Smart Meter Initiative

Meeting Notes
Metering Working Group

September 13, 2004 September 15, 2004	Ontario Energy Board 24th Floor, Room 1 2300 Yonge Street

The Meter Working Group met held its third and fourth meetings on September 13 and 15th. These are notes taken during both meetings.

1. Attendance

Attendance September 13:

Tim Vanderheide	Bluewater Power Distribution Corp.
Hugh Bridgen	Chatham-Kent Hydro
Doug Currie	Hydro One Networks Inc.
Rowan Jones	IMO
Gary Rains	London Hydro
Dave Flieler	Measurement Canada
Luc VanOverberghe	Measurement Canada
Bob Myers	Oakville Hydro Energy Services
Al Stanbury	OEB Consultant
Robert Lake	Peterborough Utilities Services
Rocco Logiudice	Toronto Hydro-Electric System
Jay Heaman	Woodstock Hydro Services Inc.

Attendance September 15:

Hugh Bridgen	Chatham-Kent Hydro
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2. Record Keeping Requirements

The Electricity and Gas Inspection Act requires that the owner of a meter retain records as specified in the Electricity and Gas Regulations.

Section 11 of the Electricity and Gas Inspection Regulations specify a list of records that shall be retained:

"(2) An owner's records shall contain the following information and documentation where applicable for each verified meter in that owner's use, namely,

(a) the type designation, serial number, rating and multiplier assigned by the manufacturer,

(b) the purchaser's account number, name and address,

(c) the inspection number assigned by the contractor,

(d) the date of the meter's latest reverification,

(e) the date of the meter's initial verification or purchase,

(f) the applicable period referred to in section 12 of the Act within which the meter shall be submitted to reverification,

(g) the most recent certificate issued for the meter by an inspector or an accredited meter verifier,

(h) the parent group identification assigned by the owner,

(i) the meter's current installation address,

(j) the date of the meter's installation at its present location,

(k) in the case of an in-service unsealed meter, the date and nature of any maintenance work, and the date and results of any calibration,

(l) the date or dates on which the meter was leased, sold, scrapped, lost or otherwise disposed of, and

(m) for each billing period, the metering information used by the owner in establishing a charge"

(3) An owner's records shall contain, in addition to the information referred to in sub-section (2), the following information on a calendar year basis with respect to the verified meters in use by that owner:

(a) the total number of verified meters used to measure electricity or gas supplied

(i) to residential locations, and

(ii) to industrial or commercial locations; and

(b) a listing of the inspection numbers and types of verified meters due or overdue for reverification."

(4) Where an owner installs a gas metering installation or an electricity metering installation, the owner's records shall contain, in addition to the information referred to in subsection (2) for each meter, the following information respecting the installation of the meters:

(a) details of any apparatus, wiring and piping that may affect the accuracy of the meters;

(b) the consumption on a calendar year basis of electricity or gas at that location; and

(c) in the case of an electricity metering installation, the overall multiplier."

Section 11 also specifies the retention period required:

"(7) An owner shall retain the records containing the information referred to

(a) in subsection (2) for a period of at least 12 months after the date the meter ceased to be used;

(b) in subsection (3) for a period of at least 12 months after the expiration of the calendar year to which the records referred to in that subsection apply;"

The concensus among those attending is that retention of records is essential.

While most of the requirements listed above can be met by industry at reasonable cost, the retention of billing information specified in section 11(2)(m) for the life of the meter may concern in the future for some meter owners. The smart metering system envisages use of interval, time-of-use or critical peak pricing data for billing which will result in a new and significant volume of data for each billing period.

