Smart Grid Initiatives in London, Ontario, Canada

Syed Mir, CIO, London Hydro
1. Introduction & Overview
   a) Speaker Biographies
   b) Ontario Electricity Market
   c) London Hydro’s Strategy

2. London Hydro – Smart Meter Initiative
   a) Key Projects
   b) Time-of-Use Overview

3. Itron/MDUS update
   a) MDUS/ODS and EP5 ramp implementation
   b) Mapping of EP5 services to Itron/MDUS
Introduction & Strategy
Syed Mir, CIO, London Hydro, Canada

- Ontario Hydro/OPG, 1979-2009, VP IT, Nuclear/ Fossil/ Hydroelectric fleet (21,000 MW), SAP PM/FICO/ MM/ SRM...

- Early Retirement, 2009 to May 2010, Sheridan College Board of Governors, My Solar Power (2.1 Kwh), golfing

- London Hydro, May 2010 to present, reporting to CEO, SAP CIS/AMI, EP5 ramp-up, LHC member, MDUS/ ODS (Itron)
OVERVIEW – LONDON, ON

Electricity Distributor for London, Ontario (Canada)

• 421km² Service Area
• 1,900km Power Lines
• Peak Load around 687MW
• 150,000 electric services
• 120,000 water services

Electricity Market:
• De-regulated in 2002
• 4.3M Consumers
• 86 Electricity Distributors
• 53 Energy Retailers
• Around 25,000MW peak

Ontario’s Supply Mix:
- Nuclear 55.0%
- Hydro 20.4%
- Gas 13.6%
- Coal 8.3%
- Wind 1.9%
- Other 0.8%
UTILITY OBJECTIVES

Consumption Management

- Demand Side Management
- Load Shifting
- Environmental Consciousness
- Customer Engagement
CURRENT CUSTOMER VOICES

- General Residential
  - 31% Payment Arrangements
  - 17% Billing Inquiry
  - 13% Moves
  - Snow storms result in high call volumes, request restoration times

- Commercial & Industrial
  - Minority of customer base but largest portion of revenue

- Students
  - Busy Move Periods @ beginning and end of school terms.

- Property Manager
  - Summary Bills, Move Notification, Continuous connection

- Low Income

- Social Assistance Program

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Empowering You.
EMERGING VOICES

The SMART Utility
“Connected” to the Customers Needs

TOU
Time of Use

Self Service

Real - Time

Green

Community

Management of Energy Consumption

Signing up and tracking savings from Conservation

Results from Customer actions & Restoration time

Cities tracking: solar, CO₂ Footprint

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Customer Focused Evolution Trends

- Increased **quantity** and type of information
- Increased **frequency** of information
- Near **real time** nature of the information
- Direct **control** of usage
To support Ontario’s smart grid objectives, 3.6M customers will be on Time of Use pricing by 2011.
### Sample TOU Bill

#### Before (non Time of Use):

**111 HORTON ST**

**Period:** Nov 26, 2010 - Dec 24, 2010  
**Account Number:** 0000001-0000001  
**Meter Number:** 999999

<table>
<thead>
<tr>
<th>Service</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity supplied by London Hydro</td>
<td>$27.33</td>
</tr>
<tr>
<td>Delivery</td>
<td>$23.58</td>
</tr>
<tr>
<td>Regulatory Charges</td>
<td>$3.20</td>
</tr>
<tr>
<td>Debt Retirement Charge</td>
<td>$2.87</td>
</tr>
<tr>
<td>HST (#86483 7430)</td>
<td>$7.74</td>
</tr>
<tr>
<td><strong>Total Electric Charges</strong></td>
<td><strong>$64.72</strong></td>
</tr>
</tbody>
</table>

