Why Are AMI and Smart Grids Being Implemented in the US?

Steen Hedetoft

Aclara Sao Paulo, Brasil
Agenda

- U.S. Utility Challenges
- What is a Smart Grid?
- Smart Grid Activity in the U.S.
- PPL Case Study
- Smart Grid Solutions and Technologies
U.S. Utility Challenges
What Challenges are U.S. Utilities Facing Today?

- Resources are less plentiful and operating costs are increasing
- Environmental concerns
- Customers are demanding more
What is a Smart Grid?
National Energy Technology Laboratory (NETL) Definition

- Self-healing from power disturbance events
- Enabling active participation by consumers in demand response
- Operating resiliently against physical and cyber attack
- Providing power quality for 21st century needs
- Accommodating all generation and storage options
- Enabling new products, services, and markets
- Optimizing assets and operating efficiently

www.oe.energy.gov/smartgrid.htm
Contributors to Achieving the Performance of a Smart Grid

- Architecture & Communication Standards
- Monitoring & Load Management Technologies
- Advanced Components & Operating Concepts
- Modeling & Simulation
AMI is a Core Component of the Smart Grid

Smart Grid Activity in the U.S.
Cost Effective Technology Is Now Available

Addressing Reduction in Resources and Increasing Operating Costs

- Prepayment systems, Pole-Mount Metering, Reduce Technical and Commercial System Losses, optimizing system performance and reducing waste

- Size system equipment properly, preventing early failure and reducing excess costs

- Demand-Side Management Programs reduce the need to add generation/transmission capacity
Addressing Environmental Concerns

• Demand-Side Management and Distribution System Optimization are “Green Technologies” that positively affect the environment

• Leakage Detection systems reduce waste and conserve natural resources

• Innovative rate structures such as demand response pricing, time-of-use, critical peak pricing encourage customers to conserve
Addressing Customers Who are Demanding More

• Advanced Metering Infrastructure and Smart Grid Technology coupled with Meter Data Management and Customer Presentment Software allow customers to have a choice with their energy consumption habits

• Outage Assessment and Distribution Automation increase system reliability, customer satisfaction and profitability
Power Reliability and Outage Assessment

Phase A

Phase B

Phase C

Outage!

High Current Alarm
Available AMI Applications

- Monthly Billing reads for electric, water and gas
- Demand and Demand Reset
- Time-of-Use Rates
- Interval Data Retrieval for rate studies and advanced billing
- Outage Assessment
- Outage Count
- Power Quality
- Last 8 outages with times and durations
- Additional available from meter
Available AMI Applications
(Continued)

- Voltage reads
- Load Control, peak demand reduction
- Distribution Automation
  - Capacitor control
  - Recloser and line switch control
- Disconnect/Reconnect
- Prepayment
- Engineering Studies
- Revenue Protection – theft prevention
Example of Benefits from North American Cumulative Industry Experience

Gross savings in $ per meter per month

- Meter Reading: $0.70
- Off-Cycle Reads: $0.26
- Billing & Customer Service: $0.56
- Outage Mgmt: $0.29
- Revenue Protection: $0.36
- Meter Operations: $0.60
- Utility Operational Savings: $2.77

Source: North American Advanced Metering AMR, Frost & Sullivan
Establishing Business Value for AMI Data Beyond Billing

-PPL Case Study
PPL Organization

- Integrated energy company with headquarters in Allentown, PA
- Assets of $19.7 billion and operating revenues of $6.9 billion

This chart does not reflect all PPL Corporation subsidiaries.

- **PPL Generation, LLC**
  - Owner and operator of a growing fleet of domestic power plants

- **PPL EnergyPlus, LLC**
  - Wholesale and retail energy sales in key U.S. markets. Full range of energy services including distributed generation

- **PPL Electric Utilities Corporation**
  - 1.4 million customer electric delivery business in Pennsylvania

- **PPL Global, LLC**
  - Energy distribution and generation projects worldwide
AMI Deployment at PPL Electric Utilities

- PPL Electric Utilities completed the deployment of an automated meter reading system for its 1.4 million customers in October of 2004

- Total implementation cost of $163 million

- The effort resulted in the following achievements:
  - deployed 1.4 million (new and retrofitted) meters
  - installed communications equipment at each of 313 substations
  - developed the computer software programs and interfaces to transfer the automated meter reads to the PPL billing system
  - informed PPL Electric Utilities customers and employees
  - prepared the business lines for process changes

- Currently retrieving Daily Reads and Interval Data on all meters
PPL Electric Utilities
Service Territory

PPL Facts
- 10,000 sq. miles (26,000 sq. km)
- 1.39 million meters
- 6 major cities
- 50% of customers

Meters per Square Mile
- > 225
- > 75 and < 225
- < 75
## How PPL uses their AMI technology

<table>
<thead>
<tr>
<th>Revenue Cycle</th>
<th>Operational Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Avoided costs of monthly reads</td>
<td>• Improved billing</td>
</tr>
<tr>
<td>• Call Center cost reductions</td>
<td>• processes/results</td>
</tr>
<tr>
<td>• Special Reads cost reductions</td>
<td>• Improved compliance performance</td>
</tr>
<tr>
<td>• Installation check cost reductions</td>
<td></td>
</tr>
<tr>
<td>• Improved revenue recovery (theft detection and equipment issues)</td>
<td></td>
</tr>
<tr>
<td>• Improved cash flow</td>
<td></td>
</tr>
</tbody>
</table>

