Data Integration Solutions for Effective Utility Management

Progression towards Smart City Implementation

One Water

2014 Ohio WEA-AWWA

Technical Conference and Expo

3:30pm Wednesday August 27th, 2014

Presented Steven Callahan

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Schneider Electric

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.

AGENDA

- Smart City Overview
- Smart Water Networks
- Effective Utility Management
- Data Solutions for Smart Utility Implementation
- Questions & Discussion

“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?

Schneider Electric

The Energy challenge and the cities

Cities today…

Earth's surface **2%**

World population **50%**

Global energy consumption **75%**

Global CO_2 emissions **80%**

…and by 2050

70% World population

40 Years to double the urban capacity developed over the past 4000 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

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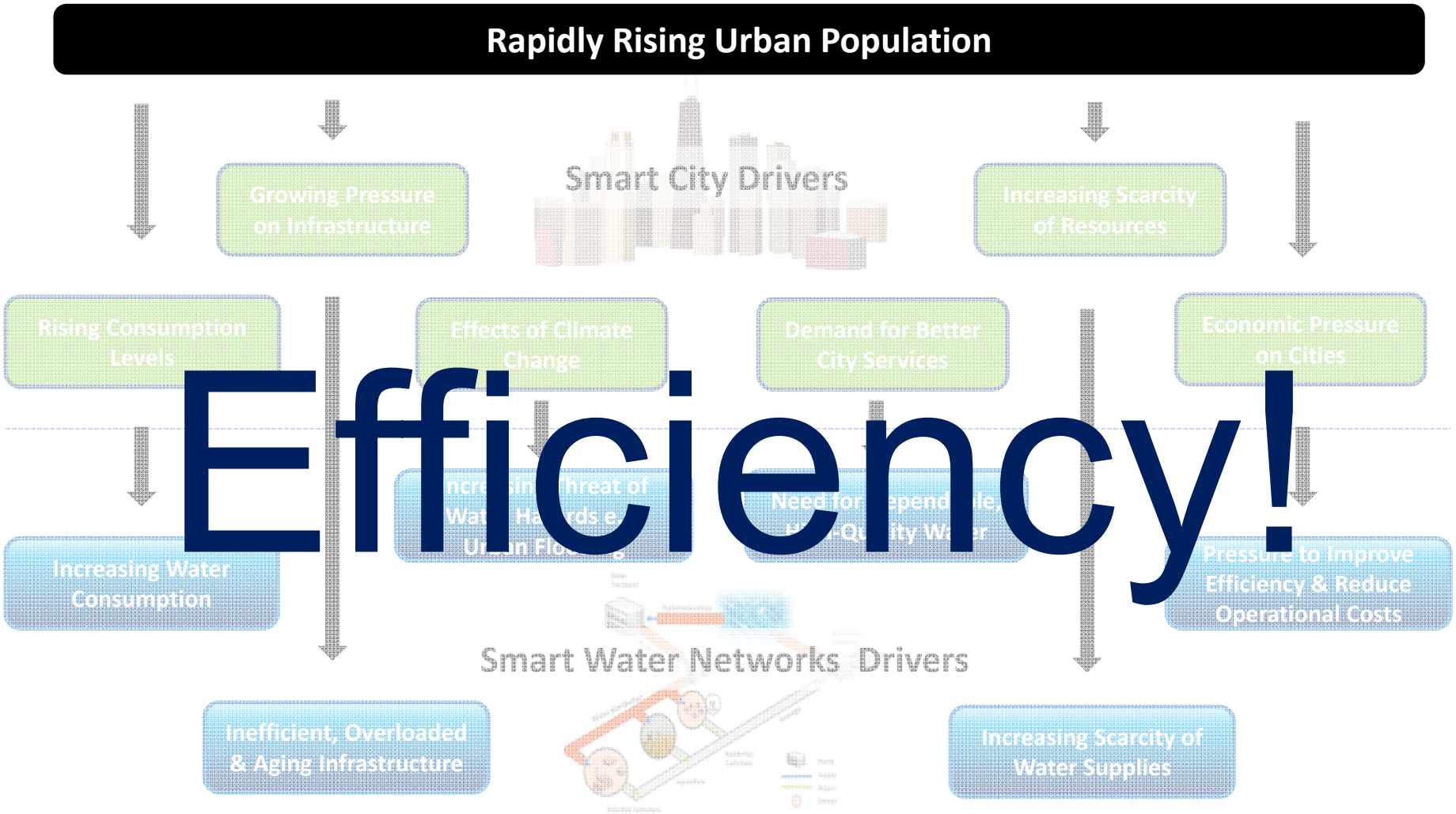
The Drivers for Smart Water Networks



Efficiency!