#### After (Time of Use):

**111 HORTON ST**

**Period:** Nov 26, 2010 - Dec 24, 2010  
**Account Number:** 0000001-0000001  
**Meter Number:** 999999

<table>
<thead>
<tr>
<th>Service</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity supplied by London Hydro</td>
<td><strong>$13.25</strong></td>
</tr>
<tr>
<td>On-Peak 133.79 kWh x $0.099/kWh</td>
<td></td>
</tr>
<tr>
<td>Mid-Peak 56.39 kWh x $0.081/kWh</td>
<td><strong>$4.57</strong></td>
</tr>
<tr>
<td>Off-Peak 236.82 kWh x $0.051/kWh</td>
<td></td>
</tr>
<tr>
<td>Delivery</td>
<td>$23.58</td>
</tr>
<tr>
<td>Regulatory Charges</td>
<td>$3.20</td>
</tr>
<tr>
<td>Debt Retirement Charge</td>
<td>$2.87</td>
</tr>
<tr>
<td>HST (#86483 7430)</td>
<td>$7.74</td>
</tr>
<tr>
<td><strong>Total Electric Charges</strong></td>
<td><strong>$67.29</strong></td>
</tr>
</tbody>
</table>

**Read Date**  
**Consumption**  
**Total kWh**

- Dec-24-10: 410 kWh  
- Nov-25-10: 444 kWh  
- Oct-25-10: 384 kWh  
- Sep-24-10: 415 kWh  
- Aug-25-10: 502 kWh  
- Jul-22-10: 449 kWh  
- Jun-23-10: 339 kWh  
- May-21-10: 269 kWh  
- Apr-21-10: 273 kWh  
- Mar-23-10: 373 kWh  
- Feb-23-10: 533 kWh  
- Jan-21-10: 463 kWh  
- Dec-22-09: 490 kWh
Your Energy Use

Your energy use for Wednesday, June 22, 2011

Total Cost: $1.84

The chart below shows how much electricity you have used during each hour of the day on Wednesday, June 22, 2011. Remember, on weekdays electricity costs change throughout the day.
DATA ACCESSIBILITY

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Current Status: No Issues
Power Production: 190W
Today's Energy: 2.47kWh
This Month's Energy: 36.4kWh
Lifetime Energy: 1.82MWh

Environmental Benefits to Date
Energy Produced: 1.82 MWh
You could power the following for 1 day:

- 5,515 light bulbs
- 1,820 computers

Carbon Offset: 3,120.77584 lbs
You have offset the equivalent of:

- 37 trees planted
- 161 gallons of gas
London Hydro’s Smart Meter Initiatives
SMART GRID DEFINED

• Utilizing information and control to maximize reliability, affordability, and sustainability – all the way from generation to customers.

• Systems & Technologies include:
  • Smart meters
  • Communications networks
  • Customer systems and devices
  • Renewable and distributed generation
  • Transmission and distribution automation,
  • Supervisory control and data acquisition systems (SCADA)
  • Work and asset management systems
  • Customer information systems
  • Geographic information systems
  • Network design applications
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Empowering You.

Meter Data Flow

Sensus Smart Meters

Sensus Radio Transceiver

Sensus Head-end System

Moving to Time-of-Use Billing
**Key Projects**

<table>
<thead>
<tr>
<th>2009/2010</th>
<th>2011</th>
<th>2011+</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAP CIS</td>
<td>EHP 4</td>
<td>EHP 5</td>
</tr>
<tr>
<td>EHP 5</td>
<td>AMI</td>
<td>AMI</td>
</tr>
<tr>
<td>HST Tax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UCES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smart Meters &amp; TOU Billing</td>
<td>MDMR Integration</td>
<td>RF network</td>
</tr>
<tr>
<td>AMR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITRON MDUS ODS</td>
<td>Go live</td>
<td>MDMR Integration</td>
</tr>
<tr>
<td>V10 Upgrade</td>
<td>Connectivity fixes</td>
<td>CYME gateway</td>
</tr>
<tr>
<td>GIS (Intergraph)</td>
<td></td>
<td>OMS</td>
</tr>
<tr>
<td>Hourly Usage Customer Web Presentment</td>
<td>Go live</td>
<td>TOU Conservation Info &amp; Tools</td>
</tr>
</tbody>
</table>

Note: MDMR – Ontario provincial MDM (Meter Data Management Repository)

The image illustrates the key projects for the years 2009/2010, 2011, and 2011+ with specific technologies and milestones indicated. Each project and milestone is represented by a bar, indicating the timeline and progression of implementation.
DATA QUALITY FOCUS

Single Source of Truths

- SAP for Customer Information
- ODS for Consumption
- GIS for Connectivity

Leverage SAP AMI

- MDUS for ODS
- CRM and ERP
- SAP Lighthouse Council
Itron IEE
MDUS Update
IEE MDUS is responsible for:

- Integration with AMI collection technologies
- **System of record for meter readings data**
- Quality assurance of collected readings data
- Providing commercial-ready readings data to SAP
- Calculation of billing determinants upon SAP request (optional)
SAP is responsible for:

- Billing and other commercial processes
- Customer relationship management
- System of record for all customer, account, premise, point of delivery and billing history data
- Initiation of meter commands like on-demand read, connect / disconnect, load control, in support of various business processes
- Other, utility-specific back office operations, depending on scope of implementation
MDUS/ODS – EP5 RAMP UP

8 custom interfaces

10,000 hours of dev & testing

Hourly meter reads by 5: am

98% Read Interval Success

Bill Determinant & Register Reads

All interval Data

Legend

Existing Interfaces

Phase 1 Config/Testing

Phase 2 Config/Testing

MDUS/ODS – EP5 RAMP UP

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PREMISE STRUCTURE IN SAP

Data Environment from 2011.03.22 to 9999.12.31

Connection Object: LONDON, 25 GRAND AVE

Premise: 3261 25 GRAND AVE UNIT 409, LONDON

Installation Subtype 4500: Electricity, LONDON, 25 GRAND AVE UNIT 409 UNIT 409
Utility contract 10.07.06-**,**..** 6484 Distribution Contract
Device 11.03.22-**,**..** E900067 5024 ISIA 3 200 240 1.5S 1PHASE FORM2S

Installation Subtype 54500: Electricity, LONDON, 25 GRAND AVE UNIT 409 UNIT 409
Utility contract 10.07.06-**,**..** 6485 Supply Contract
Device 11.03.22-**,**..** E900067 5024 ISIA 3 200 240 1.5S 1PHASE FORM2S

Device Location: D4500-01 Meter room Inside Back
Device E900067 5024 ISIA 3 200 240 1.5S 1PHASE FORM2S

Meter Install
TRANSACTIONS IN AMI MONITOR

AMI Monitoring: 3 Hits

<table>
<thead>
<tr>
<th>Status</th>
<th>Object Key</th>
<th>ObjectType</th>
<th>Secondary Object Key</th>
<th>Object Description</th>
<th>AMI Action</th>
<th>Proc. Status Descr.</th>
<th>AMIS</th>
<th>Date Out</th>
<th>Time Out</th>
<th>Crtn Date In</th>
<th>Time In</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0900067</td>
<td>Device</td>
<td>0000000000010277332</td>
<td>Measurement Task</td>
<td>Creation Request</td>
<td>Action Completed Successfully</td>
<td>SENS</td>
<td>2011.03.31</td>
<td>12:40:23</td>
<td>2011.03.31</td>
<td>12:40:00</td>
</tr>
<tr>
<td></td>
<td>0900067</td>
<td>Device</td>
<td>D4500-01</td>
<td>Device Location</td>
<td>Notification</td>
<td>Action Completed Successfully</td>
<td>SENS</td>
<td>2011.03.31</td>
<td>12:39:36</td>
<td>2011.03.31</td>
<td>12:40:00</td>
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<tr>
<td></td>
<td>0900067</td>
<td>Device</td>
<td></td>
<td></td>
<td>Creation Request</td>
<td>Action Completed Successfully</td>
<td>SENS</td>
<td>2011.03.31</td>
<td>12:40:03</td>
<td>2011.03.31</td>
<td>12:40:00</td>
</tr>
</tbody>
</table>

Sync Transaction
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And the result in Itron EE...
Data Dynamically Retrieved

