AMI STRATEGIC PLAN STATUS
Citizens Water Advisory Committee

May 8, 2013
Meeting Agenda

1. Overview of AMI Strategic Plan
2. Overview of AMR and AMI capabilities
3. Itron hardware and software functionalities
4. Results of staff functional requirements workshop
5. Economic comparison approach
Overview of AMI
Strategic Plan
Tucson Water’s Challenge:
Coordinating technology improvement in water metering and SCADA upgrades for better customer service

- Utilize Advanced Metering Infrastructure (AMI) technology to increase efficiency in measuring water use
- Further conservation by giving easy access for customers to daily water demand information
- Implement SCADA upgrades to enhance water operations and energy efficiencies
Local Issues and Questions

1. Customer acceptance – Use
2. Scalability – Magnitude/complexity of system
3. Data management – System architecture
4. Bandwidth – How much is enough?
5. Data storage – Archiving
6. Data mining application development platform for developers
7. Partnering with local electric utilities
Project Context
Advanced Metering Infrastructure (AMI)

- Tucson Water has ~240k water meters and ~70k meters have drive-by Automatic Meter Reading (AMR) hardware
- AMR offers flexible upgrades from drive-by meter-reading to a fixed network AMI system
- All manually read (walk-by) meters will be converted to AMR via a ten-year capital improvement project

The AMI Strategic Plan presents the costs/benefits of various approaches to reading water meters and establishes the business case for implementation of recommendations
Consultant Scope of Work

1. Obtain/review information
2. Conduct Functional Requirements Workshop
3. Define meter reading alternatives
4. Collaborate with Tucson Electric Power
5. Prepare spreadsheet cost evaluation
6. Prepare Draft AMI Strategic Plan
7. Attend/present at management meetings
8. Administer project execution
Keys to Developing a Utility-Specific AMI Plan (Process)

- Determine/Assemble Utility Stakeholders
- Educate Stakeholders
  - Terminology and hardware/software capabilities
- List Short- and Long-Term Functional Needs and Wants
- Prioritize Needs and Wants
- Develop a Utility-Specific Dynamic Build-out Business Case
  - Compare functional costs today with AMI costs
  - Develop key assumptions and cost information
  - Assume a 15-year AMI equipment life
  - Determine present worth capital and operating costs
Keys to Developing a Utility-Specific AMI Plan (Process)

- **Determine What is Affordable Now**
  - Terminology and hardware/software capabilities

- **Develop Financing Plan**
  - Current revenues, savings in labor costs
  - Green project grants and loans (saves energy & GHG)
  - Revenue bonds
  - Performance-based incentive contracts

- **Develop Implementation Plan**
  - Large meters first?
  - High cost meter read routes?
  - High demand meter read routes with NRW recovery?

- **Develop Business Case for Implementation Plan**
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<th>Task #</th>
<th>Description</th>
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<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
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<td>Obtain/review information</td>
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<td>2</td>
<td>Conduct functional workshop</td>
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<td>3</td>
<td>Define meter reading alternatives</td>
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<td>4</td>
<td>Collaborate with TEP</td>
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<td>5</td>
<td>Prepare cost evaluation</td>
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<tr>
<td>6</td>
<td>Prepare draft AMI Strategic Plan</td>
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<td>7</td>
<td>Attend management meetings</td>
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<td>8</td>
<td>Administer project execution</td>
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Overview of AMR & AMI Capabilities
Envisioned Future Electric Utility Smart Grid Capabilities

- Control of Customer End Use Devices to Reduce Peaks
- Real Time Pricing – Time of Day Rates
- Customer Profiling and Data Access
- Automatic Transmission/Distribution Control
- Infrastructure Pre-Failure Diagnosis

Which of the above are potential and desired capabilities for water utilities?
Why Meter?

- Equitable assignment of water cost.
- A water use history.
- Customer water auditing.
- A means of accurately analyzing growth areas.
- A signal of system water loss or leaks.
- Trends in water usage.
- A view of seasonal changes in water demand.
- Effects of system changes - rate hikes or conservation programs.
- Water use policing for conservation/drought management.
- Non-revenue water auditing.
Water Industry Meter Reading Averages

**Direct Read Meters (manual)**
- 200 to 350 reads per day

**Touch/Wand Reading Systems**
- 300 to 450 reads per day

**Radio Frequency – Handheld (walk-by mode)**
- 1,800 to 2,200 reads per day

**Radio Frequency – Mobile Interrogator (drive-by)**
- 6,500 to 8,000 reads per day

**Fixed Network (Advanced Metering Infrastructure)**
- Multiple reads per meter per day (24/7 upload)
What are AMR/AMI?

• AMR- Automatic Meter Reading technology used for automating collection of metered water consumption data for the purposes of real-time billing and consumption analysis

• AMI- Advanced Metering Infrastructure systems that measure, collect, and analyze water usage and other data through various communication media on request or on a pre-defined schedule
Typical AMI Technology: Fixed Network Architecture

Host Computer

Ethernet

Fixed Collection Unit

Endpoint
Components of an AMI System

- Meter register capable of producing a digital output
- Radio endpoint to transmit information from the meter to a collector and/or repeater
- Fixed tower collectors
- Mobile collector or data backhaul with a fixed system to return data to the office or host for reading database
- Meter Data Management (MDM) software to process reads for billing and data analysis
Some Major Driving Forces for Water Utility AMI

• Cost reduction in traditionally labor intense areas
• Reduction in fleet and fuel costs
• Carbon footprint reduction
• Water loss reduction and revenue recovery
• Improvement of customer service
• Access to customer-specific water usage data
• Customer notification of excess water use
• Water conservation
• Asset management – meters and transmission/distribution system
AMR/AMI Customer Profiling
Itron Hardware & Software Functionalities
Features of the 100W Endpoint