The Smart City / Smart Water approach

Traditional Approach	Smart Approach
Increased demand met by building more capital-intensive infrastructure	Increased demand met by making infrastructure more efficient, not larger
Departments operate in silos with little or no information sharing	Information sharing enables coordinated action and minimized network disruptions
Tons of data collected by systems but not used	Decision support & business intelligence tools used to optimize performance

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:
(1) Environmental Protection Agency (EPA), "Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities", 2008
(2) California Energy Commission. "California´s Water- Energy Relationship. Final staff report. CEC 700–2005–011 SF", 2005
(3) American Water Works Association, Manual of Water Supply Practices " Water Audits and Loss Control Programs ", 2009
(4) Environmental Protection Agency (EPA), Aging Water Infrastructure Research Program, "Addressing the Challenge Through Innovation" March 2007.

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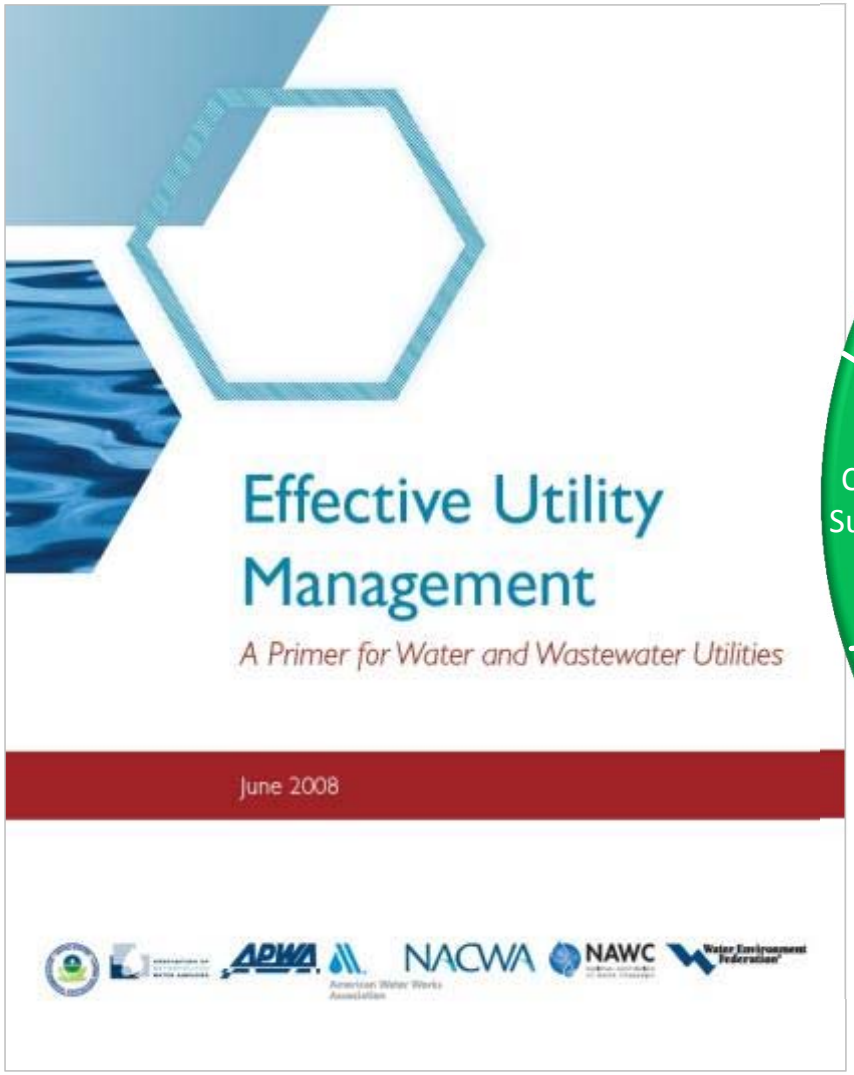
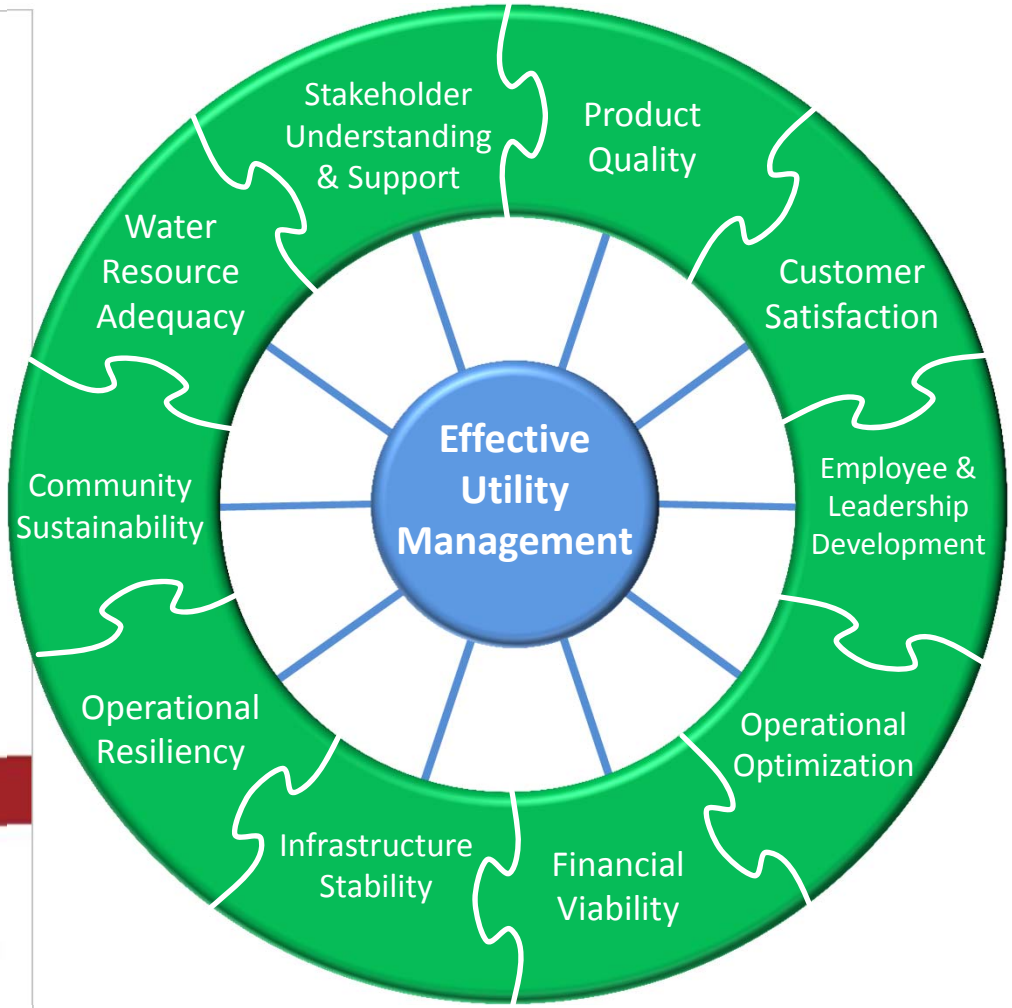
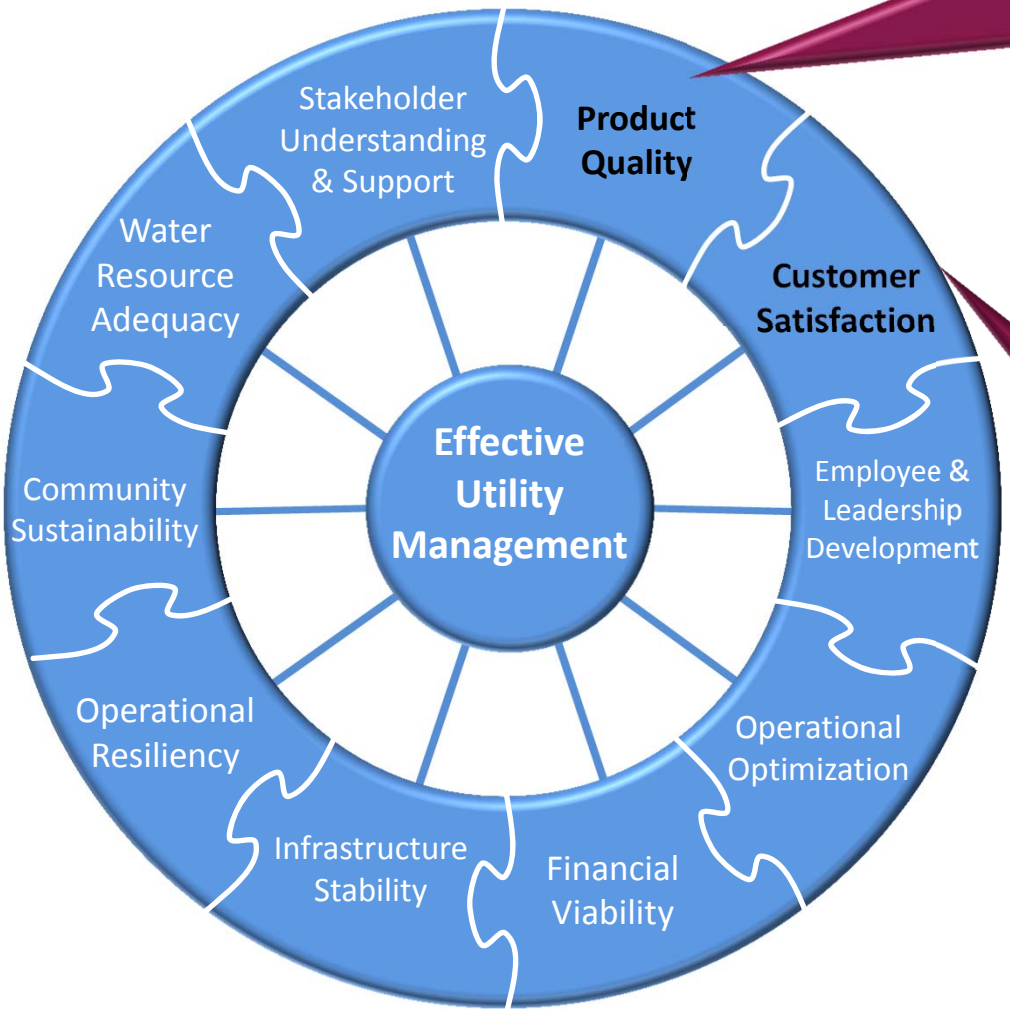
Effective Utility Management - Attributes





