Advanced Metering Infrastructure (AMI)

Overview of System Features and Capabilities

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Chief Strategy Officer
eMeter Corporation

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Today’s Presentation

1. Overview of metering technologies
2. System costs and benefits
3. Case studies
   - U.S.
   - International
## Metering Technologies

<table>
<thead>
<tr>
<th>System Element/Feature</th>
<th>Manual</th>
<th>Automatic Meter Reading (AMR)</th>
<th>Advanced Metering Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meters</strong></td>
<td>Electromechanical</td>
<td>Hybrid</td>
<td>Hybrid or solid-state</td>
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<tr>
<td><strong>Data collection</strong></td>
<td>Manual, monthly</td>
<td>Drive-by, monthly</td>
<td>Remote via communications network, daily or more often</td>
</tr>
<tr>
<td><strong>Data recording</strong></td>
<td>Total consumption</td>
<td>Total consumption</td>
<td>Time-based (usage each hour or more often)</td>
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<tr>
<td><strong>Primary applications</strong></td>
<td>Total consumption billing</td>
<td>Total consumption billing</td>
<td>Pricing options</td>
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<td>Customer options</td>
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<td>Utility operations</td>
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<td></td>
<td>Emergency demand response</td>
</tr>
<tr>
<td><strong>Key software interfaces</strong></td>
<td>Billing and customer information system</td>
<td>Billing and customer information system</td>
<td>Billing and customer information system</td>
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<td></td>
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<td></td>
<td>Customer data display</td>
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<td>Outage management</td>
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<td></td>
<td></td>
<td></td>
<td>Emergency demand response</td>
</tr>
<tr>
<td><strong>Additional devices enabled</strong></td>
<td>None</td>
<td>None</td>
<td>Smart thermostats</td>
</tr>
<tr>
<td>(but not included in base infrastructure)</td>
<td></td>
<td></td>
<td>In-home displays</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Appliance controllers</td>
</tr>
<tr>
<td><strong>Current penetration in California (residential and small commercial)</strong></td>
<td>&gt;95%</td>
<td>&lt;5%</td>
<td>None (pilot only)</td>
</tr>
</tbody>
</table>
AMI Communication Networks

**Local Area Networks**
- Local power lines
- Wireless

**Wide Area Networks**
- Telephone
- Internet
- Wireless Network
- Distribution lines
- Substation

**Consumer**
- Utility User
- Data Center
AMI Data and Software Relationships

Contact
User Name
Account

End User

Premise
Transformer
Circuit

Networks
- Wide area
- Neighborhood
- In-home

Data Center

AMI Operations
Outage Management System
Web Usage Display
Distribution Operations
Program Management
Billing and Customer Service

Network Providers
Field Technician

In-Home Display
Smart Thermostat
Load Controller
Electric Meter
Network Module
Electric Service Point
## Metering System Applications

<table>
<thead>
<tr>
<th></th>
<th>Manual/AMR</th>
<th>AMI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pricing</strong></td>
<td>Total consumption only</td>
<td>Total consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time-of-use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Critical peak pricing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Real-time pricing</td>
</tr>
<tr>
<td><strong>Other demand response</strong></td>
<td>None</td>
<td>Load control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demand bidding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demand reserves</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Critical peak rebates</td>
</tr>
<tr>
<td><strong>Customer feedback</strong></td>
<td>Monthly bill</td>
<td>Monthly bill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monthly detailed report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Web display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In-home display</td>
</tr>
<tr>
<td><strong>Customer bill savings</strong></td>
<td>Turn off appliances manually</td>
<td>Turn off appliances</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shift appliances off peak</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manual or automatic control</td>
</tr>
<tr>
<td><strong>Outages</strong></td>
<td>Customer phone calls</td>
<td>Automatic detection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verification of restoration at individual home level</td>
</tr>
<tr>
<td><strong>Distribution operations</strong></td>
<td>Use engineering models</td>
<td>Dynamic, real-time operations</td>
</tr>
</tbody>
</table>
## New Utility Capabilities Enabled by AMI