Display Profile Values - Time Zone: EST

Select object

Data Display in SAP via MDUS
### MDUS Services Tested

<table>
<thead>
<tr>
<th>Area</th>
<th>Service</th>
<th>Effort / Complexity</th>
<th>Issue (SAP)</th>
<th>Issue (LH spec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device create</td>
<td>UtilitiesDeviceERPSmartMeterCreateRequest</td>
<td>Low/ Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UtilitiesDeviceERPSmartMeterCreateConfirmation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk Device create</td>
<td>UtilitiesDeviceERPSmartMeterCreateConfirmation</td>
<td>Med/ Low</td>
<td>Y</td>
<td>(resolved)</td>
</tr>
<tr>
<td></td>
<td>UtilitiesDeviceERPSmartMeterBulkCreateConfirmation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Register create</td>
<td>UtilitiesDeviceERPSmartMeterRegisterCreateRequest</td>
<td>High/ Med</td>
<td>Y</td>
<td>(resolved)</td>
</tr>
<tr>
<td></td>
<td>UtilitiesDeviceERPSmartMeterRegisterCreateConfirmation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meter Location Notification</td>
<td>UtilitiesDeviceERPSmartMeterLocationNotification</td>
<td>High/ Med</td>
<td>Y</td>
<td>(resolved)</td>
</tr>
<tr>
<td>Measurement Task Assignment</td>
<td>UtilitiesTimeSeriesERPMeasurementTaskAssignmentChangeRequest</td>
<td>Med/ Med</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UtilitiesTimeSeriesERPMeasurementTaskAssignmentChangeConfirmation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POD assignment</td>
<td>SmartMeterUtilitiesMeasurementTaskERPPointOfDeliveryAssignedNotification</td>
<td>Med/ Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POD Change</td>
<td>SmartMeterUtilitiesPointOfDeliveryERPExternalIDNotification</td>
<td>Med/ Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profile value Query</td>
<td>UtilitiesTimeSeriesItemByIDQueryResponse</td>
<td>Med/ Med</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** The effort includes research and analysis
Benefits of MDUS with SAP

Benefits

• Lower integration costs between MDM and CIS system
• Reduces technical and integration AMI project risks
• Reduces AMI project schedule risks
• Reduces long term back-office system maintenance costs
  • Itron will continue to support new SAP releases and functionality added over time
• Itron and SAP now offer a completely integrated end to end meter to cash solution
Thank You!
Extra slides
Deliver Value to Customers

- “Insight” regarding Consumption
- Leverage AMI investments
- Engagement on their preferred medium
Everyone has a website these days...

- This is no longer a value-add to the customer
- It’s a basic expectation

Addressing the new power of the customer voice means listening to the customers, being where they are and utilizing the channels of communication they are using...

Utilities need to build strategies around how these channels can be leveraged, because the customers are already there.
Single Source of Truths

- SAP for Customer Information
- ODS for Consumption
- GIS for Connectivity

Leverage SAP AMI

- MDUS for ODS
- CRM/DSM
- UCES
ARCHITECTURE

IEE MDM

AMI Collection Engine

AMI System 1

AMI System n

High Speed VEE and Aggregation

Itron MDUS

Event Handler

Device Communication

SAP

Web Services

PI server

Enterprise Management and Business Support

SAP1

SAP2

Web Services

High Speed VEE and Aggregation

Powering London.
Empowering You.
EP5 Ramp-up (target June market release)

• Looking forward to share our results

Working with ITRON & Light House Council

• AMI and MDUS
## AMI Related Services

### Itron SAP AMI Integration Module (ISAIM) EhP5 Services

<table>
<thead>
<tr>
<th></th>
<th>SAP Services</th>
<th>Developed</th>
<th>Tested Internally</th>
<th>Tested with SAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>EhP2</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>EhP4</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>EhP5</td>
<td>31</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td><strong>Total developed</strong></td>
<td><strong>61</strong>*</td>
<td><strong>55</strong></td>
<td><strong>55</strong></td>
<td><strong>55</strong></td>
</tr>
</tbody>
</table>

**Total % of services supported by Itron in EhP5**

- **100%**
- **100%**
- **100%**

* 6 services are out of scope, for different reasons, some have been implemented in other services, some are not relevant for the ISAIM, some of the requirements have been received too late.
ISSUES FOR INVESTIGATION

• Required register read bounding for Time of Use billing determinants using EhP5/AMI ToU Interface
  
  (Canadian regulatory compliance issue)

• VEE rules synchronization for different customer types from SAP to ODS via MDUS

• Storing premise address information including unit # for apartment buildings
MDUS Test Environment

1. Configuration of 5 million meters
2. Readings data
   - 1 register channel (1 read per day, midnight read)
   - 1 interval channel (15 minutes interval channel)
3. Readings data history
   - 6 months worth of data

Test to be Performed

Request of data for 250K meters per day

2 types of services families requested each day → 500K requests per day

1. Register Reads
2. Billing determinants (Total Energy / TOU / CPP / TOU with CPP)