A Unique Approach to Smart Meter Deployment at London Hydro Inc.

Vinay Sharma, P.Eng., Ph.D., C.Dir
C.E.O

Gary Rains, P.Eng.
Director of Energy Management Programs

1 INTRODUCTION

This submission chronicles the leadership provided by London Hydro in implementing Smart Meter and Advanced Metering Infrastructure (SM&AMI). This project was massive and complex, technically as well as economically, and at the end of the day will affect every residential and small business customer not only in London Hydro's service territory but throughout the province of Ontario, for London Hydro's process was a predicate for majority of Ontario Utilities serving approximately 1 million customers. We've been involved in this endeavour for more than six years now, and it is a story of perseverance, hard work and leadership. This submission briefly narrates the perseverance and accomplishment of London Hydro in the SM&AMI space.

1.1 Background

1.1.1 Profile of London Hydro

The city of London, with a 2010 population of almost 380,000, is located midway between Detroit and Toronto.

Figure 1, Location of London, Ontario

London Hydro is the licensed distributor of electricity within London. With a franchise service territory covering 422 square kilometers (163 sq km urban and 258 sq km rural), in 2010 it serviced 146,787 customers subdivided as follows:

- 131,734 residential customers;
- 11,914 general service < 50 kW customers;
- 1,647 general service > 50 kW customers; and
- 3 large user (> 5,000 kW) customers.

The summer 2010 peak load was recorded as 688 MW, with all-time peak of 719 MW in the summer of 2006.

1.1.2 Ontario's Power Supply Challenges

The Northeast Blackout of 2003 was a massive widespread power outage that occurred throughout parts of the North-eastern and Midwestern United States and Ontario on

Thursday, August 14, 2003, at approximately 4:11 p.m. EDT. The blackout affected an estimated 10 million people in Ontario and 45 million people in eight U.S. states.

This single event combined with the leadership in phasing out the entire fleet of coal-fired generation in Ontario turned the public's attention to the looming electricity supply shortfall. Coincidently, a blue ribbon task force referred to as "*The Electricity Conservation and Supply Task Force*" was established in June 2003 to develop an action plan for attracting new generation, promoting conservation and enhancing the reliability of the transmission grid. The task force delivered their final report[1] to the provincial government in January 2004.

Amongst the various recommendations concerning energy conservation, the report had the following to say about smart meters:

> *Smart meters (which note the time of consumption) are the primary enabling tool for customers to respond to time of use price. Moving to smart meters will require significant investment from local distribution companies in Ontario. Mechanisms will need to be put in place to encourage these investments. In addition, action by the Government, local distribution companies and the private sector will be required to inform electricity consumers of the benefits of managing their usage patterns.*

1.1.3 Smartmeters – A Provincial Initiative

On June 23, 2004, the Ontario Ministry of Energy directed the Ontario Energy Board (OEB) to develop and provide to the Minister of Energy an implementation plan for the achievement of the Government's smart meter targets.

The OEB responded by inviting stakeholders to participate on working groups. Throughout the Fall of 2004 London Hydro was an active participant on the working group dealing with technical aspects of the smart meter. On January 26, 2005, the Board submitted its implementation plan on smart meters to the Minister of Energy.

In August 2006, the Ministry introduced regulations pertaining to smart metering that identify authorized metering activities, prescribe procurement principles that must be followed by distributors, govern the recovery of distributors' costs relating to smart metering, and identify priority installations.

1.1.4 How to Proceed

One of the challenges for the LDC industry was the specific wording of the governing Smartmeter regulations. On one hand, the Minister of Energy was publicly declaring that every customer would have a Smartmeter by December 2010. However, the regulations were restrictive in nature, meaning that an LDC could only proceed with the procurement of Smartmeters if their LDC was specifically named in the regulations. There was great uncertainty as to how an LDC could become "named".

[1] Electricity Conservation & Supply Task Force report: *Tough Choices: Addressing Ontario's Power Needs*; January 2004.

2 SPEARHEADING THE PROCUREMENT OF AMI SYSTEMS

2.1 Engaging the Ministry of Energy

London Hydro is a mid-sized LDC and in order to become "named", London Hydro entered into negotiation with the Ministry of Energy staff with respect to the government expectations and how London Hydro should proceed. From the joint conversations, we learned of a problem, which was turned out to be an opportunity for London Hydro, namely how to entice the entire LDC community of Ontario into stepping forward with smart meter implementation plans and deploy a province-wide procurement process so as to leverage competitive bids from vendors.

2.2 Development of a Procurement Consortium

London Hydro proposed to start the process by creating a fairly comprehensive RFP document, which could be adopted for the province-wide procurement, and sharing it with Ministry staff.