Experience in the wholesale market, with interval data, indicates that the following records would need to be retained:

- Interval readings and time stamps for each channel of data used for billing. For a meter with hourly readings this would mean 24 time-stamped readings per day with an identifier linking the track to the appropriate meter installation. For 15 minute metering there would be 96 readings per day.
- Versions, if any, of the interval readings and time stamps. Most data has only one version but in cases where validation flagged potential concerns or where a preliminary estimate or manual adjustment was required, data may exist in several versions until the metering trouble call is resolved.
- TIM file and versions there of: The Translation Interface Module is software that allows the meter to communicate with the data collection system. Since each model has its own internal protocol a TIM is required for make and model interrogated by the data collection system. TIM files require adjustment from time to time and so may exist in versions.
- Master File and versions there of: The master file is an installation specific record that contains information such as the multiplier, measured quantity represented by the pulse

count in each channel, validation criteria, last read dates, TIM file required, etc. Installation details may change from time to time so master files may exist in versions.

- Version of billing and VEE software used to calculate the bill.
- Hourly prices used on each settlement day

➔ Action: The IMO will assist in estimating annual storage costs.

The service life of electromechanical meter meters is 20 to 40 years. Service lives of 30 years are not uncommon. Solid-state (electronic) meters are expected to have service lives in excess of 20 years unless shortened by obsolescence. Dependability while in service may also affect the expected service life.

The Electricity and Gas Inspection Act has no time limitation on redress for incorrect billing in some circumstances. The only time the adjustment could possibly exceed 3 months would be if a meter was incorrectly connected, there has been an incorrect use of any prescribed apparatus respecting the registration of a meter; or an incorrect multiplier has been used. This can be found in Section 24 of the Electricity and Gas Inspection Act. The full text of the Act is available at: http://lois.justice.gc.ca/en/E-4/index.html.

Retaining a large volume of consumption information for a long period will be a new requirement arising from the smart meter implementation. Cost could be an issue for some meter owners. Concern was expressed by majority who felt that cost needs to be determined and that the retention period for the information specified in 11(2)(m) may challenge meter owners.

Presently the Electricity and Gas Inspection Regulations require retention of metering data beyond customary commercial practice, typically seven years, imposing a cost on society. The value to society of longer retention periods should be examined and balanced against the cost.

Measurement Canada has not been approached regarding the possibility of change in the regulations. If such a request were received the process would take at least 18 months. Measurement Canada is required to consult stakeholders, and if the requested for change is non-contentious and if it is a priority, Measurement Canada would then make recommendations to the Governor in Council. If the Governor in Council were satisfied with the proposed change, the new regulations would then pass through the Canada Gazette process. At the very earliest such a change could be made in 2007.

A possible solution to this potential barrier would be for industry to develop a proposal and supporting analysis and then request review of the record retention period specified in section 11(2)(m).

A possibility that might be included in the report to be prepared by the OEB based on the discussion is:

- seven years in total
- the first 13 months on-line for fast access
- the remainder in archived offline

This preliminary proposal may be amended pending assessment of costs and benefits. The report submitted to the public would be amended following public consultation in November.

Further discussion indicated that Ontario’s new statute of limitations would not apply to retention of metering records since Federal regulations prevail in the event of a conflict.

The risk that consumers would not be happy with record retention and clock error limits was discussed. The public will have an opportunity to comment on the recommendations of this working group in December. The regulations applying to record retention cannot be changed without public consultation providing another opportunity for public input.

Measurement Canada stated that a consumer representative should be present during these meetings as Measurement Canada's role is not one of a representative for consumers.

The task assigned to this working group is to identify potential barriers to the implementation of smart metering in Ontario and to indicate possible solutions. Challenge of the Act and Regulations is beyond the scope of this working group.

➔ For future discussion and action:

- Retention costs need to be determined. The IMO intends to provide information on storage and back up costs based on its experience in the wholesale market.
- Benefit to society of storing metering records in excess of normal business requirements should be assessed. How might this be done?
- Once costs and benefits have been established and an appropriate proposal developed, the process of requesting change in the regulations would be undertaken. Who should make such a request?

3. Time Synchronization Error

Time synchronization error was discussed. For time dependent rates, clock time error is equivalent to applying an incorrect price for the product. Measurement Canada does not regulate the accuracy of time synchronization. In the event of a dispute, Measurement Canada would however include clock error among its findings.