<table>
<thead>
<tr>
<th>Service</th>
<th>New Capabilities Enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Quality</td>
<td>Meter-level voltage monitoring</td>
</tr>
<tr>
<td></td>
<td>Load balancing</td>
</tr>
<tr>
<td></td>
<td>Capacitor bank switching*</td>
</tr>
<tr>
<td></td>
<td>Regulator and tap changer monitoring*</td>
</tr>
<tr>
<td></td>
<td>Transformer load management</td>
</tr>
<tr>
<td></td>
<td>Automated outage management</td>
</tr>
<tr>
<td>Distribution Automation</td>
<td>* - requires additional devices</td>
</tr>
</tbody>
</table>

* - requires additional devices

**Appearance of map with normal power status**

**Outage is now fully mapped**

**Outage known but not yet fully mapped**

**Individual customers still out**

**Monitor restoration to be sure power is fully restored**
## Major AMI Installations

<table>
<thead>
<tr>
<th>Utility</th>
<th>Type</th>
<th>Technology</th>
<th>Quantity</th>
<th>Install Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U.S.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kansas City Power &amp; Light (MO)</td>
<td>Electric</td>
<td>Wireless</td>
<td>400,000</td>
<td>1996</td>
</tr>
<tr>
<td>Duquesne Light (PA)</td>
<td>Electric</td>
<td>Wireless</td>
<td>580,000</td>
<td>1998</td>
</tr>
<tr>
<td>Ameren (MO)</td>
<td>Electric &amp; Gas</td>
<td>Wireless</td>
<td>1,400,000</td>
<td>1999</td>
</tr>
<tr>
<td>Xcel Energy (MN)</td>
<td>Electric &amp; Gas</td>
<td>Wireless</td>
<td>1,400,000</td>
<td>1999</td>
</tr>
<tr>
<td>Puget Sound Energy (WA)</td>
<td>Electric &amp; Gas</td>
<td>Wireless</td>
<td>1,500,000</td>
<td>2000</td>
</tr>
<tr>
<td>United Illuminating (CT)</td>
<td>Electric</td>
<td>Wireless</td>
<td>320,000</td>
<td>2000</td>
</tr>
<tr>
<td>Indianapolis Power &amp; Light (IN)</td>
<td>Electric</td>
<td>Wireless</td>
<td>470,000</td>
<td>2000</td>
</tr>
<tr>
<td>Exelon (PA)</td>
<td>Electric &amp; Gas</td>
<td>Wireless</td>
<td>2,100,000</td>
<td>2002</td>
</tr>
<tr>
<td>Wisconsin Public Service (WI)</td>
<td>Gas</td>
<td>Wireless</td>
<td>200,000</td>
<td>2003</td>
</tr>
<tr>
<td>Wisconsin Public Service (WI)</td>
<td>Electric</td>
<td>Distribution line carrier</td>
<td>650,000</td>
<td>2004</td>
</tr>
<tr>
<td>PPL (PA)</td>
<td>Electric</td>
<td>Distribution line carrier</td>
<td>1,300,000</td>
<td>2004</td>
</tr>
<tr>
<td>JEA (FL)</td>
<td>Electric &amp; Water</td>
<td>Wireless</td>
<td>600,000</td>
<td>2005</td>
</tr>
<tr>
<td>WE Energies (WI)</td>
<td>Electric &amp; Gas</td>
<td>Wireless</td>
<td>1,000,000</td>
<td>2005</td>
</tr>
<tr>
<td>Hundreds of Small Utilities</td>
<td>Electric &amp; Gas</td>
<td>Various</td>
<td>5,000,000</td>
<td>2004</td>
</tr>
<tr>
<td><strong>International</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENEL (Italy)</td>
<td>Electric</td>
<td>Power line carrier</td>
<td>30,000,000</td>
<td>2005</td>
</tr>
<tr>
<td>PREPA (Puerto Rico)</td>
<td>Electric</td>
<td>Distribution line carrier</td>
<td>1,400,000</td>
<td>2006</td>
</tr>
<tr>
<td>Sweden</td>
<td>Electric</td>
<td>Wireless &amp; power line carrier</td>
<td>5,200,000</td>
<td>2009</td>
</tr>
<tr>
<td>Ontario (Canada)</td>
<td>Electric</td>
<td>To be determined</td>
<td>[5,000,000]</td>
<td>2010</td>
</tr>
<tr>
<td>Victoria (Australia)</td>
<td>Electric</td>
<td>To be determined</td>
<td>[2,500,000]</td>
<td>2013</td>
</tr>
</tbody>
</table>
### Customer Service Benefits of AMI (Basic)

