Data Integration Solutions for Effective Utility Management
Progression towards Smart City Implementation

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2014 Ohio WEA-AWWA Technical Conference and Expo
3:30pm Wednesday August 27th, 2014
About the Presenter
Steven Callahan

Steven Callahan is a Business Development Manager for Schneider Electric's Water Wastewater Competency Center focusing on the Ohio Valley and Nashville regions. Steven has over 14 years of experience working in technology solution sales for local, state, and federal government agencies. Mr. Callahan has a Bachelor of Science degree in Technology from Bowling Green State University and is a member of the American Water Works Association’s Ohio Section. He is based in Columbus, Ohio.
“A smart city is characterized by the integration of technology into a strategic approach to sustainability, citizen well-being, and economic development.”

What drives cities to become smarter?
The Energy challenge and the cities

Cities today...

- Earth’s surface: 2%
- World population: 50%
- Global energy consumption: 75%
- Global CO₂ emissions: 80%

...and by 2050

- World population: 70%
- Years to double the urban capacity developed over the past 4000 years: 40 years
Cities must become smarter by becoming more efficient, more sustainable and more liveable.

- **Efficient**
  - Better information sharing
  - Increased control over city systems

- **Sustainable**
  - Reduced Carbon emissions and energy consumption
  - Decreased need for massive infrastructure investments

- **Liveable**
  - Higher quality of life for city residents
  - Increased global competitiveness
AGENDA

- Smart City Overview
- **Smart Water Networks**
- Effective Utility Management
- Data Solutions for Smart Utility Implementation
- Questions & Discussion
Rising Consumption Levels
Growing Pressure on Infrastructure
Increasing Water Consumption
Inefficient, Overloaded & Aging Infrastructure
Inadequate, Overloaded & Aging Infrastructure
Economic Pressure on Cities
Increasing Scarcity of Resources
Increasing Water Hazards & Urban Flooding
Need for Dependable, High-Quality Water
Pressure to Improve Efficiency & Reduce Operational Costs
Demand for Better City Services
Increasing Scarcity of Water Supplies
Economic Pressure on Cities
Effects of Climate Change
Growing Pressure on Infrastructure
Increasing Pressure on Infrastructure
Economic Pressure on Cities
Increasing Scarcity of Resources
Rapidly Rising Urban Population
The Drivers for Smart Water Networks
Efficiency!
A Smart Water Network is a key component of a Smart City.
Why Change How We Operate?

- Total energy consumption of U.S. water utilities is estimated to be 56 billion kWh, equaling $4 billion annually in operational expenditures\(^1\).

- California’s water and wastewater utilities energy consumption comprise 19% of the total energy usage in that state\(^2\).

- Between 5-10 billion Kw/h of power generated in the U.S. is spent in water that is either leaked or not paid for by customers\(^3\).

- The U.S.G.S. estimates that water lost from water distribution systems is 1.7 trillion gallons per year at a national cost of $2.6 billion per year\(^4\).

Sources:
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Smart City Overview

Smart Water Networks

Effective Utility Management

Data Solutions for Smart Utility Implementation

Questions & Discussion
Effective Utility Management - Attributes
Effective Utility Management

- Real-time measurement and response to product quality
- Avoidance of compliance violations
- Minimize service interruptions
- Fewer complaints
- Faster service response
- Better problem identification

Product Quality

Customer Satisfaction

Effective Utility Management

- Water Resource Adequacy
- Community Sustainability
- Operational Resiliency
- Infrastructure Stability
- Financial Viability
- Employee & Leadership Development
- Operational Optimization
- Stakeholder Understanding & Support
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Effective Utility Management

- Enhanced communication of information
- Employee satisfaction
- Higher skilled workforce
- Education and training
- Staff efficiency
- Process optimization
- Energy optimization
- Consumables optimization

- Minimize O&M expenditures
- Risk and Asset management
Effective Utility Management

- Real-time measurement and historical logging
- Access to information
- Building automation
- Energy monitoring
- Risk management
- Emergency preparedness
- Asset management
- Increased lifespan
- Predictive maintenance
- Lower maintenance costs
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Data Solutions for Smart Utility Management

Many Different Sources of Information are possible…

- FLOW / PRESSURE METERS
- ACOUSTIC SENSORS
- WATER QUALITY SENSORS
- DATA LOGGERS
- SCADA
- AMR/AMI
- UTILITY DASHBOARDS
- GIS AND SCHEMATIC TOOLS
- ASSET MANAGEMENT
- PUMP OPTIMIZATION
- HYDRAULIC MODELING
- WORKFORCE TOOLS
- LEAK DETECTION SOFTWARE
- ALERT SYSTEMS
Geographical Information System-based solutions that provide a single version of the truth—supporting coordinated decisions across a utility’s entire enterprise

Water network management through data collection, measurement and analysis—ensuring optimal efficiency, longevity and reliability

Energy and process management to help meet demand, maximize resources, reduce costs and emissions, and ensure regulatory compliance

Storm water and urban flooding management with highly accurate flow and capacity information, simulation tools, and precipitation forecasts—for better preparation and response

Water loss management and leak detection using real-time data and model network simulations to identify and resolve problems—improving service
Display of SCADA on GIS screens or vice versa can easily be accomplished.