Aside from providing some useful feedback mostly with respect to legal or quasi-legal matters, Ministry staff was intrigued by London Hydro's proposal to extend the RFP to encompass other LDC's.

London Hydro was fairly well connected in the electric metering community (among LDCs) and was able to offer the following value proposition to other LDC's regarding the smart meter initiative: "participation in a "no cost" Smartmeter procurement consortium". It didn't take long to get 30 other LDC's involved. This was the start of an innovative supply procurement process for all Ontario LDCs, where rewards were shared and costs were minimized.

Note: During the RFP phase, another 32 LDC's represented by a consulting firm joined the consortium, bringing the total number of participating LDC's to over 60.

2.3 Introduction of a Fairness Commissioner

Given the potential magnitude of the AMI procurements (likely $100M+ overall and at least $20M for London Hydro) and the public interest, Ministry staff recommended that a Fairness Commissioner be retained to oversee the procurement process.

A Fairness Commissioner was unfamiliar to London Hydro, but we hadn't heard good things "through the grapevine". As it turns out, the Fairness Commissioner isn't much different than an auditor for an ISO quality management program. His or her primary role is to ensure process transparency and fairness is preserved by the organization following predefined procedures and guidelines. The Fairness Commissioner might be perceived as running the procurement process if the organization didn't have evaluation guidelines that are known or could reasonably be inferred by bidders. Fortunately London Hydro had lots of documented procedures. [2] [3] [4] [5]

[2] London Hydro document: Evaluation Plan of Bid Submissions for "*Advanced Metering Infrastructure (AMI) – Phase I Smartmeter Deployment*"; December 4, 2007.

For our procurement, the Fairness Commissioner was most helpful. No project is perfect, and the Fairness Commissioner was very helpful with a few potential issues that could have become thorny in a public tendered procurement process where London Hydro by virtue of its leadership was inherently accountable for the issues bordering on corporate governance and responsibilities of separate corporate entities. At times it could be challenging to comprehend how a common RFP process could provide common value to 30 or more separate corporate entities yet preserving each one's unique requirements, obligations and rights. A successful management and attention to details were the hallmark of London Hydro's efforts and manifestation of the sedulous care demonstrated by its employees.

2.4 Defining the Evaluation Process and Parameters

2.4.1 Optimizing the Selection for Each LDC

The RFP itself and the evaluation process were not established to select a single AMI system for all consortium members. Rather it was an evaluated bid where technical elements accounted for 60% of the overall evaluation, predicted life-cycle costs accounted for 30%, and other factors accounted for 10% of the overall evaluation.

To make the evaluations LDC-specific, every LDC had the opportunity to develop weighting factors to be applied to the various technical clauses of the RFP. For example, if the RFP expressed a protocol preference for information exchange between a meter and a regional collector, an LDC that deemed that requirement to be of little interest to them may assign a "0" or "1/2" weighting factor. Conversely, another LDC that believes this requirement to be extremely important may assign a "2" or "3" weighting factor.

In a similar fashion, cost elements were attained from each LDC that is specific to their LDC (e.g. labour rates and number of meters that can be exchanged each day). Figure 2 and Figure 3 below illustrate the LDC specific technical evaluation and a cost model evaluation respectively.

[3] London Hydro document: Advanced Metering Infrastructure (AMI) – Phase 1 Smartmeter Deployment: *Guidelines & Workbook for Bidder Interviews*; March 25, 2008.

[4] London Hydro document: Request for Proposal for Advanced Metering Infrastructure (AMI) – Phase I Smartmeter Deployment: Assumptions used in Developing Most Probable Life-Cycle System Cost Estimates; May 23, 2008.

[5] London Hydro document: Advanced Metering Infrastructure (AMI) – Phase I Smartmeter Deployment: *Guidelines for the Evaluation of Sample Revenue Meters and Regional Collectors*; February 9, 2008.