<table>
<thead>
<tr>
<th>Service</th>
<th>New Options Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Billing</strong></td>
<td>☐ Choice of billing date</td>
</tr>
<tr>
<td></td>
<td>☐ No estimated bills</td>
</tr>
<tr>
<td></td>
<td>☐ Month-to-date bill</td>
</tr>
<tr>
<td></td>
<td>☐ Projected month-end bill</td>
</tr>
<tr>
<td><strong>Pricing</strong></td>
<td>Choice of flat rates or dynamic pricing</td>
</tr>
<tr>
<td><strong>Outage handling</strong></td>
<td>Automatic response and restoration verification by utilities</td>
</tr>
<tr>
<td><strong>Usage information</strong></td>
<td>☐ Real-time meter read</td>
</tr>
<tr>
<td></td>
<td>☐ First call problem resolution</td>
</tr>
<tr>
<td></td>
<td>☐ Web data access</td>
</tr>
<tr>
<td></td>
<td>☐ Monthly detailed usage reports</td>
</tr>
<tr>
<td></td>
<td>☐ Baseline threshold alarms</td>
</tr>
<tr>
<td></td>
<td>☐ Month-to-date usage</td>
</tr>
<tr>
<td></td>
<td>☐ Daily or hourly data for customer education</td>
</tr>
</tbody>
</table>
## Benefits – Utility Operations
### Puget Sound Energy Example

<table>
<thead>
<tr>
<th>Source</th>
<th>Electric</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter reading</td>
<td>47%</td>
<td>80%</td>
</tr>
<tr>
<td>Energy theft</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>Process improvement</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Call center</td>
<td>4%</td>
<td>7%</td>
</tr>
<tr>
<td>Outage management</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>Credit and collections</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Demand metering</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>Meter accuracy</td>
<td>13%</td>
<td>0%</td>
</tr>
<tr>
<td>Meter retirement</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>Cash flow</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Electric Operating Savings

- Meter reading: 23.7%
- Energy theft: 3.2%
- Process improvement: 3.2%
- Outage management: 2.3%
- Credit and collections: 1.3%
- Demand metering: 6.5%
- Meter accuracy: 5.1%
- Meter retirement: 3.7%
- Cash flow: 2.0%
- Other: 4.3%

### Gas Operating Savings

- Meter reading: 23.7%
- Energy theft: 3.2%
- Process improvement: 3.2%
- Outage management: 2.3%
- Credit and collections: 1.3%
- Demand metering: 6.5%
- Meter accuracy: 5.1%
- Meter retirement: 3.7%
- Cash flow: 2.0%
- Other: 4.3%

**PSE Payback:**
- Operations Only = 9 years
- Operations w/TOU = 5 years
## Utility AMI Deployment Drivers

<table>
<thead>
<tr>
<th>Operational Efficiency</th>
<th>Ameren</th>
<th>KCPL</th>
<th>NSP</th>
<th>PSE</th>
<th>IPL</th>
<th>Exelon</th>
<th>UI</th>
<th>JEA</th>
<th>IPC</th>
<th>PPL</th>
<th>WE Energies</th>
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<tr>
<td>Operating Costs</td>
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<tr>
<td>Improved Accuracy</td>
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<td>Theft Detection</td>
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<td>Distribution Service</td>
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<td>Demand Response</td>
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<td>Customer Service</td>
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<tr>
<td>Outage Response</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Service Quality</td>
<td></td>
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</tbody>
</table>
# AMI Costs in Volume

