs Contract with Ontario Power Authority*" April 2, 2008

regulated rate structures. However, smart grid technologies will open up new frontiers of different types of demand response and other commercial products that make use of consumer control. In this area, the U.S. NIST standards development effort will shortly include a comprehensive set of commercial product definitions, business cases, and interoperability standards that will be available for use in Ontario. The Government of Ontario should ensure that these standards are monitored, disseminated widely within the Ontario electricity sector, and where necessary, formally adopted. By doing so, Ontario energy service providers (be they LDCs or other 3rd parties) will be well-positioned to grow and compete on a North American scale.

Policy Statements Specific to the "Adaptive Infrastructure" Focus Area

1. **"Adaptability" needs a clear path from innovation to commercial realization.** How is true "innovation" recognized by the Government and the electricity sector in general? Does the Government have a formal mechanism to gather and catalogue the portfolio of smart grids-related intellectual property in the province of Ontario? How will that information be used to get new innovation from the laboratory to the marketplace? These (and other, similar) questions speak to the overall "adaptability" of Ontario's infrastructure. There is little that any government can do to predict the future winners and losers in the frantic technology race that constitutes the smart grids sector. However, the government and the electricity sector *can* pro-actively manage the way public funding is allocated, and make better use of available information to make intelligent decisions about planning future infrastructure. Therefore, a comprehensive plan for creating "adaptive infrastructure" should involve policies that focus on "adaptive institutions" and "adaptive regulatory mechanisms" that are responsible for it.

2. **The province's policy towards encouraging storage capacity should span all forms of the technology from Electric Vehicles to wholesale-scale facilities.** Is a kW of storage capability from an EV any more valuable than other storage capacity that may be developed in the future? Ensuring flexibility and avoiding adverse technological selection at the expense of the rate payer necessarily means avoiding policies that commit to specific technologies whose future direction is far from clear at this point.

3. **The importance of electric vehicles insofar as public policy is concerned needs to be linked to the broader societal benefits they offer.** Ideally, an electric vehicles policy should be:

    - **Technology-agnostic:** Avoiding adverse technological selection at the expense of the rate payer necessarily means avoiding policies that commit to specific technologies whose future direction is far from clear at this point. Electric Vehicles are currently at the earliest stages of the technology life cycle. The form and impact of "charging stations" or "battery life", or "battery swapping" or electric charging requirements will likely all be affected by the massive infusion of worldwide research and development activity currently underway.
    - **Focused on coordinated removal of any structural and regulatory barriers**: "Coordination" will likely include electrical code/safety standards in addition to adoption of interoperability standards at both the electrical/physical connection level as well has informational transfers between:
        - LDCs
        - Scheduling Service Providers managing EV charging products and functions

- Retailers;
- IESO – particularly for obtaining wide area situational awareness data (short term) and integration of EV load into the wholesale market (longer-term)

Submission 3

Customer Control

1. LDCs will provide consumers access to information on their consumption and how they can reduce energy consumption and benefit from time of use rates.
2. The private sector should drive the development and sale of products that allow consumers to effectively control their use of electricity and respond to time of use price signals. The LDC should facilitate the provision of base functionality in areas where the market place does not readily provide solutions. Such provision should be managed similar to existing CDM programs (such as load controls)
3. The LDCs in Ontario should provide a customer their information in a standard manner such that in home products developed for Ontario can be used anywhere in the province and are marketable more broadly outside Ontario.
4. Provision of customer information by an LDC is for the use of the customer and will be provided in a secure fashion to the customer or to the customer device.
5. Devices behind the meter should not be funded from the rate base except perhaps for concept or product trials or as point #2.

Utility Flexibility

1. When an LDC or transmitter invests to enable the connection of DG these investments should be leveraged to improve the reliability and service of existing customers where it is reasonable and prudent to do so.
2. Investments in the distribution and transmission grids to facilitate the connection of DG should be reasonable and prudent in a holistic sense. That is, grid investments and the location of DG should consider the type of the generation, impact on the grid and existing customers, community needs and desires, and all in cost.
3. In general, investments in the grid should support providing increased value to the consumer.