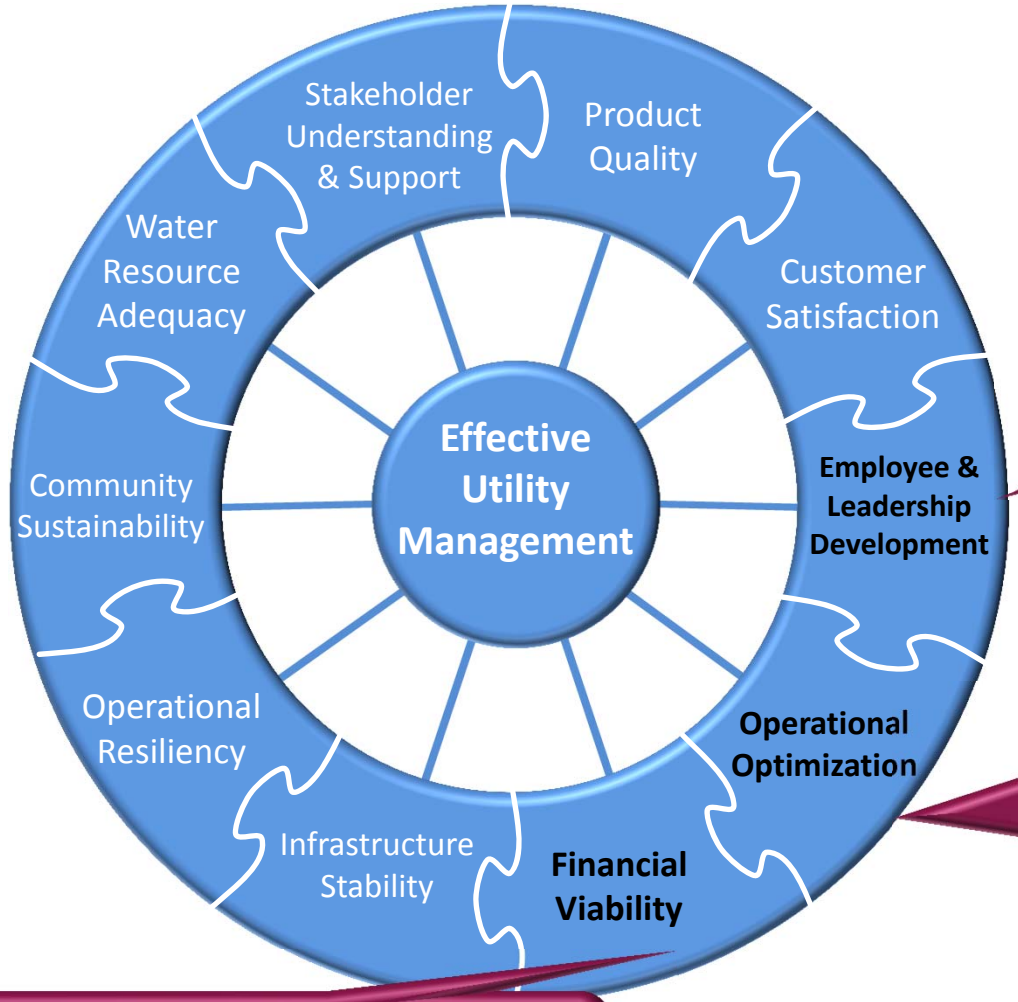
Effective Utility Management



- Real-time measurement and response to product quality
- Avoidance of compliance violations
- Minimize service interruptions

- Fewer complaints
- Faster service response
- Better problem identification

Effective Utility Management



- Enhanced communication of information
- Employee satisfaction
- Higher skilled workforce
- Education and training

- Staff efficiency
- Process optimization
- Energy optimization
- Consumables optimization