1. **Meter with Communications Module: $50-400**
   - New vs. retrofit
   - Residential/small commercial vs. large commercial

2. **Meter Installation: $10-200**
   - Residential/small commercial vs. large commercial
   - Primary variable is “drive time” (universal vs. scattered deployment)

3. **Local Area Network Node: $2-50 per meter**
   - At premise vs. pole top vs. substation
   - Primary variables are network type and number of meters connected

4. **Wide Area Network: $10 per LAN node per month**
   - Public vs. private network

5. **Data Center: $0.25 to $5 per meter per month**
   - Staffing, facilities, servers, and other operations & maintenance
   - Startup and base monthly cost

6. **Field Equipment Operations & Maintenance: $1 per meter-mo**
   - Meters
   - Local Area Network nodes

7. **Overheads: 10-20%**
   - Administrative & general
   - Financing costs for capital investments

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**Meter with Communications Module**

+ **Meter**

+ **Installation**

+ **Local Area Network Node**

+ **Wide Area Network Communications Services**

+ **Data Center**

+ **Field Equipment Operations & Maintenance**

+ **Overheads & Administrative Costs**

= Total Cost
## AMI Cost Example: 2 Million Meters

<table>
<thead>
<tr>
<th>Item</th>
<th>Assumptions</th>
<th>Cost</th>
<th>Average Cost per Meter</th>
</tr>
</thead>
</table>
| **Meters and Communications Modules** | ▪ 95% residential/5% commercial  
▪ 30% new meters/70% retrofitted meters  
▪ 55% electric/45% gas                                                                     | ▪ New residential/small commercial: $60  
▪ Retrofit residential/small commercial: $50  
▪ New large commercial: $300                                                            | Electric: $70.58  
Gas: $54 |
| **Meter Installation**               | ▪ Installation of electric meters with modules  
▪ Installation of gas modules                                                              | ▪ Electric: $12.50 per meter  
▪ Gas: $10.00 per meter                                                                  | $11.38 |
| **Local Area Network Node**         | ▪ Communications node equipment  
▪ Installation of communications node  
▪ Node covers 500 meters                                                                | ▪ Equipment: $5,000  
▪ Installation: $500                                                                      | $11.00 |
| **Wide Area Network**               | ▪ Public network                                                            | ▪ Communications: $10 per LAN node per month                           | $0.02 per meter-month |
| **AMI Data Center**                 | ▪ Software purchase and installation  
▪ System integration  
▪ Modification of existing systems  
▪ Operation of AMI                                                                         | ▪ $40 million capital costs  
▪ $0.30 per meter-month for operations                                                   | $20.00 capital  
$0.30 per meter-month |
| **Field Operations and Maintenance** | ▪ Includes hardware and labor cost                                           | ▪ 1% per year of capital cost                                         | $0.05 per meter-month |
| **Overheads and Administrative Costs** | ▪ Program management  
▪ All project overheads                                                              | ▪ 20%                                                                | $12.60 |
| **TOTAL COST**                       |                                                                             | ▪ $118.09 capital  
▪ $0.37 per meter-month                                                              |
AMI Costs Case Study

- Summary of data collected in several eastern U.S. utility procurements
- Independent consultant compared total capital cost and operating benefits of automating meters via AMI vs. AMR
- Technologies
  - Vendors with proven installations
  - Multiple technologies
- Business case
  - Benefits limited to documented utility operating savings
  - No demand response, rate, customer, or system opportunity benefits considered
- Includes meters, communications, training, IT support, and installation
# Metering Systems
## Average Unit Cost and Functional Comparison

### Automated Meter Reading (AMR)

<table>
<thead>
<tr>
<th>Average Expected Payback (years)</th>
<th>$92</th>
<th>6.5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drive-by Systems</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Functional Capability

