Automatic Meter Reading
Case Study:
City of Chicago Department of Water Management

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Commissioner

Water System Overview
Protecting public health & safety

- 2 Cribss
- 2 Water Purification Plants
  - Jardine: 1,457 MGD capacity
  - South: 720 MGD capacity
- 12 Water Pumping Stations
  - 8 Electric, 4 Steam
  - No elevated storage
- 4,300 Miles of Distribution Mains
  - 47,600 Fire Hydrants
- 4,400 Miles of Sewer Mains
  - 340,000 Ancillary Sewer Structures
- Serves City & 125 suburbs (~41% of IL)
- Serves 5.3 million people
Metering in Chicago

as of AMR project inception, 2007

• Metered accounts:
  – **175,256 accounts** (166,766 eligible for AMR)
    • ~100,000 inside; ~66,000 outside
    • High usage accounts - industrial, commercial, suburban, 3-flat residential & larger
    • All new construction & new services
    • 79% of revenue

• Non-metered accounts:
  – **320,579 accounts**
    • Mostly single family homes & 2-flats
    • 21% of revenue, based on flat rate

Chicago’s AMR Project

• Uses mobile technology to remotely read currently metered customers more efficiently
• 3 year project, 2007 to 2010
• Currently in process of cleaning up remaining accounts

Non-metered customers are not affected
Business Case for AMR

- 26,000 meters were beyond their useful life – needed replacement anyway
- Savings from reduction in workforce & more accurate readouts
- Necessary step for universal metering

Benefits of AMR

- Increase in operational efficiency
  - Go from 100 to 6,000 reads per day per meter reader regardless of weather conditions
  - Significantly reduces meter reading costs
  - With more accurate reads, there is a reduction in customer service costs
  - All meters are read monthly for a better historical profile
  - Transmitters collect & store hourly readings – can get a user’s water profile
  - 15 year warranty
Benefits of AMR

• Convenience to customers
  – Meter readers do not have to gain access to buildings or manually open vaults to get readings
  – Reduces estimated and erroneous readings
  – Conversion of units from cubic ft. to gallons makes it easier for consumers to understand their water usage
  – Leak detection – finds problems earlier
  – Tampering & theft detection capabilities
  – No additional cost to the customer

Usage Profile Example
Mobile System Overview

MIU is mounted on the exterior of building or under a meter vault lid
ADE register – Absolute Digital Encoder

Who is affected by AMR?

<table>
<thead>
<tr>
<th>Class</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family</td>
<td>22,917</td>
<td>14%</td>
</tr>
<tr>
<td>2-Flat</td>
<td>8,623</td>
<td>5%</td>
</tr>
<tr>
<td>Large Residential</td>
<td>107,427</td>
<td>65%</td>
</tr>
<tr>
<td>Commercial</td>
<td>24,534</td>
<td>15%</td>
</tr>
<tr>
<td>Industrial</td>
<td>1,778</td>
<td>1%</td>
</tr>
</tbody>
</table>
Division of Work

- City Workforce
  - Installs all 3" and larger or difficult meters
  - 10 - 15% of workload

- Contractor
  - Installs all 2" and smaller meters
  - 85 - 90% of workload

- At completion, City workforce will continue to maintain the system

AMR Retrofit vs. Replacement

- If meter is < 10 yrs old ➔ retrofit
  - Remove old register which reads in cubic ft.
  - Replace with new register which reads in gallons
  - Install Meter Interface Unit (MIU), a transmitter
  - ~80,000 meters will be retrofitted

- If meter is > 10 yrs old ➔ replacement
  - Remove entire old meter & register
  - Replace with new meter & register
  - Install MIU
  - ~82,000 meters will be entirely replaced
Pilot Program Evaluation

• Purpose: evaluate equipment, procedures, & processes, including:
  – Customer notification & scheduling
  – Meter equipment & transmitter installation quality
  – Installation data management
  – Reading system operation
  – Billing conversion
  – Problem resolution

• 400 meters – 1 month
• DWM determined continuation of deployment

Overall System Deployment

• 3 year project
• Installation began in Oct. ’07 (after pilot program)
  – Started on North side of City & moved South
  – avg 1,050 installations/week
• Meter installation work was done by licensed plumbers
• Quality Assurance/Quality Control checks post-installation
  – 25% on-site before crew leaves the home
  – 100% confirming reads
Customer Protection

• All field personnel used on this project had to:
  – Complete extensive criminal background check including fingerprinting which will be compared against national database
  – Display DWM-issued photo IDs
  – Wear uniforms & drive company vehicles displaying company logos
• Pictures & descriptions of field personnel are on DWM’s website
• Information is provided to police stations in areas where work is performed

Customer Notification

• DWM worked with each Alderman’s office, community groups, & media
• DWM notified customers 2 weeks prior to start of installation in their area
  • Contractor reminded customers 1 week before start
  • Contractor gave 3 additional notifications, if needed, to schedule an installation
  • Replacement with new AMR device is mandatory to ensure system compatibility

Still had trouble reaching residents!
Customer Scheduling

- Appointments were made at times convenient to the customers
- Customers were requested to provide clear access to their meter
- Crew’s sole purpose was to install AMR equipment
- Contractor’s call center open 13 hours per day during the week

AMR Completion Status

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td># AMR completed</td>
<td>151,735</td>
<td>87%</td>
</tr>
<tr>
<td># AMR remaining</td>
<td>15,031</td>
<td>9%</td>
</tr>
<tr>
<td># Not AMR-eligible (Suburban, Fire, etc.)</td>
<td>7,814</td>
<td>4%</td>
</tr>
</tbody>
</table>