Ties static data such as asset location with status info in the SCADA.

Provides a key link between supervisory operations and business decisions.
SCADA + ASSET MANAGEMENT
SCADA + Asset Management

- Can drive more data that managers can use while breaking down the typical silos that exist within a utility.
- Allows important information to be shared across departments.
- Can help achieve a city’s energy efficiency goals by monitoring key assets at each plant.
- Key assets could be ones that use a tremendous amount of energy such as pumps and blowers.
- Dashboards with KPIs listed can help determine which assets to focus on.
Their (Des Moines) initial plans were to optimize performance of assets that are energy hogs (blowers and pumps) but they discovered that, in the case of four of their 2,000 hp blowers, just knowing which units were operating most efficiently and using those units as the primary air movers provided results that exceeded their initial project goals.

Just understanding what they were already doing well contributed significant returns. Being able to detect process deterioration is also of high value, which the KPI dashboard can alert them to.

This integration has resulted in annual energy savings of $40,000 at one plant alone.
SCADA + HYDRAULIC MODELING
20% INVESTMENT 80% DISTRIBUTION NETWORK

20% WATERWORKS

SCADA SYSTEM

AQUIS Operation
SCADA + Hydraulic Modeling

➢ Better overview and improved operation of water distribution system

➢ By using live SCADA data a hydraulic model can be transformed from a planning tool to a decision making tool

➢ Quick assessment of required action

➢ Not dependent on specialists
SCADA + Hydraulic Modeling

▶ Pressure Control
  • Reduction in loss of water
  • Reduced number of new leaks
  • Less use of energy for pumping
  • Less CO₂ emission
  • Less wear on pumps

▶ Graphical overview of zones
  • Quick reaction
  • Correct and qualified reaction

▶ Contingency Planning

▶ Expected savings
  • 10% reduction or more in NRW
  • ROI in 18 months is common
SCADA + AMR / AMI
AMI extends current advanced meter reading (AMR) technology by providing two way meter communications, allowing commands to be sent toward the home for multiple purposes, including “time-of-use” pricing information, demand-response actions, or remote service disconnects.

- Improved understanding of water consumption and flow patterns
- Increased revenue (less unaccounted for water)
- Reduced meter reading costs
- Provides outage detection and management
Could be accomplished through a performance contract
  • Depends on a utility’s existing level of non-revenue water

AWWA Water Audit Form
  • Water Supplied
  • Authorized Consumption
  • Water Losses
  • System Data
  • Cost Data
  • Additional Info (leak detection capabilities, SCADA, etc)
SCADA + LEAK MANAGEMENT
Leak Management

Reduction of Non-Revenue Water

- **Problem:** Lost revenue due to aging infrastructure and meter inaccuracies. Bad public image and increasing regulation add stress to the problem.

- Water utilities average 15%-25% non-revenue water.
Leakage Management Modules

- Leakage Calculation
- Active Leakage Control
- Pressure Management
- Repair Management
- Asset Management
- Business Intelligence
The water industry encourages utilities to develop and use KPIs to identify areas of improvement, define realistic targets, design action plans, and track improvements over time.

<table>
<thead>
<tr>
<th>KPI</th>
<th>Description</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disruptions of water service</td>
<td>Number of customers experiencing service disruptions per 1,000 active customer accounts</td>
<td>The joint use of GIS, OMS, and CIS systems provides the quantification of customers affected by outages or by planned repairs</td>
</tr>
<tr>
<td>Distribution system water loss</td>
<td>Percent of drinking water placed into distribution that does not find its way to customers or other authorised users</td>
<td>Data from SCADA, billing/CIS, CMMS, and other sources managed by different departments within the organisation to build a comprehensive water balance</td>
</tr>
<tr>
<td>Water distribution system integrity</td>
<td>Number of breaks and leaks requiring repair per 100 miles of distribution piping</td>
<td>The quantification of the number of pipe breaks requires data coming from OMS/CMMS and GIS systems</td>
</tr>
</tbody>
</table>
Additional Possible Benefits or Uses of Integrated Data

➢ General
  • Maintenance Planning with respect to weather and lightning
  • Energy Management Benchmarking

➢ Water
  • Unidirectional Flushing Program planning
  • Raw Water Reserve, Potable Water Reserve, Current Demand, Current Production, Days of Water Reserves at current demand, etc.

➢ Wastewater
  • Collection System Flow Equalization
  • Wet Weather Flow Infiltration

➢ Stormwater
  • Public and Private Rainwater Catch Basin Control and optimization to reduce energy and minimize environmental impact
Modern day utilities collect data from various systems such as SCADA, AMR, GIS, hydraulic modeling, etc.

Data integration solutions provide valuable and innovative tools within all ten attributes of Effective Utility Management.

Proper data integration solutions are some of the first miles on the roadmap to becoming smart cities of the future.

Smart Water leads the way in providing increased reliability, operational efficiency, security, and safety.
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Questions & Discussion
Questions?

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