Smart Grid Advisory Committee

Low Volume Customers: Near Real-time Data Access

The Smart Grid Advisory Committee established a working group to investigate issues related to near real-time data access to assist in developing advice to the Board as to how and on what timeline access to real-time data can appropriately be provided to low-volume (i.e., residential and general service under 50kW) customers. In this document the Near Real-time Data Access Working Group provides its responses to several questions posed by the Smart Grid Advisory Committee.

1. What avenues are available for the delivery of near real-time data today?

There are five avenues by which low volume customers in different parts of Ontario are accessing near real-time consumption data (i.e. not billing quality) today. The method for accessing near real-time consumption data is in some cases dependant on the smart metering technology deployed at a customer's premise. In other cases, the meter can be bypassed. Further, it is important to recognize that many of the technologies listed below are not mutually exclusive; technologies can be used in concert to achieve a detailed profile of household consumption (e.g., current transformers paired with smart plugs).

However, data access is of little value if the information cannot be acted upon by the consumer or authorized 3rd-parties.

Currently, it is common that many of these technologies rely on proprietary or closed systems.[1] It is widely believed that open platforms[2] or standards can result in interoperable solutions that lead to reduced barriers to market entry, greater consumer choice, reduced costs and access barriers for consumers, and can lead to increased adoption of home energy management systems or implementation of programs such as demand response that would more fully realize the potential value of real-time data. However, this belief does not imply that proprietary systems cannot provide the same value as more open systems.

[1] "Proprietary software or closed source software is computer software licensed under exclusive legal right of the copyright holder with the intent that the licensee is given the right to use the software only under certain conditions, and restricted from other uses, such as modification, sharing, studying, redistribution, or reverse engineering." Source: Wikipedia.

[2] "Open-source software is computer software with its source code made available and licensed with a license in which the copyright holder provides the rights to study, change and distribute the software to anyone and for any purpose." Source: Wikipedia.

A brief summary of these options is provided below:

1) *Optical Sensor*

A customer can purchase an optical sensor that clamps to the outside of a meter and reads the meter's pulse output. The sensor translates the pulse output into a radio frequency signal that is conveyed into a premise to an in-home display (IHD). Some vendors have added additional features to this device (i.e., a WiFi bridge) that enable data to travel using the internet so that a customer can access it via a computer or a mobile device.

These off-the-shelf devices are in the range of $100 and can be purchased in-store and online. This is one of the technologies currently being used by LDCs to feed into the in-home display that must be provided as part of OPA's Peaksaver Plus program.

It is estimated that these devices are currently compatible with about two-thirds of the smart meters installed in the province. Due to a security issue the remaining one third of the meters have had the pulse output capability disabled.

Benefits of optical sensors:

- Provides total usage data.
- Data reading is reliable.
- Optical sensors are the most commonly deployed technology for accessing near real-time data in Ontario. Utilities and energy management service providers have significant experience with this technology.
- The cost of this option is relatively low. Consumers can purchase an optical sensor alone for approximately $100.
- Optical sensors are partially supported by standards. An ANSI standard defines how the 'pulse' operates, including the unit of measurement (1 pulse is equal to 1Wh).

Drawbacks of optical sensors:

- Consumers may have difficulty procuring them independently because they are no longer readily available through retail channels, although they are still available as part of energy management service packages and utility run conservation programs.
- Lacks data granularity - Can only capture the total consumption at a given premise. Circuit and appliance-level data is unavailable.
- Communication from an optical sensor to other devices has not been standardized. As such, most solutions relying on optical sensors are closed, proprietary systems.
- Batteries must be replaced at least annually.

- Since the optical sensor only provides consumption data to the device in the home (usually an IHD) the device must be manually updated by the consumer to reflect changes in rates and tiers.
- Optical sensors are not compatible with approximately 1/3 of the smart meters currently deployed in Ontario.

2) *Current Transformer*

Current transformers are installed in a customer's circuit breaker/fuse panel and do not interact at all with the customer's meter. These systems can cost hundreds of dollars. Installations can range from the measurement of total consumption of the facility to the measurement of consumption on individual circuits (the cost of the system will vary accordingly). These installations also have the ability to transmit data to the customer through a wireless gateway. This option should be installed by an electrician. A related technology is "smart" circuit breakers and panels, but they are similarly expensive and require an electrician.