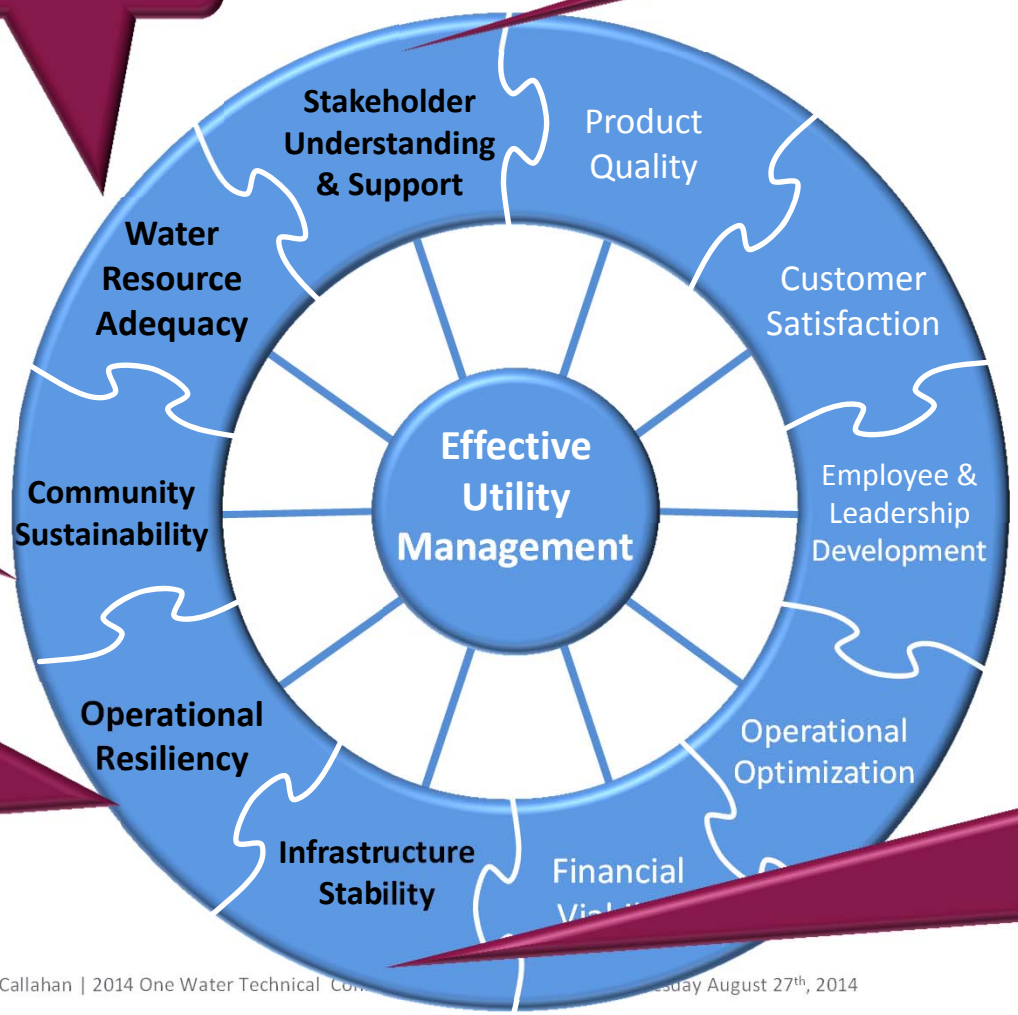
- Minimize O&M expenditures
- Risk and Asset management

Effective Utility Management

- Access to information

- Real-time measurement and historical logging

- Building automation
- Energy monitoring



- Risk management
- Emergency preparedness

- Asset management
- Increased lifespan
- Predictive maintenance
- Lower maintenance costs

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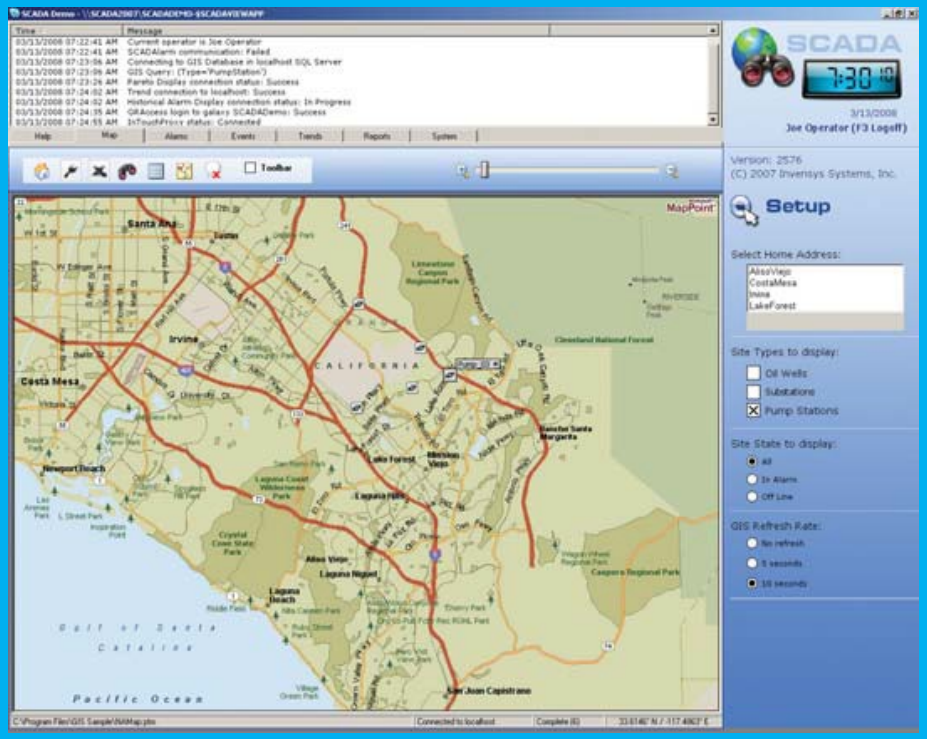
Data Solutions for Smart Utility Management