Adaptive Infrastructure

1. Smart grid technologies should be used in the electricity sector to drive innovation and accommodate innovation that benefits the people of Ontario.
2. Business outside of the traditional electricity sector should be encouraged to fund, market or own many of the solutions that are not core to electricity delivery.
3. LDCs and transmitters may own or partner in DG or energy storage where it provides a more cost effective solution to reliably and safely deliver electricity.
4. The operational impact of new technologies must be understood and trials explored prior to broader adoption.
5. Ontario should adopt international standards in preference to local Ontario or Canadian standards to enhance the competitiveness of Ontario and lower the adoption costs via broader standardization.

Submission 4

Customer Control

Context Statement:

If we accept that the large value to customer and the utility from the smart meter installations will not be realized unless we move down the path to the enabling infrastructure that provides real time feedback and real time control, then the policy path will have to lean towards language that has a mandatory element to it. But I suggest, only in so far as the enabling infrastructure is required and is necessary.
Thus, there will be a need to mandate requirement(s) for a certain level of functionality. Then the next question: who pays becomes relevant. Again, if we accept that the benefit- ultimately- is to the customer, then a justification for inclusion of the cost for added functionality to be included in the rate base is appropriate.
This makes it universal for Ontario and takes away any implied discrimination within the sector (rural vs urban, highrise vs homes, north vs south etc....).

Some Answers:

Policy

(i) Do we pick a technology type? E.g. IHD vs smart phones vs smart thermostat.
- NO

(ii) Should all customers get the same technology type?

- No; encourage a wide range of products, suppliers, choice as long as they are compatible with the enabling communication (IT) and "wires" or "wireless" infrastructure.

(iii) Voluntary or Mandatory?
- Mandatory in so far as the utility has the obligation to provide the "backbone" infrastructure for control.
- Incentives based and voluntary for the array of devices that enhance consumer choice.

(iii) Should Ontario be a leader in this area or should it wait to implement?

- Given we have already led the way to the smart meters, we should continue to close the circle to allow customers to realize the ultimate benefits

(iv) How do we encourage Ontario opportunities for Consumer control?

- Provide assurance that the utility is obliged to bring to the customer the necessary infrastructure.
- Beyond that, the customer must put some skin in the game to enjoy additional benefits. Incentives to help defray up front costs, soft loans or payback through savings in energy

consumption or demand reduction through adjustment to customer bills, etc are examples to encourage.

(v) What privacy and security measures do we need for compliance purposes?

- This is important and ensuring confidentiality of customer information is an existing obligation of utilities. Must continue to maintain this.
- This would be a requirement in any RFP for the enabling technolgies.

(vi) Will the availability of the technology provide the requisite incentive to change consumer behaviour or are other mechanisms also required?

- In a world where consumer sovereignty prevails, all you can do is take the horse to water. Flogging or other extreme methods will not be acceptable.

Technology

(i) Do we need a functional specification?

- Yes, to enable real time feedback and control

(ii) Are we standard setter or adopter?

- Adopt where available and lead the way where a standard is not available.

(iii) Do we need to develop a technical specification for LDCs with minimum interoperability requirements?

- This is important and a Working Group should be tasked to put some substance on this. Again, adopt if available or lead and develop.

(iv) Should the technical specifications be tailored for Ontario only?

- No: Aim for universality because we should aim to nurture an industry that can exploit global markets.

(v) Do we need more technology pilots?

- Pilots where necessary but not pilots for paralysis. Too often, I have noticed a desire to hedge bets through pilots: often a way to slow down implementation.
- If manufacturers and service providers see a commitment to large scale implementation, they would take some risk and optimize.

Utility Flexibility Questions

Policy

Context Statement

DG solutions, and in particular the renewable (or "green sources") have to be viewed as an integral part of the supply mix and the electricity system that works in way to enhance reliability, safety, security and help reduce cost in the long term.

DG can be a benefit but also a problem and should not be viewed as an undisputed "good" in and of itself. The smart grid is simply an enabler of DG and can help mitigate the barriers to integrating DG into the system. Without the smart grid, the complexity that DG brings to the system can make it a costly and unreliable burden on the system. The necessary investments in the smart grid will help mitigate the limitations of DG and help improve the Ontario's overall environmental performance.

(i) What are the objectives beyond incorporating DG solutions, i.e. utility efficiencies

- As noted above, enhance overall reliability of the system and environmental and cost performance.
- But the DG solutions must be shown to have demonstrably positive attributes to the system and the customer and not simply taken as assertions.

(ii) What aspects of DG implementation should be centralized vs left up to LDCs?