Measurement Canada clarified that it would regulate the accuracy of clocks used to determine the duration of a demand interval.

4. Retrofitting of Existing Meters

Measurement Canada indicated that:

- meters which are retrofitted with an automated meter reading device must obtain approval of type from Measurement Canada with the device in place, if the device is under the glass
- only the manufacturer of the meter can apply for type approval of a retrofitted meter.; the device vendor cannot apply.
- the elapsed time for type approval cannot be predicted since it varies on case by case basis with the technology and the volume of work in process in the Approval laboratory.

Some devices have been approved for use in specific meters.

Do we want to retro-fit? Utilities that have tried retrofitting in the past have found the experience unsatisfactory due to lack of resources to carry out the work and issues with the assembly line nature of the work in a process designed for meter verification. Cost was also an issue. Other utilities have tried contracting retrofitting to manufacturers with mixed results.

Of the utilities participating in the meeting only one may consider retrofitting existing electromechanical meters with automated meter reading devices.

Can we retrofit on-site? Most retro-fit devices require that the glass be removed which in turn would require removal and replacement of the seal. Measurement Canada indicated that removing the seal would require returning the meter to an accredited facility for reverification.

The maximum seal period that could be obtained in such a case would be 2/3 of the initial seal period.

Some meters can be retrofitted by inserting a printed circuit board into a slot designed for this purpose. Removal of the meter glass requires breaking the seal. The meter would require reverification before being returned to service for a period not to exceed 2/3 of the initial seal period.

In view of the issues with retrofitting and the possibly limited functionality of existing meters, most utilities attending expect to purchase new meters sealed by the manufacturer. Some may seal all or some of their own when resources permit and the cost is lower than that available else where.

5. Critical Peak Pricing

If the meter has an on-board register for critical peak pricing and there is more than one critical call within a short span of time the critical peak pricing register may contain energy readings for more than one critical peak pricing call.

➔ For future discussion: Will all critical peak pricing calls be at the same price?

6. VEE

➔ For future discussion:

◇ At minimum 95% of data will be collected during any data collection period. Means must be provided at the head end for detecting and reporting:
  - Missed readings
  - Monitoring the quality of the data transmission system and flagging insipient performance issues
  - Validating the data received
  - Automatically providing a provisional estimate of consumption

◇ How will these needs be met?

7. Meter Specifications

This is the first of two meetings scheduled for the discussion of meter specifications. The text below records the discussion and is preliminary subject to review at the next Working Group meeting.

7.1 Measurement Canada Approval

All meters used in the smart meter initiative must have obtained the approval of Measurement Canada prior to verification. Each meter must be verified and sealed by an meter verifier, accredited by Measurement Canada, prior to installation.

7.2 Minimum Accuracy Requirements

The accuracy required of a smart meter must meet the Measurement Canada specification LMB-EG-07 or its successor.

7.3 Read Resolution

The minimum resolution for automated meter reading data obtained from the dial or display readings an integrating watt-hour meter is 1 kWh for integrating devices where any fraction of a kWh are added to the next billing period.

7.4 Socket Compatibility

Several different types of sockets are used by the metering industry. Styles change depending on the number of elements, voltage of application and number of jaws. Styles may also vary among utilities which may standardize on certain designs.

All socket types are not supported by every vendor which may limit the choice of vendor for certain utilities but each utility should have several choices. Some utilities are upgrading from one socket type to the other. Some meter sockets may have to be modified to accommodate a smart meter.

When placing orders for meters each utility will aggregate meter counts by socket type, reflecting past practice.

➔ For future discussion: A number of older installations have 120V services rather than the now standard 120-120V service. All such installations must be upgraded before the home is sold. Since the population is small and shrinking, utilities may not be able to obtain smart 120V meters. What authority does the utility have to require that the consumer upgrade the installation to a 120-120 60A service before a smart meter is installed? How would such a consumer be billed in the absence of a smart meter?