Total # metered accounts at project start up = 174,580
AMR Remaining Breakdown

![Pie chart showing categories and percentages of AMR remaining issues]

- **Other Customer Issues**
  - Plumbing req’d, meter obstructed, vacant, etc.
  - 3,770
  - 25%

- **City Jobs**
  - B-box problems, unable to locate, etc.
  - 4,872
  - 32%

- **No response from customer**
  - 6,389
  - 43%

Total # AMR remaining = 15,031

Lessons Learned

- **Timing**
  - AMR vs. MeterSave
  - Many years of estimated reads = surprise upon actual read

- **Aesthetics**
  - Customers didn’t like the grey box in front of their house
  - Customers didn’t want a hole drilled for the wire = some MIUs inside

- **Hindsight**
  - Mobile vs. Fixed network
  - Call volume was more than we could handle

- **Meter Reading**
  - Reads dependent upon speed of vehicle
  - Night Shift
  - Mistakes with gallon reads being measured in cubic feet
More Lessons Learned

- Data Integration
  - From Field to Billing Software
  - Existing Data vs New data
  - Data Maintenance – additional data to be stored
- Billing Cycle
  - Commercial & Residential Accounts
  - Read vs Billing Period
- Meter Maintenance
  - Service Order Types
  - Crew Structure – 1 man crew only for transmitter-related trouble codes

AMR has allowed for beginning of universal metering

<table>
<thead>
<tr>
<th>Year</th>
<th># Metered Accounts</th>
<th># Non-Metered Accounts</th>
<th>Metered Rate ($/1,000 gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>179,649</td>
<td>318,088</td>
<td>$1.76</td>
</tr>
<tr>
<td>2010</td>
<td>183,618</td>
<td>314,002</td>
<td>$2.01</td>
</tr>
<tr>
<td>2011</td>
<td>192,304</td>
<td>304,519</td>
<td>$2.01</td>
</tr>
<tr>
<td>2012</td>
<td>202,304 (projected)</td>
<td>294,519 (projected)</td>
<td>$2.51</td>
</tr>
</tbody>
</table>
A novel, hybrid approach to begin metering in a friendly manner and with little opposition.

- Voluntary, Incentive-based
  - Financial: 7-year guarantee that metered bill will not exceed what the assessed billing rate would have been
  - Conservation: Choice of water conservation tool: indoor kit, outdoor kit, or rain barrel (looking into pilot of a new incentive: water use audit)
  - Information: Get an AMR meter w/leak detection, profile
- Geographic-based
  - Scheduling is done on a ward by ward basis – efficient

- Participants must pay bills on time
- Guarantee does not transfer to new property owners
- Limited to first 20,000 volunteers, annually

Benefits of MeterSave Program

to the customer
- Reduced & more frequent bills: avg. volunteer is saving >50%, billed every 2 months
- Equity for customer: Charges based on actual usage – use less, pay less
- Done at no cost to the customer: Free meter & installation
  - Leak notification from AMR trouble codes
  - No need to gain entry for routine readings

to the City of Chicago
- System efficiency: Easier leak detection within system
- System accountability: Actual water pumped & consumed – keeps with the Chicago Water Agenda
- Reduce wasted water: Chicago & NE IL may face severe water shortage by 2050 if fail to plan for future (Chgo Metro Agy for Planning, July ’08)

to the Region
- Population Growth: ↑ 1 million — more water needed
- Conserve water in advance of climate change:
  - reduce carbon footprint
  - use less energy
  - maintain lake levels
## Installation Contract

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Specifications</th>
<th>Risks of Contract</th>
<th>IEPA SR Loan Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on prior-metered Midwestern cities</td>
<td>In-house scheduling using on-line calendar</td>
<td>No guaranteed workload – volunteer based</td>
<td>[Smiley]</td>
</tr>
<tr>
<td>Meter experts identified “lessons learned”</td>
<td>Assumes pre-inspection</td>
<td>No payment for sites visited but not installed (i.e. cancellations or customer repairs required)</td>
<td>[Smiley]</td>
</tr>
<tr>
<td></td>
<td>Installations to be tracked using our paperless work order system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Call center operation</td>
<td>Have a better idea of minimum # of volunteers</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Technology Initiatives Achieved in an Accelerated Time-Frame

- Installation of AMR Meter
  - Paper-heavy workorders → Automated, paperless system
  - Interface between work order system & billing/collection system
  - Handheld devices for installers
  - Real-time upload to systems
  - Alternative installation methods—compression & crimp fittings (new to workforce in Chicago)
  - Photos of installers on website
- Billing for Water Usage
  - New bill format
  - Tracks annual cap – for 7-yr guarantee
- Post-Installation
  - QA/QC Post-Cards
  - Testimonials on website

### Customer Survey Results to date

<table>
<thead>
<tr>
<th>Customer Survey Results to date</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Crew Courtesy</td>
<td>4.95 / 5.00</td>
</tr>
<tr>
<td>Work Area Condition</td>
<td>4.85 / 5.00</td>
</tr>
<tr>
<td>Scheduled Appointment</td>
<td>98%</td>
</tr>
<tr>
<td>On Time?</td>
<td>96%</td>
</tr>
<tr>
<td>Uniformed?</td>
<td>89%</td>
</tr>
<tr>
<td>Wearing I.D. Badge?</td>
<td>98%</td>
</tr>
<tr>
<td>Explained Work?</td>
<td>99%</td>
</tr>
</tbody>
</table>
Questions & Answers

Thank you!