- DG being the decentralized solution can best be implemented by DG proponents on the business case that makes sense to the DG developers
- The obligation to connect to the Distribution and or the TX network poses a certain burden on the LDCs.
- There will be a need to closely monitor both the reliability and cost implications of this obligation and it is in this area that smart grid initiatives can help, either through better standards, good business practice and reduction of threat to reliability because of DG.
- DG can be a blessing and a curse from the perspective of reliability and safety and the challenge is to ensure a net positive benefit to Ontario

(ii) Do we limit the amount of investment in conventional technology in the near-term to encourage “smart” investments.

- Not clear on this one. Rather than an artificial boundary between conventional and smart, we should view investments in light of commercially available technology (or some of the emerging technolgies) and judge it on the basis of improved functionality and benefit to the system over the life of its implementation.
- Thus, a higher cost solution could still be justified if there is reasonable expectation that it would deliver a lower cost, or improved reliability over the life of the investment.

(iii) Do we pick a common technology type for all LDCs? Joint procurement?

- Sounds appealing but there may be many barriers in practice.
- Utilities can best comment on this. or they can come together voluntarily where it make sense.

(iv) How do we encourage Ontario opportunities for Utility Flexibility

Technology

(i) What technologies do we need to focus on in the near, mid, long terms?

- Will have to give this a try later

o Are functional specifications required for them? Yes

(ii) Do we mandate a open-standards to ensure interoperability (between LDCs, jurisdictions, operator)

- Yes but with all the necessary provisos that will ensure system security, reliability and safety
- As indicated before, we need a technical working group to spell out details around interoperability, what it means to whom and the state of current technology to enable.

(iii) Are we standard setter or adopter? Do we adopt int'l security standards?

- See previous answer under Customer Control

(iv) Do we need more technology pilots? If so, for what/why?

- See Previous answer.
- I would like to see a concrete list and some specifics to come to a view on what needs to be done here

Adaptive Infrastructure

Context Statement

The role of the plug in electric vehicles as part of the "greening" of Ontario- not just the Ontario power system- is a game changer. This will require a combination of incentives based policies directed at the consumer and also at the utility to provide the necessary infrastructure to enable rapid implementation.

Similar to my observations under consumer control, the provision of the required infrastructure as enabler is a legitimate utility investment partly because this can be recovered through better and improved utilization of the grid. Thus, a mandate to provide "universal" or extensive access to adaptive infrastructure for cost recovery is appropriate.

After an initial phase of encouraging consumers to adopt PHEVs, the obligation on utilities would be maintain and operate the infrastructure to meet needs and projected needs (similar to business as usual).

Significant attention and discussion will be necessary in the early phase to ensure we do not end up with parallel infrastructures and unresolvable conflict between utilities and new and emerging business models for provision of electricity services to the auto sector.

Policy

(i) Do we want to leverage EVs for storage, if so – when?

- PHEV's and EVs will begin to provide value to system under low load conditions just as they emerge and consumer acceptance picks up.
- PHEVs as storage to the grid (namely Vehicle to Grid propositions) will likely not emerge as a credible option until the 2015 time frame.
- The auto manufacturers are not convinced, primarily because of challenges to the battery technology and concerns over charge/discharge cycles, that the cars can provide effective storage on a large scale in the early phase.
- The second use of the car batter at Dx substations is a credible option and these issues are under evaluation.

(ii) What other storage options are available other than EVs?

- Pumped Hydro, Compressed Air Energy Storage Systems, Hydrogen, Superconducting Magnetic Energy Storage Systems... All with site specific limitations or technical issues or cost issues for large scale needs of the power sector

(iii) Who should own/operate charging stations?

- Allow flexibility to LDCs or new business entrants

(iv) What level of coordination is required between LDCs (roaming)

- I believe this issue has been exaggerated but it is real. There are simpler solutions in the early phase of EV implementation; we can get more sophisticated later.
-An answer to this should not be tunred into an impediment for PHEV implementation.

(v) Is there a business case for an aggregator of EV load? Is this a private sector function or gov't?
- Yes... and I can speak to this later.
- Most effective would be private sector entity but LDCs may wish to play a role.

(vi) Do we mandate new buildings/reno's to rough-in EV charging infrastructure?

- Such a mandate would be a positive step in the right direction because it could be implemented at a lower cost and planning the Dx system supply to the building loads would help reduce uncertainty

(v) From a regulatory perspective how would we treat battery swapping companies, i.e. are they retailers?