7.5 Meter Data

Time-of-use and critical peak consumption, and interval data if any, must be available to the consumer within 24 hours. Preference will be given to systems that provide system that provide real time feedback of time-of-use, critical peak pricing and interval consumption to consumers without uploading to a central server.

7.5.1 Interval Data

Preference will be given to meters that store interval data on board for subsequent reading.

Rational: Processing of interval data in the settlement system allows flexible shifting of seasonal and daily time-of-use price periods as well as critical peak pricing, all without removal the meter. Hourly real time pricing and billing on demand are a foreseeable rate options. Both can be accomplished by processing of interval data in the presentation/settlement system.

Residential consumers: The meter must be capable of 1 hour intervals.

50kW and Over: The meter must be capable of 15 minute intervals.

7.5.2 Equivalent to Interval Data

Systems that obtain the equivalent of interval data at the head end by reading the meter hourly may be acceptable where the data collection process can be demonstrated to be sufficiently reliable and where the collected data will not be used for demand billing.

7.5.3 Time-Of-Use and Critical Peak Pricing Data

Meters that have registers for time-of-use and critical peak pricing registers that can be remotely programmed would be acceptable. Less data needs to be collected, processed and archived and processing in the presentation/billing would be less complex but such meters would prevent the application of hourly real time pricing in the future.

7.6 Time Stamping of Demand Data

At present, demand rates are required for commercial and industrial consumers only.

If the rate option will have an average demand component, an interval meter is required. Time stamping must be done in the meter. Average demand is calculated as the energy consumed in the interval divided by the duration of the interval.

Rational: Time stamping at the receiving end of the automated meter reading system would be acceptable if 100% of the consumption data could be guaranteed to arrive at the time stamping device soon enough that any propagation delay between the meter and time stamping device would cause acceptably small error in the demand measurement. The time stamping mechanism would be subject to type approval by Measurement Canada.

7.7 Power Factor Penalty

At present, power factor penalties are required at commercial and industrial consumers only.

If power factor penalties will be applied the interval meter must provide either active and reactive energy readings or active and apparent energy readings in at least the first and forth quadrants. Preference would be given to four quadrant meters.

7.8 Minimum Data Storage

The meter must be capable of storing a minimum of 35 days of metering data including any time-of-use, critical peak pricing, and interval data quantities computed by the meter.

7.9 Emergency Reading Capability

The meter must be capable of transferring all stored metering data to a portable data collection device in the event that the automated meter reading function suffers sustained malfunction.

Preference will be given to products that provide industry standard access such as the optical port IEEE Standard C12.18.

7.10 Meter Clock

The clock in the meter must be capable of synchronization to a time reference traceable to national standards from a remote location without visiting the site to within a tolerance of 5 seconds.

Drift: Clock time must be maintained during a power outage. Clock time must drift at a rate less than 360 seconds per year.

DST: The clock must be capable of accommodating seasonal changes in daylight savings time without visiting the site.

7.11 Access to Internal Battery

Preference would be given to meters in which the battery or batteries can be changed without removing the meter verification seal.

7.12 Multi-Vendor Capability

For discussion with the Communications Group: Preference will be given to automated meter reading and data processing systems that can collect data from meters of more than one vendor.

7.13 Bi-Directional Communication

Non-interval meters: meters that have built-in time-of-use and critical peak pricing registers the:

- two way communication system must be capable remotely programming the time-of-use and critical peak pricing intervals and remotely synchronizing the meter clock
- a separate system may be used for load control

Interval meters:

- a separate system may be used for signaling critical periods and load control.
- if a separate system is used for load control, means must be provided for remotely synchronizing the meter clock

The system collecting metering data must also collect and report diagnostic error messages generated within the meter.

Preference will be given to systems that implement load control, demand response and critical peak signaling without communicating to the meter.