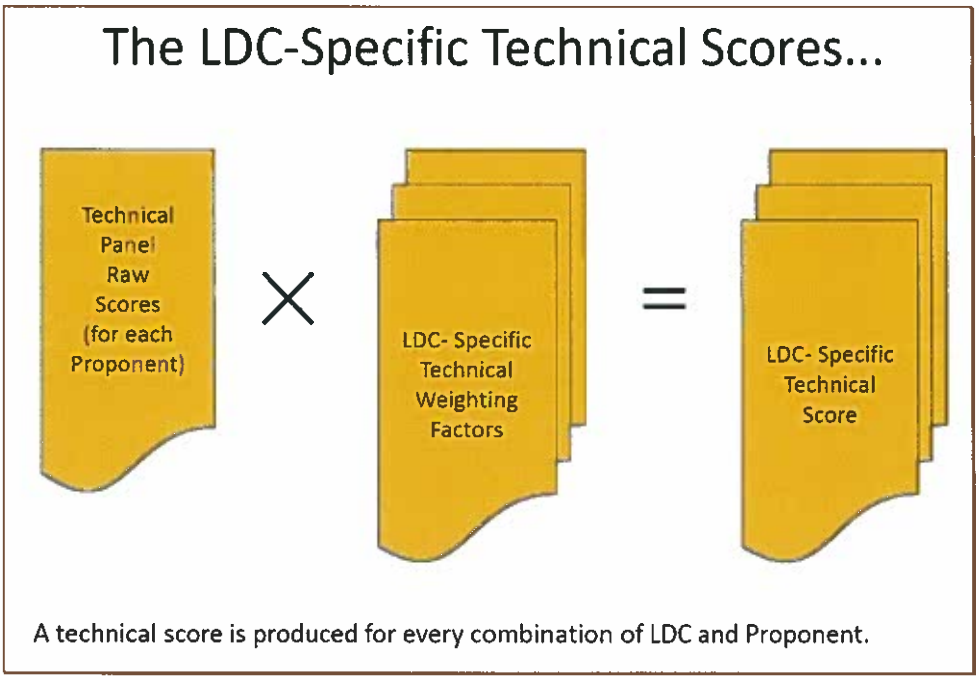

Figure 2, Determination of LDC-Specific Technical Scores

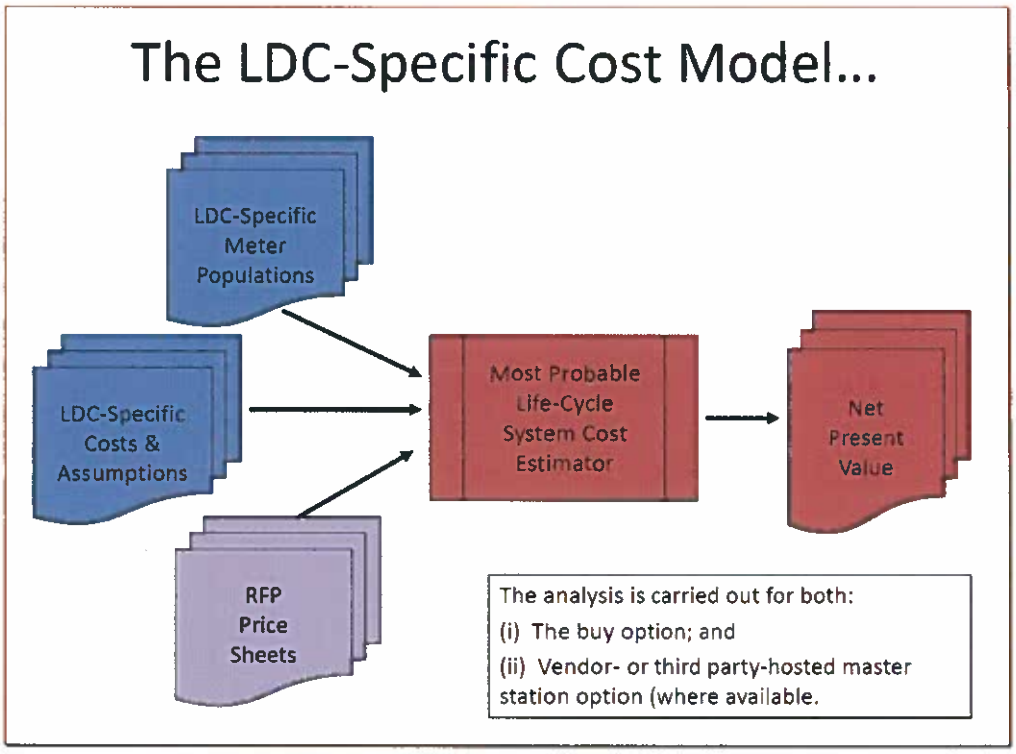

Figure 3, Determination of LDC-Specific Net Present Values

2.4.2 Formation of Technical and Cost Evaluation Panels

The technical panel consisted of about 20 subject matter experts with representation from most of the consortium LDCs. Each panel member was mandated to review and score each proposal in turn. When the proposal from one bidder was returned, it would be

replaced with the proposal from another bidder. Panel members only ever possessed one proposal at a time and scored each against the stated requirements (as opposed to comparing one proposal to another).

Once the review process was completed, a technical conference was arranged whereby all panel members came together in a room and had to come to consensus on each technical score. Panel members with outlier scores were called upon to defend their score. After some discussion and usually a review of the exact wording of the proposal, the technical panel had to arrive at a consensus score for the particular section of the RFP being discussed.