- I think this one is simple. The battery swapping company pays the utility whatever it consumes at its operating site (imagine a car wash). It charges the customer whatever the customer is prepared to pay for the convenience.

(vi) How do we ensure flexibility in the regulatory regime to accommodate for future innovations?

- Develop a capacity within the regulatory body to evaluate and assess the value of innovation to society and broaden their perspective around what is or not a legitimate cost recovery.

Technology

Do we need a specification for home charging infrastructure?

What should our focus be beyond EVs and Storage applications?

Submission 5

We need to define a role (and perhaps a policy) for early-adopters of smart grid technologies (like the LDCs) which favours domestic products/services. Domestic procurement policies will enhance the economic return of smart grid implementation for Ontario.

Economic development should be a key part of the smart grid development going forward – so if a product like a smart meter is to be deployed into 4 million homes, we consider puttng more of the value chain into Ontario (e.g. setting up manufacturing the province). The next big “product” will likely be in home displays of power use and we have several Ontario companies developing such products (e.g. Eco-bee). The economic goal will be export.

Under the heading "innovation" – the academic community in Ontario should be fully engaged and OCE can be a key conduit.

Industry-academic collaborative research, development and demonstration initiatives are invaluable tools to ensure that Ontario has the most appropriate technologies available for adoption. Such initiatives will mitigate risk for domestic procurement policies.

Regardless of the policy decisions, linking forum members, industry and academia through collaborative research and demonstration endeavours will advance the implementation of priority areas of customer control, utility flexibility and adaptive infrastructure in Ontario. As smart grid forum members represent the early adopters of new technologies, participation in and awareness of associated R&D and demonstration activities will facilitate implementation of these technologies, thus enhancing ROI on investments in research and demonstration.

For Consumer devices/control we need to engage Prof. Ian Rowlands and his team at the University of Waterloo. This team is addressing many of the questions on the MEI list and pilots are underway with the Energy Hub Project.

For Utility flexibility: we need to consider the OCE pipeline for renewable technology. These technologies be in the market In 5 + years.

We need to establish an open standards policy so that technology advances are not blocked by closed architectures.

Adaptive Infrastructure: EVs are very likely 10+ years from being an integral part of the grid - so policies on using their batteries for grid storage and peak supply are premature (or of lower priority).

Submission 6

Consumer Control Questions

Policy

1. Do we pick a technology type? E.g. IHD vs smart phones vs smart thermostat?

   We should select a suite of technologies that is adaptable to the needs of the customers. Whatever is selected should recognize that customers like to get their information and exercise control through different channels. The technologies selection needs to be based on what tools will support our ability to meet the objectives in partnership with the customers. The technologies need to be convenient for the customer while providing the functionality required by the utilities.

2. Should all customers get the same technology type?

   The same suite of technology should be available to all customers within the same customer class. (e.g. all residential customers have access to the same technologies, though not all tools may apply – only those with swimming pools may need control for the pool pump.)

3. Voluntary or Mandatory?

   It should start as voluntary with equipment provided by the utility. The technology needs to be provided to help customers be successful in managing their bills under the new structure (if they lower their bills it will be through peak shifting and energy efficiency targets creating a win-win for the province and the customers). If the voluntary program does not meet the goals then more prescriptive measures can be introduced. If the programs and technology are well selected there should be pull from the customers for more rather than push from the utilities and the regulator.

4. Should Ontario be a leader in this area or should it wait to implement?

   Ontario is already a leader on many fronts. Why should we wait? Many of the decisions being made in other jurisdictions are based on local political agendas that may not be concerned with the same factors that are compelling Ontario to move. We have the intelligence and the skills to be first; we should not let others drive the solutions that work for Ontario.

5. How do we encourage Ontario opportunities for Consumer control?

   We need to make it easy for the customers to implement and to use. If we keep it simple, cost effective and ensure that there is a direct link in the minds of the customers between these tools and the savings on their bills, it will be successful.

6. What privacy and security measures do we need for compliance purposes?

There are a host of efforts already underway that address security. We should look to some of the standards coming out of NERC for cyber security as these are likely to have an impact on our decisions in Ontario. Otherwise we can rely on standard protocols for encryption used today to protect customer privacy. There is not a lot that needs to be invented, as there are existing standards that can be applied.

7. Will the availability of the technology provide the requisite incentive to change consumer behaviour or are other mechanisms also required?