> **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

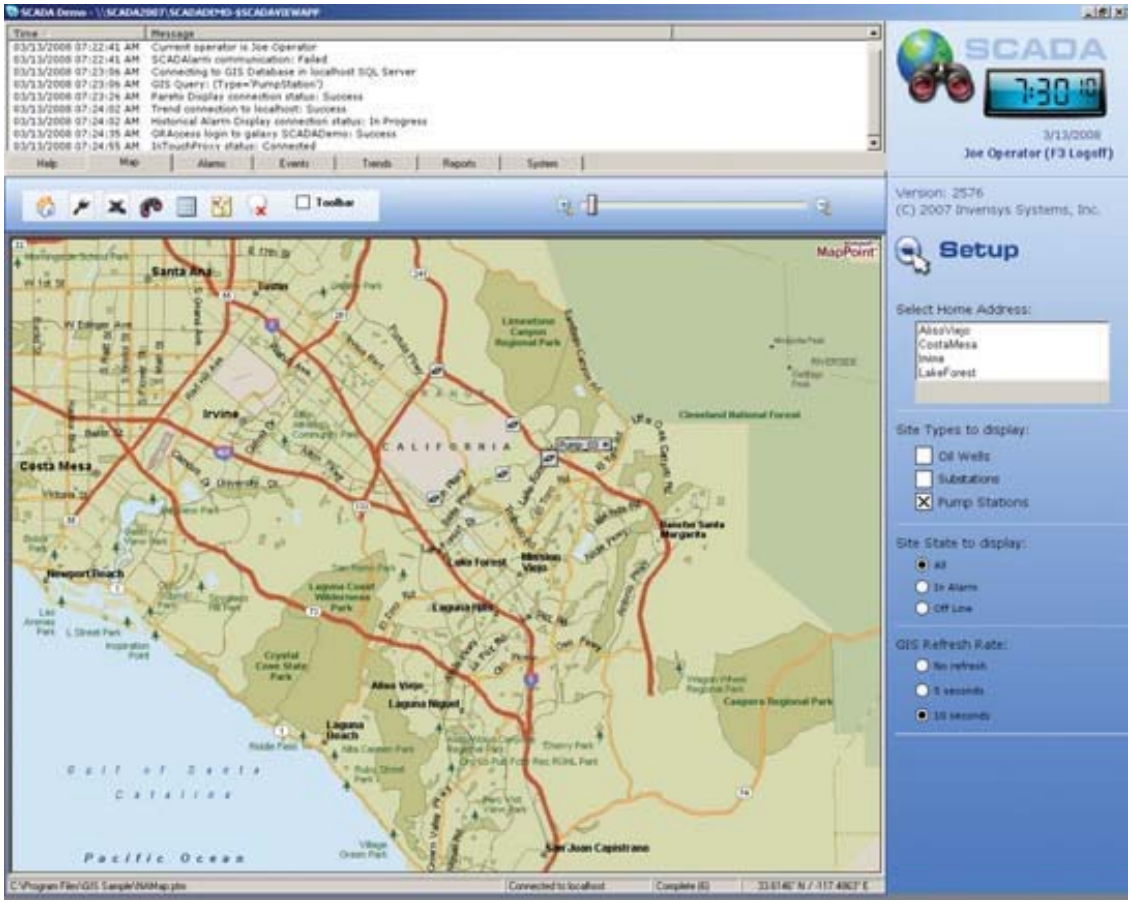
Data Solutions for Smart Utility Implementation

- 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


SCADA
Setup
Joe Operator (F3 Logoff)
Version: 2576
(C) 2007 Invensys Systems, Inc.
Select Home Address:
Site Types to display:
Oil Wells
Substations
Pump Stations
Site State to display:
GIS Refresh Rate:
Santa Ana
Irvine
Costa Mesa
Newport Beach
Lake Forest
Laguna Hills
Laguna Beach
San Juan Capistrano
CALIFORNIA
Pacific Ocean
MapPoint