- kWh Usage
- kW Interval Data
- Dispatchable Rates
- Tamper Detection
- Outage Monitoring
- Read on Demand
- Selectable Billing Dates
- Customer Usage Profiles
- Dynamic Load Research

### Advanced Metering Infrastructure (AMI)

<table>
<thead>
<tr>
<th>$107</th>
<th>6.5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Network Systems</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Notes:

1. Private communication (9/13/04), established utility consulting firm. Costs represent information drawn from multiple vendors and several utility procurements during summer 2004. Cost data exclude the high-low estimates in each system category.
2. Costs include meter hardware, installation, communication systems, IT support, training.
3. Only vendors with proven gas and electric installations qualified to bid. Evaluation considered only utility operating costs, no DR, rate, customer or other system costs or benefits considered. Multiple communication technologies included in results.
AMI Financing

- Capital costs
  - Around $100 per meter
  - Various financing options

![Graph showing NPV over years for Outsource, Pay-for-Read, Synthetic Lease, and Purchase options.]
Cost recovery options

**Problem**
Fixed charges disproportionately impact low use customer bills.

**Solution**
Consider a ‘volumetric’ kWh based cost allocation method.

• Preferred in general as it promotes conservation

---

<table>
<thead>
<tr>
<th>Monthly Usage</th>
<th>Meter Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 kWh</td>
<td>$0.20 per month</td>
</tr>
<tr>
<td>500 kWh</td>
<td>$0.33 per month</td>
</tr>
<tr>
<td>1,000 kWh</td>
<td>$0.67 per month</td>
</tr>
<tr>
<td>1,500 kWh</td>
<td>$1.00 per month</td>
</tr>
</tbody>
</table>
Fixed meter charges disproportionately impact low use customer bills.

Consider a ‘volumetric’ kWh based cost allocation method.

**Total Cost Per Meter / Customer**

- **Residential**
  - $85-$265

**Fixed Meter Cost Per Customer**

- $1.05 - $2.25 / month

**kWh Volumetric Cost Allocation Per Customer**

<table>
<thead>
<tr>
<th>Monthly Usage</th>
<th>Meter Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 kWh</td>
<td>$0.33 per month</td>
</tr>
<tr>
<td>500 kWh</td>
<td>$0.56 per month</td>
</tr>
<tr>
<td>1,000 kWh</td>
<td>$1.12 per month</td>
</tr>
<tr>
<td>1,500 kWh</td>
<td>$1.67 per month</td>
</tr>
</tbody>
</table>
Case Studies
Pennsylvania Power & Light
Idaho Power Company
Florida Power & Light

Ward Camp
Vice President
Distribution Control Systems, Inc.
PPL AMI Project

- **Goal:** reduce utility operating costs and improve customer service

- **Scope**
  - 1.3 million electric meters
  - Central Pennsylvania
  - Split between urban and rural

- **Schedule**
  - Began rollout spring 2002
  - Completed installation September 2004 on schedule

- **Total capital costs of $160 million**
  - $123 per meter
  - More than offset by operating savings
PPL Technology: Distribution Line Carrier

- Distribution Substation
- Substation Communications Node
- Power Lines
- Power Line To Home
- Telephone Line
- AMI-equipped Electric Meter
- Billing / CIS
  - Database
  - Workstations (PCs)
  - LAN / WAN
- Master Station
  - Distribution Automation, Energy Management, Outage Management
  - Air Conditioner Load Controller
  - Water Heater Load Controller
- Distribution Substation
- Substation Communications Node
PPL Cost Recovery Filing

- Justified based on direct operational & maintenance savings
  - Remote meter reading
  - Fewer customer calls resulting from estimated meter reads
  - Shorter phone calls as a result of having better data and having daily data
  - Remote collection of move-in/move-out meter reads
  - Lower cost to handle high-bill investigations
  - Several others
  - Other benefits
    - Recognized non-economic customer satisfaction benefits (e.g. reduced estimated reads, quicker restoration after Hurricane Isabel)
    - Believe demand response benefits will occur, but did not attempt to quantify as part of rate case