### Outage Management

- Time-of-Use Rates
- Forecasting
- Asset Management
- Customer Communication
PPL AMI System Utilization

- 70,000 Billing reads
- 33,600,000 Hourly Consumption
- 70,000 Demand Resets
- 100 Meter Searches
- 2,000 Site Scan
- 780 Connects/Disconnects
- 1.4 million Daily Reads
- 185,000 PROasys/Blinks
- PROasys Pings

Smart Grids Latin America 2008, Santiago, Chile
Meter Data Management (MDM) is a repository that leverages AMI data through various operational and customer care tools.
PPL Electric Utilities Customer Self-Service using Aclara Software

Bill Center
Welcome JACK STRAW Today is Tuesday, July 25, 2006.

Account Summary
Last Payment Received 3/7/2006 - Thank you $267.97
Account balance $228.99 as of last bill
Bill Summary ending 3/23/2006
Previous balance $0.00
Budget amount billed $221.00
Amount Due 4/13/2006 $228.99

PPL has various bill payment options: View Payment Options (button) - URL to view payment options unknown at this time.

Bill Highlights
29 Yale Ave
- The amount due on this bill is based on your budget-billing plan.
- Your electric usage increased for this bill.

How does my home use energy? 29 Yale Ave
Electricity Costs 2/1/2006 to 3/7/2006
- Heating $19
- Pool $12
- Lighting $18
- Other $16
- Hot Water $5
- Cooking $4
- Food Storage $1

Control my costs! Heating is your highest energy expense. Click Find ways to save to get specific recommendations for reducing your energy costs.

How does my home compare? 29 Yale Ave
- $273 Avg Home
- $229 My Home

Daily Energy with Temperature

Choose a period:  Billing cycle  Month  Week

Note: On Weekends, the colors will appear lighter or paler.
Self Service Landing Page

Bill Center
Welcome JOHN DOE! Today is Friday, January 26, 2007.

Account Summary
6625001111

Last Payment Received 1/22/2007 - Thank you!
Account balance $0.00

Bill Summary ending 1/11/2007
Previous balance $0.00
Total current charges $76.01
Amount Due 2/1/2007 $76.01

Bill Highlights
123 FAKE ST
- Your energy charges were $0.43 lower for this bill.
- Other Electric service charges/credits were $0.04 higher for this bill.

Bill Analysis
Still have questions about this bill? Find out more about why your bill has changed.

How does my usage compare?
123 FAKE ST

Usage Comparison
- Electric Use (kWh)

How does my home use energy?
123 FAKE ST

- Heating $23
- Other $15
- Cooking $13
- Hot Water $9
- Lighting $9
- Food Storage $5

Electricity

Central my costs!
Heating is your highest energy expense. Click Find ways to save to get specific recommendations for reducing your energy costs.

How does my home compare?
123 FAKE ST

$152
Avg. Home

Usage Least Energy
$78
My Home

Usage Most Energy

Congratulations! Your home used less energy than most of the similar homes in your area.
Revenue Protection

- Revenue Vision (RV) is used today to find meter issues as well as theft.

- RV collects raw data from meters with a specific scenario:
  - For example, meters with three (3) hours of no use are collected between the hours of 6 pm and 6 am and reports them to a hot list for further investigation.

- Additionally, RV collects meters that have reverse rotation with blinks and places them on a hot list for additional investigation.
Results for April and May 2008:

- Identified forty (40) cases in a field investigation where 100% resulted in action being taken
  - Eighteen (18) cases were a result of equipment issues
  - Theft detected in twenty (20) cases
  - Two (2) cases revealed customer-owned generation

PPL continues to refine other tests that monitor accounts within two days of an event, such as termination for non-payment and slowing or stopped meter
Summary

- **PPL leverages their meter data to ...**
  - Provide internal and external customers with tools to analyze their bill, and view payment history and energy saving tips
  - Streamline the complex billing process
  - Validate, edit, and estimate daily, hourly, and interval data
  - Improve theft detection
  - Increase reporting of unbilled revenue
  - Enhance load profiling
  - Expand distribution operations and planning functions
Smart Grid Solutions and Technologies
BUILDING SMART GRID SOLUTIONS OVER A STRONG FOUNDATION
Aclara Solutions

• Customer Satisfaction
  • Provide fast, efficient, personalized service
  • Retain loyal customers with innovative energy programs
  • Deliver pricing and billing information via in-home displays and the web

• Operational Excellence
  • Apply integrated technologies to the Smart Grid
  • Enhance service scheduling, delivery, and outage planning
  • Provide PLC and RF-based AMI/AMR systems for gas, water, and electric
Aclara Solutions (continued)

• **Resource Conservation**
  - Provide two-way demand response to reduce peak energy use
  - Collect, manage, and transmit high resolution usage data
  - Present innovative time-based rate programs and incentives

• **Risk Mitigation**
  - Offer proven AMI solutions with service-oriented MDM
  - Enable rapid deployments with hosted systems
  - Integrate new technology with legacy systems
Thank You

Steen Hedetoft, Aclara
shedetoft@aclara.com
Phone: 55.19.9305.3876
www.Aclara.com