7.14 Meter Diagnostic Information

Installation trouble shooting: Preference will be given to meters that provide both local and remote access to information used to detect tampering and diagnose meter connection issues and meters which report internal malfunction.

7.15 Firmware Upgrade Capability

Preference would be given to meters capable of local or remote upgrading of meter firmware without affecting metrological functions previously approved by Measurement Canada.

Preference will be given to products that can be upgraded without visiting the meter.

Rational: The smart meter initiative is six years in duration. Technology will evolve during the implementation period and experiments with rate design may require functionality not foreseen at the beginning of the project. Reprogramming of meter firmware will be required to prevent early obsolescence of smart meters, add new features and correct bugs in previous versions of the firmware software.

7.16 Passwords and Security

Local assess to information and firmware stored in the meter must be protected by passwords protection. At least two levels are required. The highest would allow reprogramming during verification by an accredited meter verifier, the lowest would allow change time-of-use and critical peak pricing periods and synchronization of the meter clock.

7.17 Meter Programming Software and Vendor Support

The vendor must make available:

- software required by the accredited meter verifier to program and verify the meter
- training and technical support required by the accredited meter verifier

7.18 Initial Seal

The manufacturer must be able to verify, or arrange for verification, of new meters in an accredited facility. Purchasing utilities may specify that meters will be delivered either sealed or unsealed by the manufacturer.

7.19 Reclosure

The meter must immune to distribution system reclosure.

A reclosure is an outage of 0.1 to 2 second caused by tripping of a protective device between the meter and the supply station. Up to four separate reclosings may occur over a 10 to 30 second period during in sequence during any single power system event.

7.20 Feedback of Consumption

Any ancillary devices connected to the meter for in-home or local feedback on consumption must be connectable to the meter without breaking the meter seal or removing the meter.

7.21 Multi-Read Capability

If the meter is included on the path taken by water and gas readings during data collection, the connection and disconnection of these information sources to the meter must be possible without breaking the seal on the meter.

This may be accomplished through the use on an inter-base between the meter and the socket.

8. Net Metering

Metering for small generators using either one or two registers is outside the scope of the smart meter initiative. Net and bi-directional metering will be dealt with on a case by case basis due to the small number of net metering consumers expected in the foreseeable future.

9. Clock Time Error

If the clock in a time-of-use meter is not synchronized with standard time, the wrong price will be applied during part of the time-of-use interval. The following analysis provides a rough estimate of the order of the pricing error:

Example 1:

The meter has three registers, one recording consumption during the off-peak period, daytime and evening hours. The rate for each time of use period is 5 ¢/kWh, 20 ¢/kWh and 10 ¢/kWh respectively.

The meter switches to the daytime rate 8 am in the morning and back to the off-peak rate at 8 pm. During the periods 00:00 to 8:00 am, 8:00am to 4:00pm and 4:00pm to 00:00 the rate of consumption is assumed to be 1, 2 and 4 kW respectively. The pattern assumed to be identical for the following day.

If the clock in the meter were accurate the bill for the day would be:

$$\mathrm{True} = 8\cdot\mathrm{hr}\cdot 1\cdot\mathrm{kW}\cdot\frac{5\cdot ¢}{\mathrm{kWh}} + 8\cdot\mathrm{hr}\cdot 2.0\cdot\mathrm{kW}\cdot\frac{20\cdot ¢}{\mathrm{kWh}} + 8\cdot\mathrm{hr}\cdot 4\cdot\mathrm{kW}\cdot\frac{10\cdot ¢}{\mathrm{kWh}}$$

$$\mathrm{True} = 680.000\,¢$$

If the clock were five minutes slow energy recorded in the off-peak register would be:

$$\text{Actual} = [(7\cdot\text{hr} + 55\cdot\text{min})\cdot 1.0\cdot\text{kW} + 5\cdot\text{min}\cdot 2.0\cdot\text{kW}]\cdot\frac{5\cdot¢}{\text{kWh}} \ldots$$
$$+ [(7\cdot\text{hr} + 55\cdot\text{min})\cdot 2.0\cdot\text{kW} + 5\cdot\text{min}\cdot 4.0\cdot\text{kW}]\cdot\frac{20\cdot¢}{\text{kWh}} \ldots$$
$$+ [(7\cdot\text{hr} + 55\cdot\text{min})\cdot 4.0\cdot\text{kW} + 5\cdot\text{min}\cdot 1.0\cdot\text{kW}]\cdot\frac{10\cdot¢}{\text{kWh}}$$

$$\text{Actual} = 681.250\,¢$$

in which the last 5 minute period is from the following day. The error would be:

$$\text{Error} = \frac{|\text{Actual} - \text{True}|}{\text{True}} \qquad \text{Error} = 0.18\,\%$$

Example 2: Analysis with 5 minute error:

$$\text{True} = 8\cdot\text{hr}\cdot 1.5\cdot\text{kW}\cdot\frac{5\cdot¢}{\text{kWh}} + 12\cdot\text{hr}\cdot 3.0\cdot\text{kW}\cdot\frac{10\cdot¢}{\text{kWh}} + 4\cdot\text{hr}\cdot 1.5\cdot\text{kW}\cdot\frac{5\cdot¢}{\text{kWh}}$$

$$\text{True} = 450.000\,¢$$

$$\text{Actual} = [(7\cdot\text{hr} + 55\cdot\text{min})\cdot 1.5\cdot\text{kW} + 5\cdot\text{min}\cdot 3.0\cdot\text{kW}]\cdot\frac{5\cdot¢}{\text{kWh}} \ldots$$
$$+ [(11\cdot\text{hr} + 55\cdot\text{min})\cdot 3.0\cdot\text{kW} + 5\cdot\text{min}\cdot 1.5\cdot\text{kW}]\cdot\frac{10\cdot¢}{\text{kWh}} \ldots$$
$$+ [(3\cdot\text{hr} + 55\cdot\text{min})\cdot 1.5\cdot\text{kW} + 5\cdot\text{min}\cdot 1.5\cdot\text{kW}]\cdot\frac{5\cdot¢}{\text{kWh}}$$

$$\text{Actual} = 449.375\,¢$$

$$\text{Error} = \frac{|\text{Actual} - \text{True}|}{\text{True}}$$

$$\text{Error} = 0.14\,\%$$

Example 3: A ten minute error

$$\text{True} = 8\cdot\text{hr}\cdot 1\cdot\text{kW}\cdot\frac{5\cdot¢}{\text{kWh}} + 8\cdot\text{hr}\cdot 2.0\cdot\text{kW}\cdot\frac{20\cdot¢}{\text{kWh}} + 8\cdot\text{hr}\cdot 4\cdot\text{kW}\cdot\frac{10\cdot¢}{\text{kWh}}$$

$$\text{True} = 680.000\,¢$$

$$\text{Actual} = [(7\cdot\text{hr} + 50\cdot\text{min})\cdot 1.0\cdot\text{kW} + 10\cdot\text{min}\cdot 2.0\cdot\text{kW}]\cdot\frac{5\cdot¢}{\text{kWh}} \ldots$$
$$+ [(7\cdot\text{hr} + 50\cdot\text{min})\cdot 2.0\cdot\text{kW} + 10\cdot\text{min}\cdot 4.0\cdot\text{kW}]\cdot\frac{20\cdot¢}{\text{kWh}} \ldots$$
$$+ [(7\cdot\text{hr} + 50\cdot\text{min})\cdot 4.0\cdot\text{kW} + 10\cdot\text{min}\cdot 1.0\cdot\text{kW}]\cdot\frac{10\cdot¢}{\text{kWh}}$$

$$\text{Actual} = 682.500\,¢$$

$$\text{Error} = \frac{|\text{Actual} - \text{True}|}{\text{True}}$$

$$\text{Error} = 0.37\,\%$$