2.5 The Evaluation Verdicts

At the end of the process, each participating LDC was given a letter specifically identifying the highest and second highest ranked bidders for their LDC based on LDC-specific weighting factors and LDC-specific costs. They were also provided with a letter from the Fairness Commissioner attesting to the transparency and fairness of the overall process.

The next phase of the procurement involved each LDC negotiating a contract with the highest ranked bidder. If negotiations failed then that LDC could start negotiations with their second highest ranked bidder.

2.6 The Regulatory Permission to Proceed

On June 25, 2008 the provincial government filed amendments to three smart metering regulations, namely O. Reg. 427/06 (Smart Meters: Discretionary Metering and Procurement Principles), O. Reg. 426/06 (Smart Meters: Cost Recovery), and O. Reg. 393/07 (Designation of Smart Metering Entity).

Of specific interest, the Amendments to O. Reg. 427/06 (Smart Meters: Discretionary Metering Activity and Procurement Principles) will:

- Authorize metering activities pursuant to the *Request for Proposal (RFP) for Advanced Metering Infrastructure (AMI) – Phase 1 Smart Meter Deployment* issued August 14, 2007 by London Hydro Inc. This would include distributors named in the RFP and those distributors that procure AMI pursuant to the parameters established by the RFP;
- Allow previously authorized distributors to continue to move forward with metering activities beyond the original procurement process, provided subsequent procurements meet the standards prescribed by regulation

This was a crowning achievement for London Hydro as we were recognized by the government and the regulators for the leadership provided to the Ontario utilities (LDCs).

3 Negotiating an AMI Procurement Contract

For London Hydro, the AMI system that was evaluated providing "best value" was the Sensus FlexNet AMI system.

It took more than six months to negotiate a Statement of Work. There wasn't much work required to develop the contract; rather the successful bidder seemed to be too busy to finalize this work in an expedient timeframe.

4 PROCURING & DEPLOYING A WIRELESS BACKHAUL SYSTEM

As the technical evaluation of Smartmeter proposals was drawing to a close, it became apparent that the front-runner technologies were based on adoption of public carrier or alternatively fibre-optic links (where the LDC had such holdings directly or via an affiliate company) for backhaul services between regional collector devices and a central master station.

An engineering analysis was carried comparing the expected lifetime costs associated with various public carrier options with the initial investment and recurring operating and maintenance costs of a utility-owned wireless backhaul system. The analysis indicated that the private wireless communications system would be considerably less expensive.

At the time, London Hydro was spearheading an initiative with the City of London to explore interest in a common municipal wireless broadband communications system. The project was referred to as UniFi London. As it turns out, each organization's needs at the time were slightly out of synch. The City's so-called first responders (e.g. fire, police, and ambulance) were mostly interested in mobile applications for which the industry group IEEE had not yet promulgated a standard. London Hydro's Smartmetering backhaul system didn't need mobility

An RFP was subsequently issued and London Hydro selected a wireless broadband wide area network solution that works in the license-exempt 5.8 GHz spectrum. The selected system provides path redundancy in that there are at least two independent paths between each communications node and London Hydro's complex. Network reconfiguration is automatic and there are messages to a central control system to allow supervision of the WAN. The specifications of London Hydro WAN are given in Figure 4.

The system can be expanded in future to municipal sites, and London Hydro has adopted the City's addressing scheme to promote such expansion and sharing of resources.

	Phase I	Phase II	Maximum Capacity
BelAir BA200 Access Points (AP) with Hot Standby Redundant RF Paths	9	14	7,000 per BelAir BelView NMS
AP Radio Transmit Power in dBm	+18	+18	+27
# of VLAN Group per RF Path	1 (AMI only)	1 (AMI only)	12
# of Concurrent VLAN per RF Path	128	128	128
Availability for Point-To-Point RF Path	99.999%+	99.999%+	99.999%+
Availability for Point-To-Multi-Point RF Path	99.95% (average)	99.95% (average)	99.95% (average)
Longest RF Backhaul Range Without Repeater (km)	9.573 (CFPL-TV Tower to 1795 Oxford Street)	11.21 (Arva Reservoir to 1795 Oxford Street)	30
Frequency Spectrum	License-exempt Frequency: 5.8GHz (WiFi)	License-exempt Frequency: 5.8GHz (WiFi)	License-exempt Frequency: 2.4GHz (WiFi), 5.2GHz (WiFi), 5.8GHz (WiFi) Licensed Frequency: 2.3GHz (WiMAX), 3.5GHz (WiMAX), 4.9GHz (WiFi/WiMAX)
Operating Temperature (°C)	-40 to +55	-40 to +55	-40 to +55
Operating Temperature of BelAir BA200 AP under Stress-Tested (°C)	-55 to +85	-55 to +85	-55 to +85
# of BelAir BelView NMS (Hot Standby Redundancy)	2	2	10
# of BelAir BA200 AP managed by BelAir BelView NMS	9	14	20,000
MTBF (Years)	15	15	15