   For this program to work we need to be able to combine price signals with convenience to get the maximum benefit. If we give customers tools to curtail usages during peak periods then they will use them and we will see the reduced demand. The customers will appreciate that they are in control of their energy usage and the ability to manage their bills. If we only provide them with price signals, but no tools to control usage then we run the risk of dealing with unhappy customers that feel victimized by the changes.

Technology

1. Do we need a functional specification?

   Yes. But it needs to be just that – functional. If we get too detailed in the specification we run the risk of limiting choices available and stifling innovation. We need to recognize that the tools used inside the home will probably grow and change in a pattern more like consumer electronics than like utility standards. If the goal is to create pull from the customers for more tools and ways to reduce consumption then we need to ensure that the standards set the minimum requirements (security, privacy, etc) and allow for growth and expansion driven by customer requirements.

2. Are we standard setter or adopter?

   We should set the functional standards and the architecture standards. As for communications protocols we should likely adopt something ubiquitous like IP and take a neutral position on communications path.

3. Do we need to develop a technical specification for LDCs with minimum interoperability requirements?

   Yes. But it should be a functional standard and we should be clear about what it is we are trying to achieve with interoperability. What devices really need to be interoperable and why. The tighter we make the specifications the more limited the choices we and the customers will have.

4. Should the technical specifications be tailored for Ontario only?

   Ontario's needs should be at the top of the list. That said, we should be pragmatic about it. If we are adding Ontario specific items we could be hurting ourselves cost wise. Anything we do that results in economies of scale result in lower cost to us and to our customers. We need to ensure that Ontario requirements are met but not go overboard in defining those requirements.

5. Do we need more technology pilots?

   Yes. But we should be clear what the goals and timelines are for the pilots. We don't want to get ahead of the technology but we should also be cautious about using pilots as an excuse to go slow.

Implementation

1. What are the knowledge gaps or barriers? (regulatory, technological, cost-benefit?

   There are a lot of solutions out there. Most of us know about those that make the headlines. We need to be more deliberate about ensuring that we see the quieter players that have good solutions but may not be in the limelight. The big guys making the front page don't always have the best solution, they have good PR.

   We need a better understanding of cost recovery models for expenditures the utilities make on behalf of the customers to support:
   - *Energy efficiency related savings*
   - *Demand reduction related savings*

   We need to understand regulatory treatment of the asset investments we make in support of our customers (HAN equipment, communications networks, etc) in terms of depreciation life etc.

2. What is the best way to rollout devices, i.e. phased, all at once?

   This really depends a lot on costs and cost recovery. In most cases an all at once roll out is only possible if the costs are low. If we are contemplating HAN investments then the rollout should probably be:
   - *Well defined pilot*
   - *Phased roll out running in synch with the roll out of TOU*
   - *Expansion of the capabilities to support customer pull*

3. What is the preferred distribution model for the devices?

   It depends on the devices. If they are customer installed then it can be as simple as shipping the kit to the home with an instruction package. If the equipment requires qualified installers then we need a more deliberate roll out with appointments and delivery by the installers. There is a hybrid model where the customer installed devices are shipped directly to the customer and then, as they get used to the devices ask for more capability and they set an appointment themselves with a certified installer.

Cost

1. How much will it cost?

The prices range significantly. We have seen everything from HAN systems that offer full home control at less than $200/home for the equipment to $300 for one thermostat. We should be targeting less than $200/ home for fully capable HAN systems (A/C, water heater, measurement, communications, and plug loads).

2. What is the opportunity cost of being a leader in the technology versus a lagger?

   Leaders get to define what the products will look like. Many vendors will make the modifications that you want as they are looking to get into the market. Followers benefit from others having done the shake down testing. Followers though don't get much choice in what is being offered as the designs have been established by the leaders.

3. Do we need more pricing pilots?

   Only if they have clear objectives that align with the overall goals of the province. In other jurisdictions we have seen them consider pilots that test the impact of pricing signals by looking at the usage of three different groups of customers:

   - *Control group – no real time usage information, no change in price, no price signals*
   - *Price Only Group – provided real time pricing information but no control capabilities other than what they can do by shutting of devices*
   - *Price and Convenience – provided with real time pricing information and with devices that can operate automatically to adjust thermostats, shut down plug loads, shut off pool pumps, etc.*

   This type of pilot would allow us to determine the cost benefit of HAN related expenditures that give customers control, over information only related expenditures.