SCADA + GIS

SCADA + GIS



- 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

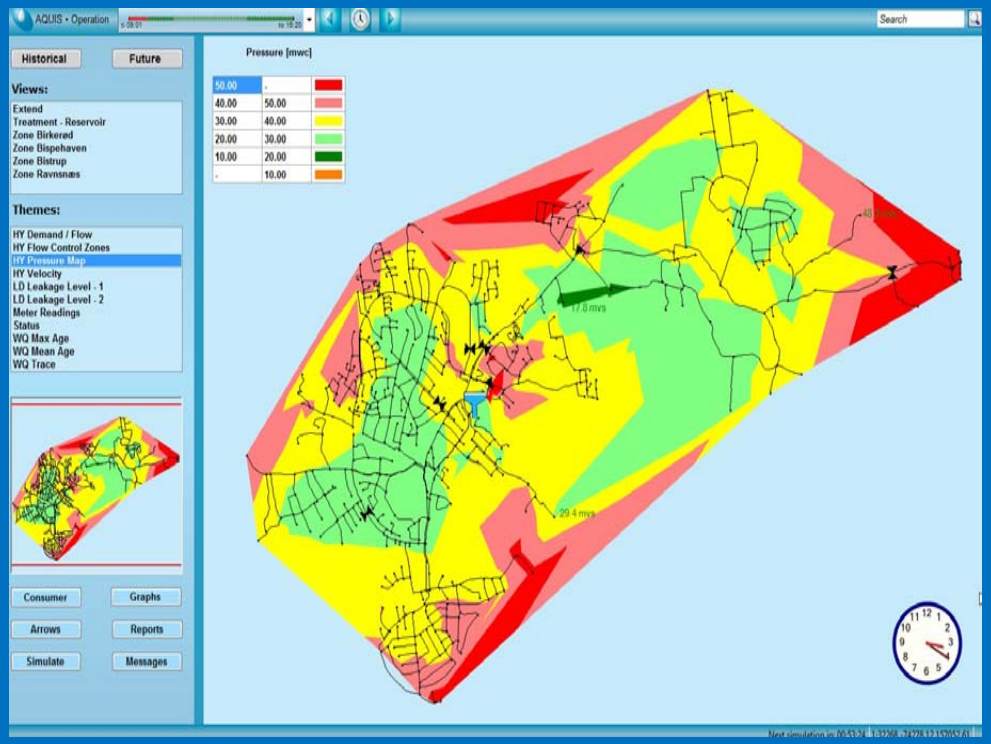
SCADA + ASSET MANAGEMENT

SCADA + Asset Management

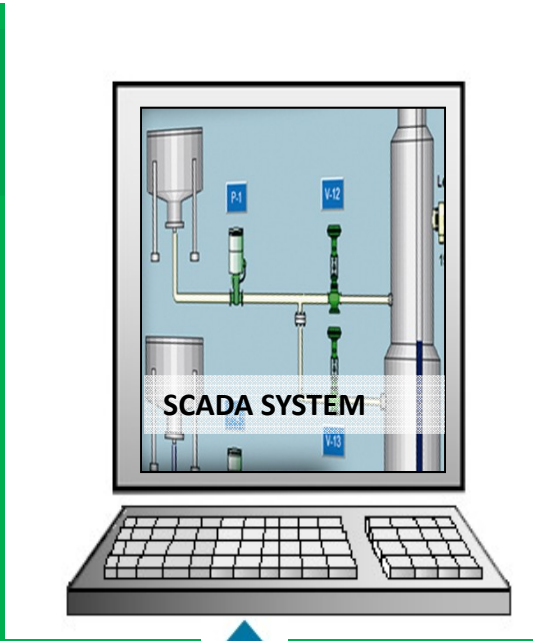
- Can drive more data that managers can use while breaking down the typical silos that exist within a utility.
- Allows important information to be shared across departments.
- Can help achieve a city's energy efficiency goals by monitoring key assets at each plant.
- Key assets could be ones that use a tremendous amount of energy such as pumps and blowers.
- Dashboards with KPIs listed can help determine which assets to focus on.

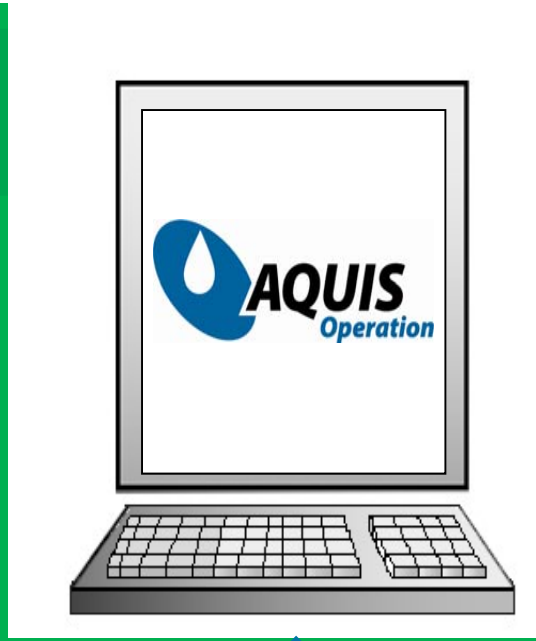
SCADA + Asset Management - Des Moines, IA

