Data-driven Approach to Reduce Apparent Losses
~ From America to Asia ~

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Apparent Losses Challenges

**PROBLEM**

- Apparent losses impact water and financial sustainability
- Average of 2% of top-line revenue is lost annually via apparent loss issues

Hidden Revenue Locator – Customer Metering Inaccuracies
Thousands, tens-of-thousands, or even hundreds-of-thousands of meters in a water system.

*How do I know which meters are underperforming and losing revenue?*
**Reinventing Meter Asset Management Strategy**

**Status Quo State**

Typical Strategies:
- Meter replacement schedules based on meter age and/or throughput
- Bench testing a very small percentage of meters and drawing assumptions based on results
- Meter replacement at failure

**Data-Driven Approach**

- Meter replacements based on asset performance
- Replacement budgets guided by number of inaccurate meters in the system and expected payback scenarios
- Trackable and quantifiable impact on Apparent Loss reduction

**Status quo:** 6-10% of meters actually require replacement

**Future State:** a proven 4x improvement over current meter management practices
Solving Apparent Losses with Data-driven Approach

- Quantifies the apparent loss for prioritization, meter-by-meter
- Locates meter under registration, leaks, data errors and unauthorized consumption
- Locates issues on up to 5% of meters to recover 1.5% top line revenue, annually.
- Empowers proactive revenue recovery and operational efficiency

**SOLUTION**

Data Inputs

- Machine learning/AI
- Industry Intelligence

Dashboards

- Operational Interventions

- Revenue Recovery
- Operational Efficiency
- CAPEX Deferment
Case Study

Clayton County Water Authority (CWWA)
Case Study on Clayton County Water Authority (CWWA)

Background
- Provides water, sewer, and storm-water services
- 85,150 meters, mostly mechanical
- 2,449 are commercial meters
- AMR – monthly readings (installed 2006-2010)
- $110M in revenue, $24M capital/year

Challenges
- Reactive ‘top down’ water audits
- Large data volume challenges
- Need timely and trusted data insights
- No structured meter replacement program backed by data

Goals
1. Pro-actively manage ~2500 commercial meters.
2. Recover revenue from under-performing meters
3. Use innovative technologies to improve operational performance
Previous approach to **meter management** and **apparent losses** at CCWA:

- Random meter accuracy testing and replacement.
  - **Select 100 large meters** (1.5” and greater) randomly and test them
  - Only ~5 meters/year would fail test and be replaced
  - Water audit results based on small random sample – many decisions made based on this data.

**Takeaway:** Standard methods incur the cost of 100 truck rolls and tests but provide minimal benefits.
How can CCWA *proactively* manage apparent loss to yield benefits such as:

- Improving revenue assurance
- Apparent loss reduction
- Improved capital planning
- Better operational efficiency

A program was established using Hidden Revenue Locator:

- Phase 1 (2016) – All meters in the system
- Phase 2 (2017) – 1.5 and 2-inch meters
- Phase 3 (2018-current) – All large meters (1.5 inch and above)
Indicators of Water Meter Anomalies

1. **Water Meter Under-Registration:** Detects meters registering less water than actual flow through the meter.

2. **Water Meter Read Errors:**
   Detects:
   - Negative reads
   - Anomalous consecutive zeros
   - Implausible reads

3. **Meter Right-Sizing:**
   Detects when a meter is too large or small for its water demand.
**Goal:**
To detect meters registering less water than actual flow through the meter.

**Why?**
About 5% of mechanical meters under-report consumption – but it is hard to identify which ones are degrading.

Age alone does not predict when meters will degrade.

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**How is this better than traditional meter replacement practices? (E.g., age-based sampling)**

- Analyzes each meter and service area to understand customer behavior (e.g. weather, conservation).
- Filters out expected short-term changes in water consumption (e.g. changes in occupancy).
- Analyzes multiple under-registration factors (age, throughput, and others).

3-6x as effective at identifying degrading meters as standard utility practice.
Meter Under-Registration Algorithm

![Graph showing Meter Read Volume, Scaled Volume, Predicted, Flag Start Date, and Revenue Discrepancy with dates from 06/01/2014 to 06/11/2017.]
2. Water Meter Read Errors

**Goal:**
To detect anomalous meter reads (negatives, high reads, unexpected zeros) which indicate a meter issue.

**Why?**
High accuracy method for detecting mechanical or communications issues, incorrect account data, or meter network failures.