- Advanced features including:
  - Leak Flag
  - Cut Cable Tamper Flag
  - Reverse Flow Flag
  - Low Battery Alarm (20-year Itron warranty)
  - Daily Time Synchronization
- Auto-sensing for any encoder register – no programming makes installation and change-outs easy
- Compact and various mounting options
- Open architecture at the meter interface
- Compatible with fixed network, mobile, or handheld collectors
- Special data aggregation modes for meter right-sizing
- Option for acoustic leak sensing technology
Tucson Water’s Vision for Itron ChoiceConnect

- Web User/CSR Interface
  - Level 1 Solution
- Itron Hosted Server / Collection Engine
- Itron Hosted Analytics Software for Tucson Water
  - Level 2 Solution
- Mobile Reads and Fixed Network Reads to Tucson Water MVRS Software
- Tucson Water Billing System

Diagram:
- Tucson Water’s Vision for Itron ChoiceConnect
- Web User/CSR Interface
- Hosted Server / Collection Engine
- Analytics Software for Tucson Water
- Tucson Water Billing System
- Mobile Reads and Fixed Network Reads to Tucson Water
Meter Data Management System Considerations

- Far more than monthly billing reads
- Multiple metering systems
- Provider options
  - Utility builds it
  - Acquired/leased
  - Turnkey/hosted
- Integration with other systems (billing, SCADA, DMAs, system audits)

- Phasing and timing of deployment
- Operational ownership
- Applications development
- Maintenance & upgrade
- Reports, custom queries, data mining
- Migratability
- Expandability
- Customer data access
- Security
Functional Requirements Staff Workshop
Functional Requirements Staff Workshop held on February 13, 2013 (18 Stakeholder Attendees)

- Described AMI Strategic Plan goals and approach
- Reviewed functional requirements
- Solicited feedback and supplemented requirements
- Voted on the importance of each functional requirement

Need versus want? Unimportant?
• Short term (starting in 0-3 years)
• Long term (starting in >3 years)
Tucson Water Functional Requirements (>70% criticality)

1. Accurate, reliable readings for billing
2. Reliable and secure data storage and transmission
3. End to end cyber security
4. Public outreach/ marketing
5. Demonstrated migration path (drive by to fixed network w/o hardware change)
6. Easier/ faster high bill investigation
7. Stuck meter detection
8. City of Tucson AMI data hosting
9. Tamper detection
10. Customer consumption profiling
### Tucson Water Functional Requirements (cont’d)

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<tr>
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<td>Integration with asset management system</td>
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<tr>
<td>12.</td>
<td>Conservation monitoring and enforcement</td>
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<tr>
<td>13.</td>
<td>Integration with billing system</td>
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<td>14.</td>
<td>Customer-specific daily usage information</td>
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<td>15.</td>
<td>Theft of service detection</td>
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<td>16.</td>
<td>Both manual and AMI capability in the meter register</td>
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<td>17.</td>
<td>Distribution system leak detection</td>
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<td>18.</td>
<td>Customizable reporting and data mining</td>
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<td>19.</td>
<td>On-cycle and off-cycle meter reading</td>
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<td>20.</td>
<td>Real-time water quality monitoring</td>
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## Tucson Water Functional Requirements (cont’d)

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<tbody>
<tr>
<td>21.</td>
<td>Customer access to data</td>
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<tr>
<td>22.</td>
<td>Customer leak detection</td>
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<tr>
<td>23.</td>
<td>Noise-logging for leak detection (system and/or customer)</td>
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<tr>
<td>24.</td>
<td>Integration with SCADA</td>
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Economic Evaluation of Alternatives
Resultant Long-Term Four Meter Reading Alternatives

1. Maintain Existing System: Manual Read Plus AMR
2. All AMR
3. Hybrid System: AMR Plus AMI
4. All AMI
Monthly Meter Reading O&M Cost Considerations

- Monthly Meter Reading for Billing
- High Bill Investigation
- High Consumption
- Meter Lock Out
- Inactive Service With Consumption
- Meter Re-read
- Can't Read Meter
- Leak at Meter
- Test for Stuck Meter
- Turn On/Turn Off Meter
- Tampering Investigation
- 100W Data Logging
- Meter Master Data Logging
## Example Economic Assumptions

<table>
<thead>
<tr>
<th>Item</th>
<th>Assumptions for comparative analysis</th>
<th>Maintain Existing Hybrid System: Manual Read Plus AMR</th>
<th>All AMR (100W Drive By)</th>
<th>Hybrid System: AMR Plus AMI (Itron)</th>
<th>All AMI (Itron)</th>
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<td>Monthly reading frequency</td>
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<td>Hourly labor rate meter reader</td>
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<td>Hourly labor rate meter repairer</td>
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<td>High Bill Investigation (min/event)</td>
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<td>High Bill Investigation (event/month)</td>
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<td>High Consumption (event/month)</td>
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<td>Meter Lock Out (min/event)</td>
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<td>Meter Lock Out (event/month)</td>
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Endpoint Assumptions for 2023 Cost Comparison

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<tr>
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<th>Maintain Existing Hybrid System: Manual Read Plus AMR</th>
<th>All AMR (100W Drive By)</th>
<th>Hybrid System: 50% AMR and 50% AMI</th>
<th>All AMI</th>
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<td>Manual</td>
<td>167,579</td>
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<td>AMR Non-100W</td>
<td>23,108</td>
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<td>AMR 100W</td>
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<td>AMI 100W</td>
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<td>136,000</td>
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<td>Total</td>
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Next Steps

• Finalize assumptions
• Validate economic comparison
• Evaluate Tucson Electric Power network use feasibility and cost
• Prepare recommended plan
Feedback and Questions