Benefits of current transformers:

- Provides total usage data.
- Provision of more granular data (i.e. circuit level).
  - Better lends itself to automation/home energy management.
- Circuit-level current transformers are capable of detecting phantom load making deeper demand reduction possible.

Drawbacks of current transformers:

- Current transformers are costly to install since a licensed electrician is needed (hardware is approximately $300 and installation costs can vary, estimated $300).
- Current transformers are less accurate than optical sensors (usually within plus or minus 3-5% of the meter measurement).
- Solutions involving current transformers are closed and / or proprietary systems for transmission of data, reducing options for compatible home automation or HEMs.
- Risk of obsolescence because the devices typically work only with specific operating systems.

3) *Smart or Pre-Plugs*

Another option is plug / outlet level monitoring using a 'pre-plug' that installs between the outlet and the load (e.g. appliance) that can send a signal through a web portal to provide near real time data on individual outlets within a home / business.

Benefits of smart or pre-plugs:

- Provides appliance level data.
- Granular data better lends itself to automation / HEMs.
- Pre-plug devices are widely available to consumers at a cost of approximately $25-$50.
- These devices do not require professional installation and are easy to use.
- Pre-plugs are more accurate than current transformers.
- Some of these devices are capable of communicating through widely accepted standard protocols such as WiFi and Zigbee.
- Capable of detecting phantom load making deeper demand reduction possible.

Drawbacks of smart or pre-plugs:

- Does not provide total usage data.
- Pre-plugs cannot be used for directly wired loads (e.g. ceiling lighting, fans etc.).
- Limited availability for use with heavier loads (e.g. dryers, ovens, HVAC systems etc.).
- Some solutions involving smart or pre-plugs are closed and / or proprietary systems.
- Risk of obsolescence because the devices typically only with specific operating systems.

4) Proprietary Advanced Metering Infrastructure (AMI) chip

There are also IHDs and devices available in the market from various vendors, which act as a node on the AMI network, where the IHD / device communicates using the proprietary AMI communication protocol of the meter and therefore acts as an endpoint to the mesh system that is used by the utility.

Benefits of proprietary AMI chips:

- Provides total usage data.
- Data reading is reliable.
- No battery required at the meter.
- Plug & Play (i.e. no sensor required).
- Can be set-up and updated remotely (i.e. no manual intervention).

Drawbacks of proprietary AMI chips:

- Solutions currently available are all proprietary and closed systems (i.e. services from parties other than meter/AMI provider are not available).
- Risk of obsolescence - dependent on AMI vendors to maintain product support.

- This solution is not available from all AMI vendors.
- Lacks data granularity - Can only capture the total consumption at a given premise; circuit and appliance-level data is not available.
- System development costs (i.e. AMI chip) limit the number of 3rd-party suppliers offering such solutions.

5) Zigbee enabled smart meters

Zigbee enabled smart meters can provide near real time data access to consumers using display devices (IHDs and smart thermostats) and web / app enabled access. Some utilities have also installed Zigbee enabled meters (Zigbee under glass), where the Zigbee protocol can be used to communicate to devices within the home / business. Others use Peaksaver Plus funding to replace an existing meter with a Zigbee enabled meter and then adding displays that access data using the Zigbee protocol. The extracted non-Zigbee meter is kept in stock for maintenance of the remainder of the non-Zigbee metered stock.

In Ontario, Peterborough Utilities has been deploying this solution in their service territory for over a year. Powerstream, Newmarket and Cambridge & North Dumfries Hydro are also piloting Zigbee enabled meters meaning Ontario specific experience will soon be available. In addition, jurisdictions in the United States and Australia have also deployed the technology.

Benefits of Zigbee enabled smart meters:

- Provides total usage data.
- Data reading is reliable.
- More highly functional communications is possible. For example, in addition to real-time consumption data, rates and demand response information / signals can be conveyed.
- Limited utility-specific two-way communications is possible (subject to bandwidth constraints and slow speed of AMI network, such communications will mostly be limited to confirmation signals).
- Communication from the meter directly to multiple devices is possible. The number of devices that can be accommodated may vary, but options are available to increase reach to additional devices (such as use a gateway / bridge)

Drawbacks of Zigbee enabled meters:

- Lacks data granularity - Can only capture the total consumption at a given premise; circuit and appliance-level data is not available.
- There is a significant utility installation and maintenance cost involved, including:
    - IT and back office infrastructure, including staff training;

- Potentially significant hardware renewal costs because there is not a significant penetration of Zigbee-enabled meters in Ontario at this time.