How is this better than traditional identification practices? (E.g., exception reports, meter/AMI alarms)

- **Looks for severe, ongoing, repeated issues** — not small/non-issues
- **Filters out expected short-term changes in water consumption** (e.g. changes in occupancy)
- **Factors in past behavior to filter out seasonal trends** (i.e. vacation homes)
- **Creates prioritized list of most urgent and actionable issues** to save you time & money
3. **Water Meter Right-Sizing**

**Goal:**
To detect incorrectly sized meters.

**Why?**
Meters that are too large may not register low flows, losing revenue. Meters that are too small will degrade rapidly and start to under-register or fail completely.

**How is this better than traditional identification practices?** (E.g., relying on customer requests to downsize)

- More granular insight available with AMI data
- Creates list of meters to monitor with data loggers
- Extrapolates hourly usage profiles from historical consumption at meter
- Compares to AWWA specifications for max/min recommended for meter type and size
# Dashboard: Issue Overview

## Meters for Investigation

**Filter by:** Ongoing, To Review, Selected For Investigation, Investigated

### Key Metrics
- **Revenue Loss To Date:** $1,605,071
- **Volume Loss To Date:** 279,761,716 GAL
- **Ongoing Issues:** 227

### Issues

Showing 1 to 10 of 227 results

<table>
<thead>
<tr>
<th>Issue Start Date</th>
<th>Volume Lost To Date (GAL)</th>
<th>Monthly Revenue Risk (USD)</th>
<th>Meter Id</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/12/2015</td>
<td>215,793,664</td>
<td>$26,130 *</td>
<td>0070944814</td>
<td>5546 Michelle Terrace, South Conception</td>
</tr>
<tr>
<td>01/25/2012</td>
<td>12,596,811</td>
<td>$2,015 *</td>
<td>001596970B</td>
<td>343 Kozey Plaza, Ogaport</td>
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<tr>
<td>02/15/2012</td>
<td>11,393,219</td>
<td>$1,687</td>
<td>0001596970</td>
<td>3700 Schmeler Pike, West Shannon</td>
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<tr>
<td>04/12/2015</td>
<td>6,440,072</td>
<td>$774 *</td>
<td>006384974A</td>
<td>8349 Gidason Square, South Conception</td>
</tr>
<tr>
<td>03/23/2018</td>
<td>2,385,087</td>
<td>$1,198 *</td>
<td>0072796360</td>
<td>4606 Morton Viaduct, West Shannon</td>
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<tr>
<td>06/15/2015</td>
<td>1,790,834</td>
<td>$319 *</td>
<td>006566998C</td>
<td>4182 Harvey Ferry, Ogaport</td>
</tr>
<tr>
<td>01/25/2012</td>
<td>1,707,895</td>
<td>$181 *</td>
<td>0030478455</td>
<td>5985 Lawrence Junction, Ogaport</td>
</tr>
</tbody>
</table>

### Filters

- **Issue Type**
- **Location Group**
- **Customer Type**
- **Meter Size**

### Investigation Status

- To Review
- Selected For Investigation
- Investigated
- Correct
- Unverifiable
- Postponed
- Ignored

[Apply Filters]
Dashboard: Information for Action

Meter Under-Registration

February 08, 2012 - Present

Issue Details
- Meter ID: 001596972C
- Premise ID: 46364
- Location: 5346 D’Amore Bridge, West Shannon

Other Issue Details

Impact Details

<table>
<thead>
<tr>
<th>Revenue Loss</th>
<th>Volume Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total To Date</td>
<td>Total To Date</td>
</tr>
<tr>
<td>$308,766</td>
<td>55,158,348 GAL</td>
</tr>
<tr>
<td>Risk Per Month</td>
<td>Risk Per Month</td>
</tr>
<tr>
<td>$4,668</td>
<td>821,838 GAL</td>
</tr>
</tbody>
</table>

Usage

Volume in GAL

Monthly

Xylem
Let’s Solve Water
### Investigation Results

This feedback helps you track the ROI of your program.

**Select Meter Type** *  
**Select Test Date** *  

- Ran the Low Flow test before any High Flow test

### Flow Rates

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Accuracy</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Investigation**  

We highly recommend you investigate this issue:

- Follow our Investigation Best Management Practices and AWWA Requirements.
- Roll a truck and perform a visual inspection.
- Test meter accuracy in place with a known meter.
- Click below to enter investigation and flow test results.

