This presentation premiered at WaterSmart Innovations

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Suspect Measurement of Customer Consumption: Customer Metering Challenges in the Drinking Water Industry

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IWA / AWWA Water Balance

- Unauthorized Consumption
- Customer Metering Inaccuracies
  - Poor installation
    - Meter failure (stopped meter)
    - Poor performance (low accuracy)
    - Wrong size of meter
    - Wrong type of meter for application
- Systematic Data Handling Error
- Unbilled Authorized Consumption
- Billed Authorized Consumption
- Water Losses
  - Real
  - Apparent
- Non-Revenue Water
  - Billed Water Exported
  - Billed Utilized Consumption
  - Unbilled Utilized Consumption
  - Unauthorized Consumption
  - Customer Metering Inaccuracies
  - Systematic Data Handling Errors
  - Leakage on Mains
  - Leakage on Service Lines
  - Leakage & Overflows at Storage

Water (allow for known errors)
Importance of Customer Meter Data

- Sends price signal to customers
- Basis of customer billing/revenue
- Water conservation
- Water loss control
- Hydraulic modeling (demands)
- Quantify community water needs:
  - Locally: infrastructure modeling/sizing
  - Regionally: water resources management
Customer Metering Applications

- Residential (small)
- Commercial/industrial (large)
- Fire Service
- Residential Fire Service
Apparent Loss from Meter Inaccuracy occurs due to:

- Poor Selection of Meter for the given application
- Poor installation
- Poor surveillance and management of the meter population
- Key focus areas
  - Small (residential) meters – less complexity (except for residential fire sprinkler systems)
  - Large (commercial, industrial) customers – greater complexity in management due to many different sizes and types of meters
Who conducts the meter installation?

How are permits issued for new installations?

Is there an inspection process?
Service Line Sizing and Metering of Large Customers

- AWWA M22 Publication provides guidance
- Historic guidance derived from Hunter Curves (1941)
- Guidance now results in many lines/meters being oversized relative to low consumption and peak flows
- New data collection and research is needed
- New guidance should be coordinated with governing plumbing codes and International Association of Plumbing and Mechanical Officials (IAPMO) – Pipe Sizing Task Group
- AWWA Customer Metering Practices Committee is striving to launch a data collection process to establish basis for an updated rational method for large meter and service line sizing
Positive Displacement meters – commonly used in the residential setting but also appears in larger sizes up to 2-inch

Turbine meters – designed to measure steady, moderate to high flows; often used for large sizes of 3-inch and up

Compound meters – designed to measure varying flows from low to high; used typically in sizes of 3-inch to 8-inch
Emerging Metering Technology

✦ Single Jet Meters
✦ Solid State Meters
  – Non-mechanical meters free of moving parts
  – Electro-magnetic meters
  – Ultrasonic meters
✦ Advantage: strong accuracy at both high and low rates of flow, even in large sizes
Electric Power Required
- Long Battery life is making these meters feasible for the retail customer setting
- Ultimate battery life “to be determined”
- Loss of power = loss of meter readings

Wave of the future – some manufacturers are moving away from mechanical meters
Coca Cola Bottling Plant
- 6-inch Sensus compound meter
- Data-logging data collection: Sept 2010

Wide variations in flowrate occur. This meter is adequately sized, but a different meter (single jet) might register more flow.
**PWD: Large Customer Meter Study**

- **Coca Cola Bottling Plant**
- **Time profile and economic analysis**
  - Potential payback in 0.6 year with single jet meter, which costs $4,050

**Projected Annual Savings**

<table>
<thead>
<tr>
<th></th>
<th>Monetary ($/year)</th>
<th>Volume (kgal/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensus Total Apparent Losses</td>
<td>$10,900.45</td>
<td>1,870.28</td>
</tr>
<tr>
<td>Actaris Total Apparent Losses</td>
<td>$3,562.33</td>
<td>611.22</td>
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<tr>
<td>Savings from switching from Sensus to Actaris</td>
<td>$7,338.12</td>
<td>1,259.06</td>
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</tbody>
</table>
St. Joseph’s University – Drexel Library – 3-inch ABB turbine meter

Note: flow through this meter is zero for 97% of the data-logged values. The above graph shows the profile for the remaining 3% of data values. This meter is dramatically oversized, but typical of many such buildings.
St. Joseph’s University – Drexel Library

Time profile and economic analysis

– Potential payback in 46 years with single jet meter, which costs $2,014
Service Charges – can be a disincentive to the water utility to right-size an over-sized meter

<table>
<thead>
<tr>
<th>Meter Size, in</th>
<th>Monthly Water Charge</th>
<th>Monthly Sewer Charge</th>
<th>Combined Monthly Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8</td>
<td>$6.46</td>
<td>$6.55</td>
<td>$13.01</td>
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<tr>
<td>3/4</td>
<td>$7.49</td>
<td>$8.04</td>
<td>$15.53</td>
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<td>1</td>
<td>$9.98</td>
<td>$11.39</td>
<td>$21.37</td>
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<td>1-1/2</td>
<td>$15.56</td>
<td>$19.24</td>
<td>$34.80</td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
<td>$39.64</td>
<td>$52.07</td>
<td>$91.71</td>
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<tr>
<td>4</td>
<td>$69.00</td>
<td>$89.15</td>
<td>$158.15</td>
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<tr>
<td>6</td>
<td>$133.60</td>
<td>$174.77</td>
<td>$308.37</td>
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<td>8</td>
<td>$208.47</td>
<td>$275.38</td>
<td>$483.85</td>
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<tr>
<td>10</td>
<td>$302.43</td>
<td>$398.07</td>
<td>$700.50</td>
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<tr>
<td>12</td>
<td>$530.00</td>
<td>$715.77</td>
<td>$1,245.77</td>
</tr>
</tbody>
</table>
If service charges are high then improved meter accuracy without a size change is an advantage.

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<th>Monthly Sewer Charge</th>
<th>Combined Monthly Charge</th>
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<tbody>
<tr>
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<td>$4.61</td>
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<td>$178.65</td>
<td>$5,901.45</td>
<td>$6,080.10</td>
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<tr>
<td>12</td>
<td>$305.82</td>
<td>$10,981.96</td>
<td>$11,287.78</td>
</tr>
</tbody>
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Customer Metering: Food for Thought

- Metering of customer consumption is beneficial for many reasons.
- Accurate customer metering can be compromised by:
  - Poor knowledge of meter population demographics by utility managers.
  - “Blind” adherence to traditional metering practices or manufacturer guidance.
  - Poor oversight of meter permitting, installation and data collection processes.
- Water utility managers can promote accurate metering by:
  - Proactive management of the meter population.
  - Transition from traditional guidance to emerging guidance for meter sizing and type.
  - Pilot new meter types, particularly if service charges are high.