4. Should procurement be coordinated?

   That should be left up to the individual utilities to decide. If it is mandated then we could find the progress in the province being driven by the slowest moving organizations. We would need to believe that there was greater value in procurement economies than there is by getting information and control to the customers earlier. It appears that the value to the province is in meeting the targets as quickly as possible. The earlier we start the better.

Utility Flexibility Questions

Policy

1. What are the objectives beyond incorporating DG solutions, i.e. utility efficiencies?

   - *Energy efficiency*
   - *Reduction in system losses*
   - *Improved relationships with the customers*
   - *Better predictability of load changes*

- *Enhanced intelligence and automated controls*
- *Improved load restoration*

2. What aspects of DG implementation should be centralized vs left up to LDCs?

   The smaller Dg facilities can be managed entirely within the oversight of the LDC. For larger installations, particularly those that are dispatchable, centralizingmay make some sense for:
   - *Dispatch of DG for grid support*
   - *Economic settlement*

3. Do we limit the amount of investment in conventional technology in the near-term to encourage "smart" investments?

   Only if we believe that smart investments are being curtailed in favor of imprudent or lower priority conventional investments. Many conventional investments are needed because there is yet no smart alternative.

4. Do we pick a common technology type for all LDCs? Joint procurement?

   Joint procurement is difficult to achieve on a sustained basis. Many of the joint procurement efforts in North America have failed because they stopped meeting the needs of the members. The utilities should be encouraged to do joint procurement but not required to do so, otherwise we run the risk of limiting innovation and moving as fast as the slowest mover.

5. How do we encourage Ontario opportunities for Utility Flexibility?

   We need to ensure that there is encouragement and recovery for investments that come from flexibility, innovation and leadership in meeting the provincial goals and objectives.

Technology

1. What technologies do we need to focus on in the near, mid, long terms?

   - *Fault current limiters to help deal with increasing fault levels resulting from more DG and new construction and rising reliability requirements*
   - *Smart distribution technologies that allow for "self healing" actions on the grid and more intelligence on system and equipment conditions*
   - *Smart transmission technologies that allow better utilization of the transmission system, reducing congestion costs*
   - *Better modeling of the interconnected grid*

2. Are functional specifications required for them?

Yes but in many cases these exist at least at a functional level. In the case of modeling there are standards being developed that apply to all utilities in North America. Given the interconnected nature of the grid it would make sense to adopt a common modeling platform

3. Do we mandate an open-standards to ensure interoperability (between LDCs, jurisdictions, operator)?

   Yes, to a point. They should be open standards so that any vendor has the opportunity to integrate with the system. We should be careful about not selecting a specific standard such as Wi-Fi, Z-Wave, ZigBee, etc, all of which are open standards. If we choose one, we limit the ability of any of the other open standards to make offers to the market. We are better off standardizing on something like Internet Protocol that requires a common standard for interoperability but is independent of communication path. We believe that communications protocols will continue to evolve at a rate much faster than the utility industry can drive them. Consumer electronics will be the driver of the next generation of communications and we need to ensure that our systems are open to integrating the latest devices that the customers are purchasing.

4. Are we standard setter or adopter? Do we adopt int'l security standards?

   With regard to security we will likely have to meet NERC security standards at a minimum. We should probably be an adopter on those types of standards as they are more likely to drive the market than we are.

5. Do we need more technology pilots? If so, for what/why?

   Yes we need pilots for new technologies that could reduce or redirect capital and operating expenditures in the future, e.g.
   - *Fault current limiters for both T & D applications*
   - *Smart wires for both T & D applications*
   - *New Conductors for both T & D applications*
   - *Storage for both T & D applications*

Implementation

1. How do we ensure that today's investments fit into the long-term smart grid strategy?

   We need to have a clear vision of the future provincial grid

2. How do we maximize our current infrastructure before making larger investments?

   This is not one or the other - we need to find the optimal approach to achieving both aims. We need to recognize that both new and conventional solutions are required to meet the objectives.

   We need to ensure that there are mechanisms in place that encourage or foster new investments, including accepting the risk associated with newer technologies

We need to focus on technologies that unlock the existing infrastructure and allow us to get better use of the assets, e.g.

- *Fault current Limiters*
- *Smart wires*
- *Smart controls*

3. How do we ensure that best practices are shared?

   One suggestion would be to set up benchmarking forums that look at the results and identify sustainable practices that have led to improved performance.