- Utility benefits of $205 million vs. costs of $198 million
  - Present-value analysis over 15-year life
Idaho

- In March 2003, Idaho PUC ruled that dynamic pricing should be made available to all Idaho consumers

- Idaho Power
  - Installing first phase of AMI now
  - Critical peak pricing pilot planned for summer 2005

- Avista
  - Filed a rate case indicating they too, will start implementing AMI
Florida Power & Light (FPL)

- AMI system for both advanced metering and load control
  - Distribution line communications
  - First units installed 1987
  - 710,000 customers
  - 815,000 load control devices
  - Several tens of thousands of AMI meters
- Result is “demand response power plant”
  - 1,000 MW of load reduction in normal operation
  - 2,000 MW in emergency
Emergency Demand Response

Predicted Demand Profile

- Over 975 MW shed in 60 seconds
- August 1995
- Now over 1,300 MW under control

Time (h): 1530, 1545, 1560, 1575, 1590, 1605, 1620, 1635
System Load (MW): 1450, 1475, 1500, 1525, 1550, 1575, 1600, 1625

- Normal Load Control
- Generator Down, Emergency Control (SCRAM)
- Generator Restoration Started
- 80 Minute Time-out
- Restoration Suspended
- Restoration Started
- More Generation Down, System re-SCRAM
Demand Response at FPL

- FPL works actively with customer to help them reduce electricity consumption and lower their bills
- Together, FPL’s demand response programs total 3,300 MW
  - Over 20% of peak load
- FPL has been able to avoid building ten 400 MW power plants
Italy (ENEL)

- 30 million AMI meters
  - All customer classes (>90% residential)
  - Approximately 20 million already installed
  - Adding 700,000 per month

- Key functions
  - Remote meter reading
  - Pricing and demand response options
  - Remote connect/disconnect for load control
  - Theft detection/anti-tampering functions
  - Customer usage information
  - Prepayment (without card) enabling
  - Conservation voltage reduction
  - Individual customer service quality level monitoring
  - Potential development of value added services for energy market

- Economics
  - Four-year payback on utility operating savings
Sweden (Multiple Utilities)

- 2003 legislation mandating AMI deployment to all Swedish power consumers
  - 5.2 million residential, commercial, and industrial customers
  - Installations began 2004
  - Completion by July 1, 2009

- Goals
  - Energy conservation (by providing better, more frequent usage data to consumers)
  - Improved settlement in wholesale power market

- Technologies
  - Combination of wireless and power line carrier communications
  - Typical AMI functionality
Australia (Multiple Utilities)

- July 2004 decision by Victoria Essential Services Commission (Melbourne)

- Conclusions
  - Market forces alone would fail to deliver a timely AMI rollout
  - Regulatory intervention is required to achieve the economic benefits from a more timely and larger scale rollout
  - A net economic benefit would arise to consumers from a timely, mandatory rollout

- Requirements
  - Install AMI on all large businesses by 2008
  - Install AMI on all small businesses and large residential customers (>1,667 kWh/mo) by 2011
  - Install AMI on small residential customers from 2006 to 2013
Canada (Multiple Utilities)

- July 2004 Directive by Ontario Minister of Energy
- Goal: “make more efficient use of the current supply of electricity and to reduce the province’s reliance on external sources”

- Requirements
  - Install 800,000 AMI meters by December 2007
  - Install AMI for all Ontario consumers by December 2010
  - Minimum AMI capabilities
    - Record usage during prespecified time periods
    - Support seasonal, time-of-use, critical peak pricing, and other “foreseeable” rate structures
    - Retrieve data from meters remotely at least daily and be capable of providing such data to consumers as feedback
  - Consider additional functions
    - In-home or Web display of usage data
    - Load control
    - Meter reading of gas and water