Emerging Architecture: The NIST 2.0 Smart Grid Reference Architecture identifies an Energy Services Interface (ESI) as the mechanism by which near real-time data can or should be provisioned to the Customer Domain. While devices that incorporate a standardized ESI are not readily available today, it is anticipated this will be forthcoming, given the attention to ESI development by organizations such as the Smart Grid Interoperability Panel, etc.

2. What is an appropriate definition of near real-time data?

The OPA's Peaksaver Plus program requires a data refresh rate of no more than 60 seconds.[3]

At this time, the OPA's data refresh requirement is an appropriate definition because of the technical limitations of some existing metering infrastructure. However, as infrastructure is renewed and home / business energy automation evolves and matures, reducing response times, a 1 minute period will be too long to maximize value. In the long-term, the refresh rate will approach seconds. For example, the Working Group views the Zigbee standard protocol of 7 seconds or less as a future standard.

[3] Actual access through third-party providers may vary.

3. What value does near real-time data provide to the electricity system?

Potential value from enabling near real-time meter data access to consumers can be realized by the parties in Table 1 below.

The value exists in using the data to deliver desired programs, products and services that are targeted for cost savings consumption and demand reductions, and / or comfort to consumers. It is important to note, however, that the value of near real time data access is unlikely to be realized in the absence of:

- Secure third party access to data to enable developers to build solutions for Ontario consumers that are not based on proprietary access to data;
- More dynamic pricing that motivates customers to respond to price signals and achieve savings to their energy bill. Examples include greater variance between time-of-use commodity pricing, creating time-of-use distribution and transmission rates, offering a critical peak price option, and / or declaring the meter evolution end date;
- Integrated and automated energy management systems that are standardized, convenient and affordable (e.g. after customer indicates preferences for cost and comfort the system automatically optimizes energy asset usage via “set-it and forget-it”); and
- Industry accepted communications and operating systems standards or protocols.

When the above situations exist, customers will have the means, opportunity, and incentive to better manage their usage. When customers are better able to conserve and shift usage, the aggregation of the these reductions and shifts will make system wide benefits achievable through deferred investments and extended life of network assets at both the transmission and distribution level.

Table 1 – Potential value of Near Real-Time Meter Data Access

Domain	Value	Consumers	Utility	System
Services	Increased consumer engagement and education around energy consumption Increased consumer empowerment and consumer satisfaction Providing consumers more choice around how they engage and access their data	A more aware and engaged and empowered consumer can take action to understand and manage their bills Increased choice can lead to increased engagement of additional customer demographics	Lower customer care needs over time Greater consumer satisfaction Meeting customer satisfaction metrics Meeting conservation targets	
Grid	A reduction in overall energy consumption (kwh) A shift and/or reduction in demand from peak to off-peak or during critical peak events (kw) respectively Enable greater responsiveness to system supply conditions and dynamic demand capability. Increased reliability and resilience based on being able to impact both electricity supply and demand	Energy cost management Reduction in consumer bills Potential payment if tied into varied price plans or demand response initiatives More reliable energy supply	Achievement of CDM targets Manage peak and load on LDC systems Meeting requirements and customer service metrics	Reduced consumption and associated costs Flexible demand reduces costs for supplying energy or defers generation / capacity costs[4] Reduced costs to balance supply and demand on system More resilient system
Economic Development	Building businesses and jobs due to technological and services solution development Growth and development in related industries such as home automation and building/facility management	Increased convenience, empowerment and choice	Less onus on utility to meet customer demands and rapidly evolving expectations. Transfer risk associated with solution development.	

[4] There is a potential for significant cost savings if demand reductions can be achieved (see footnote note 5). For example, if access to near real-time data, when leveraged en masse, produced system demand reductions of 10% that represents approximately 2 GW in Ontario. This would represent a potential significant avoided cost if such a demand reduction was achieved.

a. How does the value differ across low volume customer classes?

Value will differ across (and within) customer classes based on a variety of internal and external factors. For example, some demographics (e.g., high-use residential users) will be more price sensitive than others and behaviour changes would reflect this (e.g., running pool pumps during off-peak hours). Also, customers with electric heat may also benefit more from near real-time data. In contrast, the extent to which seniors, consumers living with a disability or low-income customers could potentially benefit from near real-time access and conservation / demand shifting-related cost savings is not as clear due to the perception of inflexible demand and limited means or opportunities to pursue energy efficiency improvements.