   Industry Associations across Canada would participate, and our proposed Corporate Partners initiative would be an appropriate forum to engage the industry..

4. How do we minimize duplication in piloting DG technologies?

   Ensure that each of the pilots has clear objectives. Ensure that pilots seeking recovery or non-standard regulatory treatment are approved in advance so that the OEB can serve as a clearing house for the pilot projects.

   Develop a list of pilot objectives for the province and allow each of the LDCs to offer pilot projects to test different approaches to achieving the objectives

Cost

1. How will a maximum cost threshold be established?

   There should be no maximum cost threshold. There should be a benefits case threshold. If the short term and long term benefits line up with the provincial objectives then the cost should be approved and not otherwise.

2. How will LDCs distinguish between "smart" investments vs. conventional investments?

   By demonstrating how the investment

   - *Improves visibility of operations by the LDC*
   - *Offers intelligence or control beyond what they have now*
   - *Improves the insight or decision making capability beyond what they have now*
   - *Is significantly different from the solutions that they have employed in the last 1 to 10 years.*

Adaptive Infrastructure

Policy

1. Do we want to leverage EVs for storage, if so – when?

Yes we should leverage all plug in vehicles including PHEV and EV and we should do it now. At minimum we should do this by controlling the charging cycle. Using off peak energy will decrease peak demand and likely will increase the renewables content of the energy put into the vehicle. At some point in the future (this is a manufacturer warranty issue) we should leverage two way flow with PHEV and EV because the batteries offer a level of spinning reserve that is available and would only be called upon in dire emergencies.

2. What other storage options are available other than EVs?

    - *Batteries (L-ion, NaS)*
    - *Compressed air*
    - *Water heaters (adding auxiliary electric water heaters in homes that are controlled and charged off peak)*

3. Who should own/operate charging stations?

    There could be several models

    - *Provincially owned and the revenue they generate pays for the infrastructure and the energy used*
    - *LDC supplied with either a charge card payment process or associative billing – the charging station recognizes the car and adds the usage to the bill of the car owner (creates cross provincial billing requirements)*

4. What level of coordination is required between LDCs (roaming)?

    This could be significant.

5. Is there a business case for an aggregator of EV load? Is this a private sector function or gov't?

    This could be either or both.

6. Do we mandate new buildings/reno's to rough-in EV charging infrastructure?

    This is probably a sound idea as the incremental cost to put this in new buildings will be small

7. From a regulatory perspective how would we treat battery swapping companies, i.e. are they retailers?

    That seems like a logical way to think about it as they are selling energy in a box, not unlike propane tanks for grills

8. How do we ensure flexibility in the regulatory regime to accommodate for future innovations?

    Specifications should be functional and open to innovation

Technology

1. Do we need a specification for home charging infrastructure?

   Probably but we should be cautious about how detailed the specifications are. We should also specify that the home charging stations have charging controls that allow for LDCs or IESO to signal when it is ok to charge.

2. What should our focus be beyond EVs and Storage applications?

   - *Smart appliances*
   - *Better sensing and measurement*

Implementation

1. Are all charging models workable? i.e. can battery swap, home recharge and charge stations co-exist?

   - *Yes, without a doubt*

2. What type of coordination is required for building out infrastructure?

   - *Clear specifications for the minimum requirements*

3. How are risks associated with being an early adopter of the technology mitigated i.e. if technical specifications change rendering sunken infrastructure costs useless, safety concerns with technology/infrastructure may not be known?

   - *The charging infrastructure is pretty well understood and the vehicle manufacturers are attuned the need to keep the requirements within the parameters found in existing and new homes.*

Cost

1. What is framework for determining price paid to consumers who feedback energy to the grid through EV batteries storage or other means of storage?

   - *Market price for time of charge and discharge; or*
   - *Fixed predictable price for permission to pull energy from the vehicle*

2. How do you handle out of province EV customers who sell into the grid?

   Don't pull energy from their vehicles is probably the easiest in the short term. In the long term this will require cross border policies to be worked out at the govt level.

3. What is the mechanism to integrate charging infrastructure with other provinces?

   This will take a lot of policy work first to get the basic principles around taxation etc. Once those principles are worked out the technical solutions can be developed.

4. What is the cost recovery model for building charging infrastructure?

   - *It should be treated the same as other smart grid infrastructure investments.*