**Add to Investigation List**  
**Enter Results**  
**Add Note**  
**Postpone**  
**Ignore**

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**Investigation**  

- * Investigated

**Flow Test Results: Accuracy at Tested Rates**

- **Reported:** August 28, 2019, 5:11 PM
- **Low:** 0.25 GPM 95.00%  
- **Medium:** 2.00 GPM 99.00%  
- **High:** 10.00 GPM 99.90%

**Add Note**
CCWA – Insights from Large Consumption Meters Analysis

1. High Revenue Impact from Commercial Meters

- 67% of revenue gains are from **16 large meters** equating to **$195,553** in incremental revenue gains over next 24-mo
- 33% of revenue gains are from **61 small meters** equating to **$91,883** in incremental revenue gains over next 24-mo

- Continue taking proactive action on commercial meters due to high revenue impact
- CCWA is in their 4th year of using Valor’s Hidden Revenue Locator product.
2.

**Revenue Discrepancy** of 30 flagged meters: **USD $622,759**

**Incremental revenue** value of 30 flagged meters: **USD $270,360**

<table>
<thead>
<tr>
<th>Meter Population Analysed</th>
<th>Meters Flagged</th>
<th>Meters Validated</th>
<th>Correct Predictions</th>
<th>Replacement Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,439 large meters</td>
<td>94 meter flags</td>
<td>74 meters tested</td>
<td>30</td>
<td>42% (compared to 6% status quo)</td>
</tr>
</tbody>
</table>

- Revenue discrepancy from start of issue identification to current date: **USD $622,759**
- 24-Month incremental revenue gain: **USD $270,360**
Bringing Digital to Asia
Applying Digital Solution in Asia Context

Challenge 1
Low Water tariffs
In Asia, water tariffs are lower due to high government subsidies. This results in lower value in revenue recovery.

Challenge 2
Bulk Replacement of Meter Fleet
Meters with high degradation rate and less advanced meter replacement strategy results in high CAPEX on large fleet replacement

Challenge 3
Less Guidance from Regulators
Regulators are less mature in providing guidance on good standard practices to manage meters

Opportunity 1
Focus on Large Consumption Users
Greater interest to focus on commercial and industrial accounts which consume larger amounts of water and meters degrade faster

Opportunity 2
Better CAPEX Planning
Replace meters only when they are identified as degraded. Better CAPEX planning and a more transparent replacement methodology

Opportunity 3
Guidance by Data-driven Insights
Utilities can develop good strategy by themselves with support from decision intelligence solution
Opportunity 1: Focus on Large Consumption Users

Illustrative Example

Total Meter Fleet Size: 800,000 accounts
Total Annual Revenue: USD $300 million
Commercial Meter Fleet Size: 40,000 accounts (5% of total)
Commercial Meter Revenue: USD $ 120 million (40% of total revenue)
  • Higher tariff for commercial use
  • Higher consumption

Value Calculation
Assumption: Recover 1.5% with HRL
Total commercial revenue recovered: USD $ 1.8 million
Total domestic revenue recovered: USD $ 2.7 million
Commercial revenue recovered per meter: USD $ 45 per meter
Domestic revenue recovered per meter: USD $ 3.55 per meter
Opportunity 2: Better CAPEX Planning

Illustrative Example

Total Meter Fleet Size: 1,000,000 accounts
Current Meter Replacement Strategy: >8 years
Average No of Meters Replaced Annually: 125,000 (12.5% of total)
CAPEX: USD $3.1 million (Assume USD $25 per meter)

Value Calculation

Analysis of 20,000 Meters → 2,500 meters > 8 years
Total number of anomalous meters > 8 years: 410 (16%)

New Replacement Strategy: Data-driven results
Number of Meters Replaced Annually (full fleet): 100,000 (10% of total)
Capital Deferment: At a replacement cost of USD $25 per meter this would save the utility USD $625,000 per year.
Value Summary of a Data-driven Meter Management Approach

Revenue Recovery
Identify and recapture up to 1.5% of annual top-line revenue being unbilled

Operational Efficiency
Locate specific revenue and volume loss issues with individual meters, creating a prioritized, data-driven meter asset program

CAPEX Planning
Avoid unnecessary repair and replacement of functioning meters. Re-design an optimal meter replacement strategy