There may be more bill management and cost reduction opportunities to small commercial customers (i.e., general services under 50kW) who are largely on-peak users, if they can use the data to increase automated energy management, energy efficiency, or participate in conservation programs to better manage usage under TOU (or spot) pricing**.**

b. Will this change as third party service providers have more access?

Until access to near real-time data is standardized, inexpensive and widely available there will be a small market for third-party service providers. This market is expected to grow, as more customers take a greater interest in their energy costs, standards are developed to enable 3rd party access to data, and innovative energy management solutions develop, and the integration of automation technology advances. The development of dynamic pricing options will further catalyze the demand for solutions based on standardized real-time data access and encourage the growth of this market as well.

Currently there are some data access / energy management pilots being pursued across the province.

For example, Energent is piloting a home energy optimization solution with Milton Hydro and Hydro One. The system is connected to several devices in the home and based on parameters set by consumers (comfort levels, preferred appliance usage time windows, occupancy schedules, etc.), both meter data and external data (e.g. weather information) inform the system in achieving a customer defined objective (e.g. minimise cost, consumption, carbon footprint).

Also, Energate is working with six LDCs on a Smart Grid Fund pilot, involving optical readers on meters and thermostats in homes, with access to a portal and mobile app that consumers can use to monitor and control what is happening in their home. The pilot will involve approximately 800 customers.

More information regarding value will emerge as pilot projects are conducted and evaluated with a consistently documented process. As real time access to consumer data brings together smart grid developments (which are constantly changing) and consumer IT and electronics, which have an even faster evolution cycle, it is important to start identifying key variables that enable maximum value to be derived from real-time access to data in Ontario.

Findings from general studies[5] and recent Ontario-specific studies such as Navigant's Time-of-use Rates in Ontario: Impact Analysis and the Enernoc study on SmartGridCity™ Pricing Pilot Program can be combined with existing and new pilots to isolate the impact of the different internal and external variables that can affect the value derived from real-time access to energy data.

c. *What factors should be considered when evaluating the value of near real-time data?*

The aforementioned studies indicate a relatively wide range of outcomes with respect to the value / savings that arise from access to near real-time energy data, some showing very encouraging savings potential and others less so. In general two categories of factor can lead to such variation;

i) **Internal factors:** the definition of access to near real-time data and how it is provided

ii) **External factors:** extraneous influences that also affect consumer / market behavior when access to near real-time data is provided.

Internal factors:

A. *The following differences in the definition of real time data access can result in finding variances:*

- **Frequency:** i.e. hourly ,15-minute, 1- minute or sub-minute interval consumption data provisioning can impact what/how the market-place can derive value from the data.
- **Granularity:** refers to whether the energy consumption data is provided at a whole home level, circuit or at a plug level. The granularity of the data can influence the value consumers may potentially derive from it.

[5] Studies have found a wide range of energy savings ranging from 0% to 20% as well as mixed results regarding the persistence of these savings. See: Ehrhardt-Martinez, K., K. Donnelly, and J. Laitner (2010), "Advanced metering initiatives and residential feedback programs: A meta-review for household electricity-saving opportunities," Technical Report E105, American Council for an Energy Efficient Economy; Ehrhardt-Martinez (2011), "The Persistence of Feedback-Induced Energy Savings," Boulder, CO: The Renewable and Sustainable Energy Institute, University of Colorado; Houde et al. (2013), "Realtime Feedback and Electricity Consumption: A Field Experiment Assessing the Potential for Savings and Persistence," *The Energy Journal*, 34(1).

- **Refresh Rate:** refers to how frequently the energy data is updated or refreshed for the consumer.

- **Latency:** this reflects how much time elapses between the end of the measured consumption interval and the provisioning of the data to the consumer / energy application using it. For example, hourly consumption data refreshed on an hourly basis may in fact have up to one hour latency, or delay thus representing energy consumed up to two hours previous. Both the refresh rate and latency impact how current the data is and thus the relative value that may be derived from it. Currently, the OPA's Peaksaver Plus program requires a data refresh rate of no more than 60 seconds. However, as home automation evolves and matures the 60 second refresh rates will be too long; consumers will need closer to real-time to maximize value. Current *de facto* near real time standards such as Zigbee have latency defined at 7 seconds or less. The latency of data can influence the types of applications that the data stream can be used for. In some cases data access around critical peak pricing may even need to be provided in advance of the critical peak pricing event (to allow consumers, devices to prepare and respond – e.g. HVAC pre-cooling algorithms)

- **Type of data -** what information is provided and what additional layers of data are available to provide context? kWh, kW, price (TOU, critical peak, dynamic pricing), total bill cost or cost of energy only, weather, system conditions, etc.