Figure 4, Specification of London Hydro's WAN

5 LONDON HYDRO'S AMI SYSTEM DEPLOYMENT

Throughout the project, we achieved several goals and unique solutions; however, as is typical with any implementation of a large project, one begins with specific business objectives and along the way several other goals and objectives reveal themselves. The newly-revealed goals and objectives take on a garb of significance – they become important part of the project. Such is the story of London Hydro's AMI project. Some of our unique achievements are briefly described in this section.

5.1 Establishing a Project Team

Given the magnitude of the project, it was necessary to assemble a project team with representation from all affected parts of the organization. On paper, the project team had a two-level hierarchy.

At the highest level, there were four (4) project managers with assignments as follows:

- Project Director, with overall responsibility for the project and reporting to Executive Management
- Project Manager responsible for Smartmeter deployment and installation of wireless 900 MHz LAN communications systems
- Project Manager responsible for deployment of wireless broadband wide area network (i.e. the wireless backhaul)
- Project Manager responsible for integration of the AMI master station with other corporate computer systems and the provincial Meter Data Management / Repository (MDM/R).

Also included on the project team were consultants, representatives from Electric Metering, Procurement, Finance, Customer Service, Settlements, Information Systems, etc.

5.2 Deploying a Wireless Communications Network

The architecture of the Sensus FlexNet™ AMI solution is depicted in Figure 5 below.

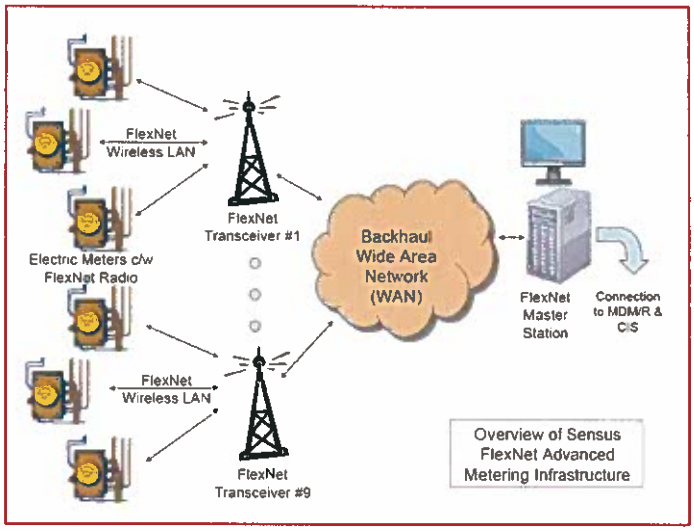

Figure 5, Architecture of Sensus FlexNet AMI

The individual revenue meters are outfitted with an under-glass FlexNet radio and communicate with the nine (9) regional transceivers distributed throughout the service territory on licensed frequencies[6] in the 932/941 MHz band. Since this channel plan is shared and London is close to the USA/Canada border it was necessary to obtain approvals from both Industry Canada and the FCC.

Coincidentally, shortly after the first transceiver started communicating with the 50 or so smart meters that were installed at the time, we received feedback from the local fire department that a radio link that was dedicated to 911 service calls was experiencing frequent link failures and London Hydro's AMI was the suspected culprit.

The manufacturer verified that the radio transmissions from their devices were well within the channel plan and associated tolerance. To provide greater separation between the two radio systems, London Hydro's contractors changed the polarity of the 911 radio link antenna and coincidentally discovered that one of their panel antennas was out of alignment. It is suspected that a contractor that was mounting another antenna on the tower (shortly after London Hydro activated its 900 MHz system) dislodged the antenna from its aligned position. With the change in polarity and alignment of the antennas on the 911 radio link, the channel dropouts disappeared and there have been no further (suspected interference) problems.

[6] Industry Canada Standard Radio System Plan document SRSP-505, *Technical Requirements for Multipoint Communications Systems Operating in the Bands 928-929 / 952-953 MHz and 932-932.5 / 941-941.5 MHz*; Issue 2; July 22, 1995.

5.3 Deploying the smart meters

London Hydro's Electric Meter Shop has a quality management system that certified as compliant with the ISO-9001:2000 quality model and is accredited by Measurement Canada to their Specification S-A-01:2010. *Criteria for the Accreditation of Organizations to Perform Inspections Pursuant to the Electricity and Gas Inspection Act and the Weights and Measures Act*. This means that London Hydro can verify / re-verify the accuracy of revenue meters and install a "*seal*" on behalf of the federal government.

With compliance sampling programs and end-of-life meter replacements, the staff and systems are in place to exchange a few thousand meters every year. Exchanging almost 150,000 energy meters with Smartmeters could not be contemplated using internal metering staff, call centre staff, and available vehicles.

As a result, London Hydro went to the marketplace with an RFQ to solicit labour and other services associated with the mass deployment of Smartmeters. The successful contractor impressed London Hydro during the evaluation phase and throughout the deployment phase with their attention to detail (e.g. employee safety training and supply of personal protective equipment, workmanship, uniforms, identified fleet vehicles), systems for effective logistics, and customer service flexibility (multi-language call centre, ability to arrange very flexible appointments with customers with indoor or otherwise inaccessible meters). As part of the service offering, the Contractor arranged for the recycling of used meters and all the shipment containers.

5.4 Hosting our Master Station

One area that differentiates London Hydro from most other LDC's in Ontario and from most of Sensus' other clients in North America is our desire to host our own AMI master station (as opposed to contracting this responsibility to the manufacturer or a service bureau).

With the prospect of Smart Grid on the horizon and a knowledge-based economy, we believe that our future success will be derived from first-hand knowledge of the various computer systems and our ability to effectively harvest useful and meaningful information from these systems.

5.5 Managing the Unexpected

An important element in the project team discipline was ongoing contingency planning. Wherever possible, contingency plans were developed for critical path elements on the project Gantt chart.

> *"Success depends upon previous preparation, and without such preparation there is sure to be failure."* Confucius

In hindsight, many of the project setbacks that actually occurred were not even contemplated in the formulation of contingency plans. These unexpected events typically required significant management and project team attention as they arose. Examples of some such events are recounted below.

5.5.1 Reinforcing the Communications Towers

London Hydro owns some communications towers and has access to other City-owned communications towers that are used for radio communications with work crews, SCADA and Distribution Automation. At the outset, installing some 900 MHz omni-directional antennas and panel antennas (each measuring about 18 inches square) for the microwave broadband backhaul system and associated microwave-class coaxial cable wasn't foreseen as problematic. Antennas are lightweight compared to the apparatus that a distribution utility commonly bolts onto distribution poles.

What we failed to realize at the time was that the governing standard (CSA Standard S37-01, *Antennas, Towers and Antenna-Supporting Structures*) had changed almost in lockstep with the more stringent requirements for roof loading in the Building Code.

The structural engineering analysis showed that the existing communications towers were already loaded in excess of the CSA S37 standard, and that significant reinforcing was required for three communications towers (CFPL, Arva and Springbank). London Hydro's main communications tower was also found to be overloaded and showing evidence of internal corrosion of tubular structural members. Replacement was deemed to be more economic and advantageous than attempting to remediate the deficiencies.

The continental transition to digital broadcasting strained the supply pool of qualified riggers, contractors and structural engineers knowledgeable in this field. Nonetheless the communications tower upgrades were eventually carried out and project workarounds were implemented.

5.5.2 Insolvency of Turnkey Tower Contractor

The 900 MHz radio design called for nine (9) transceivers to be distributed throughout the service territory, and then interconnected to London Hydro's main complex via a microwave backhaul system. For a number of reasons (security, existing properties, backup power, etc.), London Hydro elected to erect short (i.e. 15 m / 50 ft) communications towers adjacent six (6) bungalow-style municipal substations.

For this project activity, London Hydro elected a turnkey approach whereby the successful contractor would be responsible for soil samples, the design and construction of a concrete foundation, the design, supply and installation of specified communications towers, the installation of radio antennas and coaxial cabling on the towers, and the routing of communications cabling into the bungalow-style substations.

Well into the project when the Contractor started requesting payments in advance of the established milestone payments for a variety of excuses, it was discovered that the Contractor was financially over-extended on other projects, and hadn't been using progress payments to pay suppliers and subcontractors.

While there were certainly grounds to launch legal action, this would have unduly delayed the project. Instead, London Hydro terminated its contractual arrangements with the Contractor and assumed responsibility for working directly with sub-contractors and communications tower supplier to complete the project.

5.5.3 Broken Meter Bases

London Hydro was very aware that vintage residential meter bases made by now defunct manufacturers during a certain time period are very prone to breakage of the stand-off insulators during a meter exchange operation. Meter bases are considered part of the customer's service entrance equipment and as such London Hydro has never tracked the make and model number of such customer premise equipment. We had no idea of the magnitude of the problem that might arise, but we had heard stories from Smartmeter deployments in the Toronto area.