B. The following differences in how access to real-time data is provisioned can result in findings variances:

  - Is the information provided through a static in-home display, programmable thermostat, a utility website, commonly used third party website, platform, or application (Google, Facebook, twitter), on a desktop of a mobile computing device, or some combination of the above? How does this match with current and evolving technological solutions, and consumer needs and expectations around how they are engaged and consume information.

  - Is access to real time data being provided to a consumer through just one proprietary closed system (i.e. from one party to the consumer) where the consumer only has one choice on how to view or process the information or is the data provided through a standards based approach where the consumer can select any third party of his / her choosing (i.e. from many potential parties to the consumer) to access their information. The latter option is likely to have two significant impacts: 1) it provides consumers greater choice and engages consumers who would otherwise not be engaged through a one-size fits all proprietary closed data access system; 2) significantly reduces the cost of entry for applications, which results in greater innovation and lower cost solutions that will lead to increased consumer choice and engagement.

External factors:

- What is the cost of energy (absolute costs and also relative to the cost of living, income of participants)?

- What is the price structure of how energy is billed? E.g. flat rate, TOU (including the differential between on-peak and off-peak), dynamic pricing, pre-pay?

- How is the customer billed by its utility? (e.g., monthly v. bi-monthly)

- What types of demographics are enlisted in the studies? (e.g., early adopters / green champions vs. a representative sample of the population; high energy intensity users vs. low energy intensity users, high income vs. low income, young demographic vs. older demographic etc.)

- What types of information and tools are consumers provided along with their access to near real time energy data? i.e. basic education about energy consumption, programmable thermostats, remotely programmable controllable thermostats, smart plugs, and home energy management systems with full automation and set-it and forget it capabilities. What is the cost of accessing this system to the consumer? Can they leverage existing funding mechanisms such as conservation or demand response programs to access these supplemental capabilities?

Each of the internal and external factors described above can significantly influence the findings from studies that seek to measure the value derived from near real-time access to energy data.

Given how significantly each of these factors (in isolation and even more so in combination) can impact results, it is highly recommended that no one study be used to point to effectiveness or ineffectiveness (in terms of value) of provisioning access to real-time energy data. Instead a comprehensive review that considers multiple studies and variables (e.g. Ehrhardt-Martinez, K., K. Donnelly, and J. Laitner (2010)) should be used to identify key internal and external factors that significantly impact the value that can be derived from provisioning access to near real-time data. These factors can then be carefully selected based on potential implementations that are applicable to Ontario to determine what or how value may be realized or maximized from real-time access to data (when value is recognized as per the Table 1. above).

4. Are changes to the Ontario Energy Board's regulatory instruments needed to account for near real-time data access in Ontario? Why?

The Working Group notes that the Board has given LDCs guidance via the Supplemental Report on Smart Grid on education and facilitating near real-time data access:

> *'Regulated entities must provide information and education to their customers regarding the potential benefits of smart grid.' (p. 10)*
>
> *'As metering infrastructure is renewed and replaced over time, distributors must explore mechanisms that facilitate "real-time" data access and "behind the meter" services and applications for the purpose of providing customers with the ability to make decisions affecting their electricity costs.' (p. 12)*
>
> *'…near real-time" data is expected to be delivered through "behind the meter devices" (e.g., an in-home display) supplied by third party service providers. In the RRFE Report, the Board concluded that achievement of the customer control objective in the Minister's Directive will require that "behind the meter" services and applications be available to customers. Further, the Board determined that there is no element of natural monopoly in the market for behind the meter services and concluded that customer control would be best served by the forces of market competition.' (p. 12)*

Further, in the Board's Renewed Regulatory Framework, the Board concluded that:

> *"distributors will continue to be engaged in the provision of behind the meter services and applications that fall within the parameters set out in section 71(2) or section 71(3) of the OEB Act. In so doing, they are engaging in a non-utility activity." (p. 49)*

With the above in mind, the Working Group discussed a number of options regarding the role of the Board. They are listed below in no particular order. Some options can be combined, others are mutually exclusive.

a) Enabling near real-time access to data in the near-term:

Option A - Customer Engagement and Education & Market Evolution: As noted above, there are solutions today that provide near real-time access and do not involve replacing the existing meter stock. Currently, customers have multiple avenues to access near real-time data, if they desire such access, either behind-the-meter (i.e., non-utility) or through their LDC.