As a consequence, we planned for the worst case (and hoped for the best case). A pool of electrical contractors was made available to the Smartmeter deployment contractor, and systems were put into place for the Smartmeter deployment contractor to contact the electrician pool, London Hydro to disconnect service to the residence to facilitate repairs, tracking incidents, making remedial repairs, notifying the customer, and providing the affected customer with a copy of the Inspection Certificate (issued by the Electrical Safety Authority) as proof that the equipment and workmanship had been inspected and were in accordance with the relevant provisions of the Ontario Electrical Safety Code.

In spite of all these pre-planning activities, London Hydro only encountered 295 broken meter bases, or about 0.37% of the population of residential meter bases. This is well below the frequency of broken meter bases encountered in other jurisdictions.

5.5.4 Delayed Approval of Niche Revenue Meters

In Canada, the Electricity & Gas Inspection Act requires that all electricity and natural gas meters used for trade first receive type approval by Measurement Canada. Any under-glass change requires the meter be subject to re-approval. Thus for every combination of revenue meter and AMI interface module, the entire assembly is subject to re-test and re-approval.

The widespread interest and investments in AMI technology has resulted in a considerable backlog at Measurement Canada. One of the revenue meters that is needed for the niche 3-wire 600 V (delta) applications, only received approval in late 2010 and is only now available from the manufacturer.

The point here is that the project planning process is somewhat hampered for both the LDC and AMI supplier when product approval lies in another party's control over which neither the LDC nor AMI supplier have any apparent influence.

5.5.5 Lacking and Inconsistent Technical Information

The product offerings from many AMI suppliers are fast changing and it needs to be appreciated that often the product documentation doesn't keep pace with the product development. On several occasions the procurement or configuration of meters was held up for appreciable timeframes to seek clarity on exactly what features the delivered product was to include. For example, the governing contract document might call for certain features, the contractor would state that the features were included in the offered product, but this claim wasn't substantiated in the (out-dated) literature. To make matters

worse, sometimes the supplier's technical staff didn't agree on what features a product included or its specific mode of operation.

There were several instances where such inconsistencies in the technical message delayed the procurement of product by weeks and months.

5.5.6 An RF Design Oversight

When there is a mass deployment of Smartmeters, it can be counter-productive to try and tune or optimize the operation of the RF network, as the number and hence density of end points changes every day.

Towards the end of 2010 when London Hydro had installed almost all residential and network energy meters (the latter in apartment buildings), it became apparent that there was an issue with the 900 MHz radio system. Whilst the built-in tuning / system optimization features had clearly significantly improved the performance of the wireless network, there was a threshold of about 92% Read Interval Success that appeared impenetrable. The original RF propagation study had suggested that there would be less than 400 meters for which communications would be indirect (i.e. through another meter that acts as a repeater) or not at all in which case there are products that can enhance the RF signals in small areas that otherwise would have no coverage. The reality is that with the deployment of Smartmeters now almost complete, there were tens of thousands of meters where the communications is either non-existent or unreliable.

The AMI manufacturer was called in to offer assistance. It was determined that the RF receive channels were congested and that the solution would involve increasing the number of radio transceivers from 9 to 17 by converting the RF systems at four locations from a "single transceiver / omni-directional antenna" arrangement to a sector design consisting of three transceivers and three directional antennas (each with a 120 degree beam).

London Hydro has an "RF performance guarantee" clause in its governing contract with the AMI contractor, so the significant cost associated with the described RF upgrades are entirely at the Contractor's expense.

These RF modifications are ongoing now and probably won't be completed until mid-May, 2011.

6 INTEGRATING THE AMI WITH OTHER COMPUTING SYSTEMS

On the Customer Information System (CIS) front, London Hydro had a multi-year project underway to migrate to the SAP IS-U (Industry Specific Solution for Utilities Industry) system. It was contemplated that the interface to the AMI, the provincial Meter Data Management / Repository (MDM/R) and the EBT hub for energy retailers would be via SAP's Energy Data Management (EDM) module.

Before any integration work had started for the overall smart meter solution, London Hydro became aware of the formation of a special interest group (comprised of CenterPoint Energy, CLP Power Hong Kong Limited, Consumers Energy, Energy East,

Florida Power & Light, Oklahoma Gas & Electric and Public Service Electric & Gas) called *SAP AMI Lighthouse Council* that was examining the integration of market-leading AMI systems with Enterprise technology.

Rather than use the EDM module as the integration engine, the SAP AMI Lighthouse Council chose an architecture that uses an external product that complies with their *Meter Data Unification & Synchronization* (MDUS) specification as the preferred architecture. From a long-term support perspective it made more sense to "*follow the pack*" than to create a "*one of a kind*" process within EDM.