However, it is likely that many customers are not aware of the options available to them. Therefore, the Board may wish to ensure that education and engagement programs are making customers aware of the current instruments which provide near real-time access, although consumer engagement and the benefits that they can derive from the existing solutions to access near real time data may be limited in certain situations in the short-term. This limitation arises from the relatively high costs associated with adopting some solutions that enable access to real time data, although these will naturally decrease as the market for data access and energy management solutions evolves and matures over time. These education and engagement activities should also raise consumer awareness of any relevant privacy and cyber-security issues.

Given the existing options to access data (both via the meter and completely behind the meter), competition in the "smart" home market (e.g., Samsung and Honda) and the lack of an established standard, an argument can be made that no changes to regulatory instruments are required or advisable. Ontario is unlikely to be able to influence market evolution by picking its own standard because the province is a small player in the world market for data access products and home automation services.

Manufacturers and application providers are more likely to take standardization cues from larger markets in the United States and Europe. Moreover, it could very well be that the "standard" turns out to be 3rd party (e.g., appliance manufacturers) home energy management systems that provide wholly behind-the-meter solutions (i.e., a non-utility activity). Therefore, the costs of Ontario prescribing standard or specific LDC investments could be unnecessary and impost high costs in terms of stranded assets, lack of customer choice, and/or technological lock-in. This approach is consistent with the Board's statement in its Supplemental Report that "'near real-time' data is expected to be delivered through 'behind the meter devices' (e.g., an in-home display) supplied by third party service providers."

However, during this evolution period it would advisable for the Board to continue to encourage distributors to undertake near real-time pilot projects and ensure that these pilots are evaluated in a consistent way that assists in identifying how value from near real-time data access in Ontario can be maximized based on identifying the key influencing internal and external factors (identified above). The Board should also seek to ensure that distributors continue to explore mechanisms that facilitate near real-time data access and behind-the-meter services and applications, and that no barriers to access are being created.

Option B – Customer funded smart meter replacement: In the event that an LDC can replace the current smart meter with one that provides near real-time access via a de facto standard (e.g. Zigbee SEP / HA), it may be advantageous for the Board to allow and / or encourage this activity so as to catalyze the take-up and utilization of near real-time data by the consumer. For example, the Board may wish to provide clarity to LDCs and consumers regarding on whether this option is permissible under current rules (i.e., the Distribution System Code).

b) Enabling near real-time access to data in the medium to long-term:

Option C - Long term guidance for an interoperable behind the meter marketplace: To encourage the market for behind the meter solutions to provide or enable information and services that customers value and to empower consumers, as set out in OEB Supplemental Report, the Board may consider taking a more proactive approach. For example, with respect to promoting or encouraging standardization, the "dial tone" of the telecoms industry is a useful analogy. A consistent 'dial tone' of energy data into the home would leave customers free to choose services and products that interface with that signal is all that is needed to facilitate this market. There are two broad ways to express the dial tone.

The Board could define the dial tone itself: the data structure; frequency; and latency of the data etc., however this could share the same obstacles as choosing a particular standard because manufacturers of products and services could base their products on other parameters.

Alternatively, the Board could set out the minimum outcomes the dial tone must support including enabling consumer choice, privacy and control over who accesses their data; the communication from one gateway / signal to many devices is accommodated; that bi-directional communications is possible for specific purposes (e.g. demand response etc. (capabilities of AMI systems is a consideration here)); the latency and frequency of data is within consumer expectations (e.g. 60 seconds refresh is the current minimum, as consumer expectations evolve it may become only a few seconds); and that all these expectations be met within a given timeframe.