In late 2010, London Hydro entered into a contract with Itron to deliver and configure their Enterprise Edition™ product, one of but a few MDUS-compliant products. Also London Hydro was accepted to become a member of the SAP AMI Lighthouse Council. Since Ontario has one of the most complex energy markets in the world, our current project puts us into the frontier and well ahead of the other members of the Lighthouse Council, i.e. what we are doing now is what they are simply talking about doing in future. Figure 6 below illustrates the solution architecture using Itron's Enterprise Edition™ and SAP's NetWeaver tools.

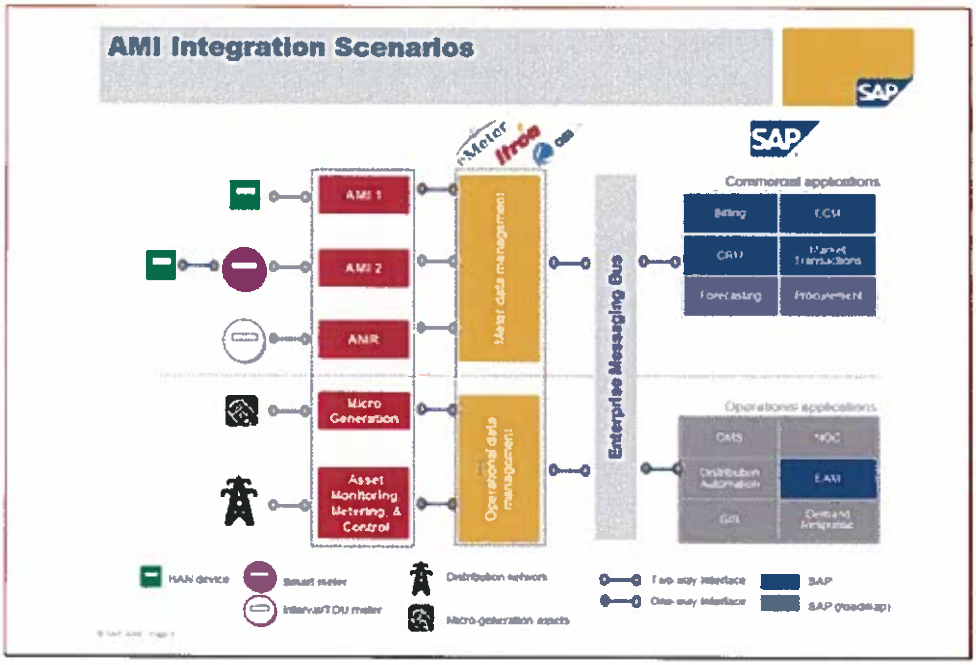

Figure 6, Smart Grid and Smart Meter IT Architecture

7 SUMMARY AND CONCLUSION

London Hydro's leadership to Ontario utilities combined with our sound project management and use of advance technologies has placed the utility in the optimal performing quadrant of the capacity-capabilities model as shown below in Figure 7.

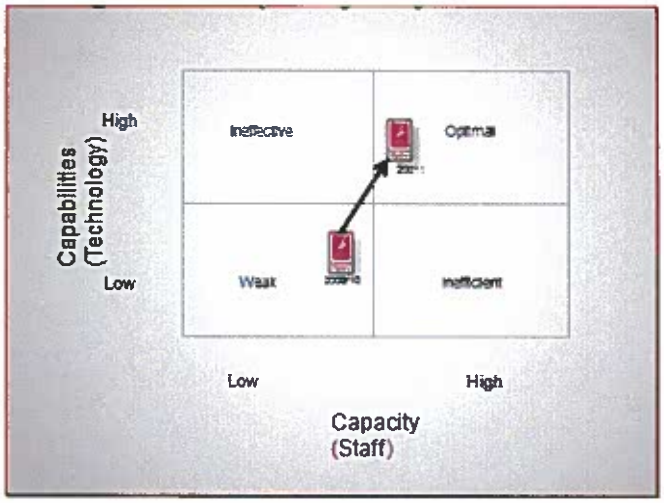

Figure 7, Classic Capability / Capabilities Model

The story of London Hydro SM&AMI project is one of leadership, perseverance, sedulous care in project management, deployment of advance technology and management commitment against all odds. Our claim to fame in the SM&AMI space is to implement the entire project in a most cost effective basis despite our moderate size; this was achieved by our collective procurement process wherein we were able to leverage the collective needs of 60+ utilities. Furthermore our zeal to deploy advanced technology and seek LDC-specific solutions has placed London Hydro in a strong position to deploy the smart grid technologies in the future. Our commitment and qualification is further manifested in that we continue to meet customer expectations as well as regulated requirements expeditiously and in the most economic manner.

♣ - ♣ - ♣