In the longer term, there could be a role for the Board in promoting (rather than prescribing) standardization and avoiding proprietary solutions by updating its expectations of utilities and for the Government in Ontario in evolving its functional specifications for AMI (or delegating control of the functional specification to the Board). For example, the Board might promote standardization in the long term by ensuring that "as metering infrastructure is renewed and replaced over time" minimum functionality expectations keep pace with and are consistent with the technology advancement and asset replacement, as well as accommodating an established standard near real-time data access protocol (e.g., meter is a gateway that sends data directly to home energy system interface / network, or other devices and appliances).

Option D – Encouraging the use and deployment of devices which support the NIST Energy Services Interface (ESI): A primary business requirement driving an ESI is the need to effectively and efficiently enable customer energy assets (i.e. electrical loads, storage and generation) to actively participate in maintaining electric grid reliability while improving both grid and customer energy efficiency. ESIs are enablers to meet the needs of today's grid interaction models (e.g. demand response, feed-in tariffs, renewable energy) as well as those of tomorrow (e.g. retail market transactions)."[6] In this context the value and benefit of near real-time data access may be significantly enhanced through the broad deployment of ESI enabled devices. At such time as such standards based components become widely available the Board may encourage / directly support LDC deployment of and / or education about such devices in their service territories.

c) Other Considerations

Energy Integration: In the long-term the Board may also want to look into ways at using its regulatory instruments to integrate and coordinate data access and energy management across both electricity and gas. If customer control over energy usage and costs is a goal then integrated service to customers from gas and electricity with respect to in home automation and DSM should be investigated. Total energy management systems may offer the greatest benefit to customers and the energy system at large from near real-time data access for gas and electricity consumption. This option could be considered as part of the Long-term Energy Plan's stated initiative of having "the province will also work with the Ontario Energy Board to incorporate the policy of conservation first into distributor planning processes for both electricity and natural gas utilities."

Issue a review of the relevant market factors for real time data in Ontario: This document has identified that there are a number of internal and external factors that are affecting the value of real time data access in any given market, including the potential value in Ontario. It is apparent there will be a number of continued investments in the evolution of real time data access and use by both regulated and unregulated market participants.

These investments may need additional guidance on how to best to deploy in line with the behind the meter market structure. A review of those internal and external factors, as they impact and apply to Ontario and the pilots and projects to date would provide guidance for market participants in considering further investments and deployments to ensure they are in line with the market structure the board envisions. The review would also assist the Board by identifying the factors it should monitor as the market evolves, both in the short term (under option A) and the longer term (though option C).

At a high level the review of market factors would provide practical guidance to market participants seeking to realize real time solutions in line with the Ministers Directive. The OEB's Supplemental report on the Smart Grid recognizes the value of customer control and customer focus:

> *"The Customer Focus outcome aligns with objectives In the Ministers Directive as both emphasize realizing customer value and empowering consumers."* And

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[6] *Customer Energy Services Interface White Paper*, SmartGrid Interoperability Panel B2G/I2G/H2G Domain Expert Working Groups, 2011

> directly help market participants to address the challenge of "*the objectives set out for customer control… Regulated entities and third party providers (i.e. private and, unregulated business) must know what information and services customers value (i.e. their preferences) in order to tailor their offerings (e.g., education, data, or services).*"

At a detailed level the review would place the different pilots that tested real-time data access for consumers in Ontario and continue to be undertaken, as well as other programs such as Peaksaver Plus or commercial. This could support the Board in providing guidance and decisions so that pilots and market deployments are evaluated in way that assists in identifying how value from near real-time data access in Ontario can be maximized based on the same key internal and external factors

The statement of the market factors to consider and being tracked by the Board would enable distributors to continue, with some confidence, to explore mechanisms that facilitate near real-time data access that support standardized behind-the-meter services and applications, without unintended barriers to access and customer value being created and can clearly demonstrate cost effective approaches are being adopted. Likewise solution providers investing in the behind the meter market will be able to make continued investment in the development of the Ontario market.

MDM/R Access and the 'metering evolution period end date': As noted earlier in this document, dynamic and other alternative pricing models are an avenue that could create incentives for consumers to take a greater interest in their electricity consumption via non-billing quality data access. With this in mind, another consideration in terms of encouraging and facilitating data access would be for the Board to determine the 'metering evolution period end date' in order to allow electricity retailers access to "smart meter" billing quality data for their customers via the Electronic Business Transactions (EBT) System. In addition to the above, the Board may wish to consider initiating a consultative process to regarding allowing authorized third-parties the option to access the MDM/R directly and on demand.