- 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

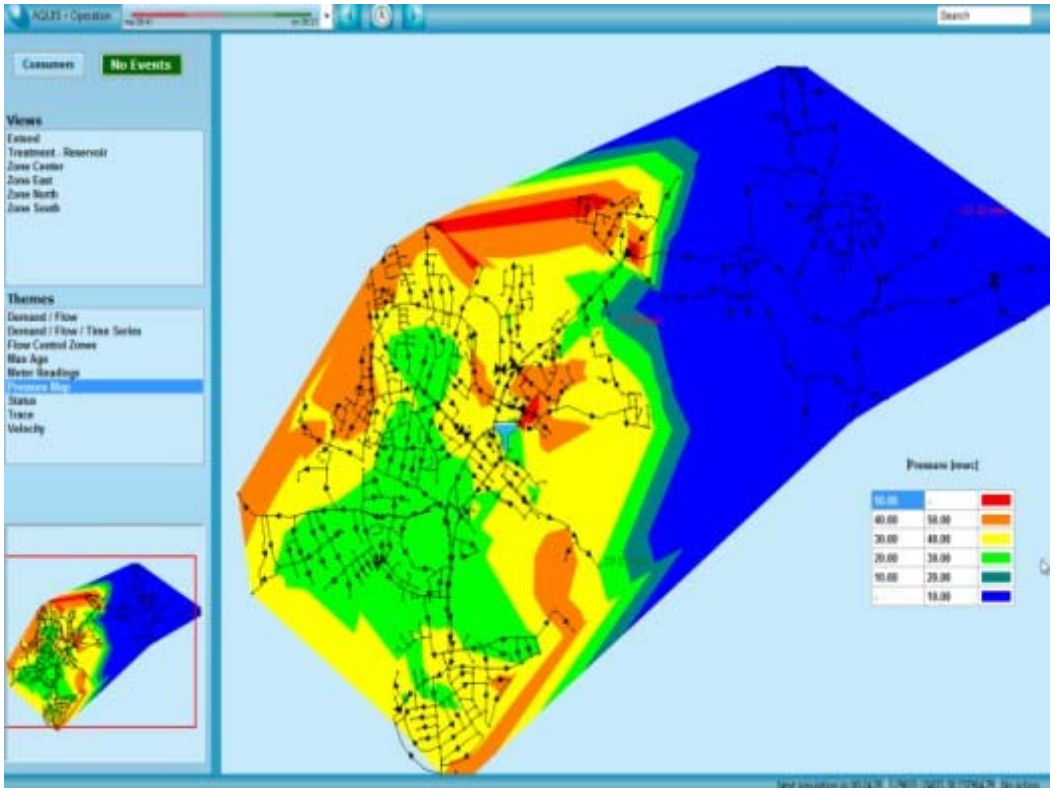




20 % **INVESTMENT** **80 %**

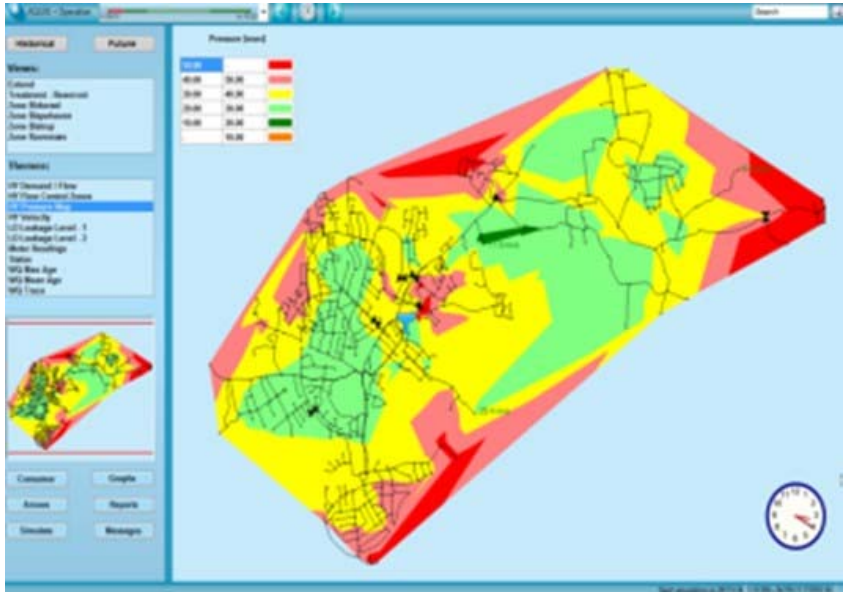
SCADA + Hydraulic Modeling

- 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 CO_2 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



AQUIS • Operation

ti 09:01 to 15:20

Search

Historical | Future

Views:

- Extend
- Treatment - Reservoir
- Zone Birkerød
- Zone Bispehaven
- Zone Bistrup
- Zone Ravnsnæs

Themes:

- HY Demand / Flow
- HY Flow Control Zones
- HY Pressure Map
- HY Velocity
- LD Leakage Level - 1
- LD Leakage Level - 2
- Meter Readings
- Status
- WQ Max Age
- WQ Mean Age
- WQ Trace

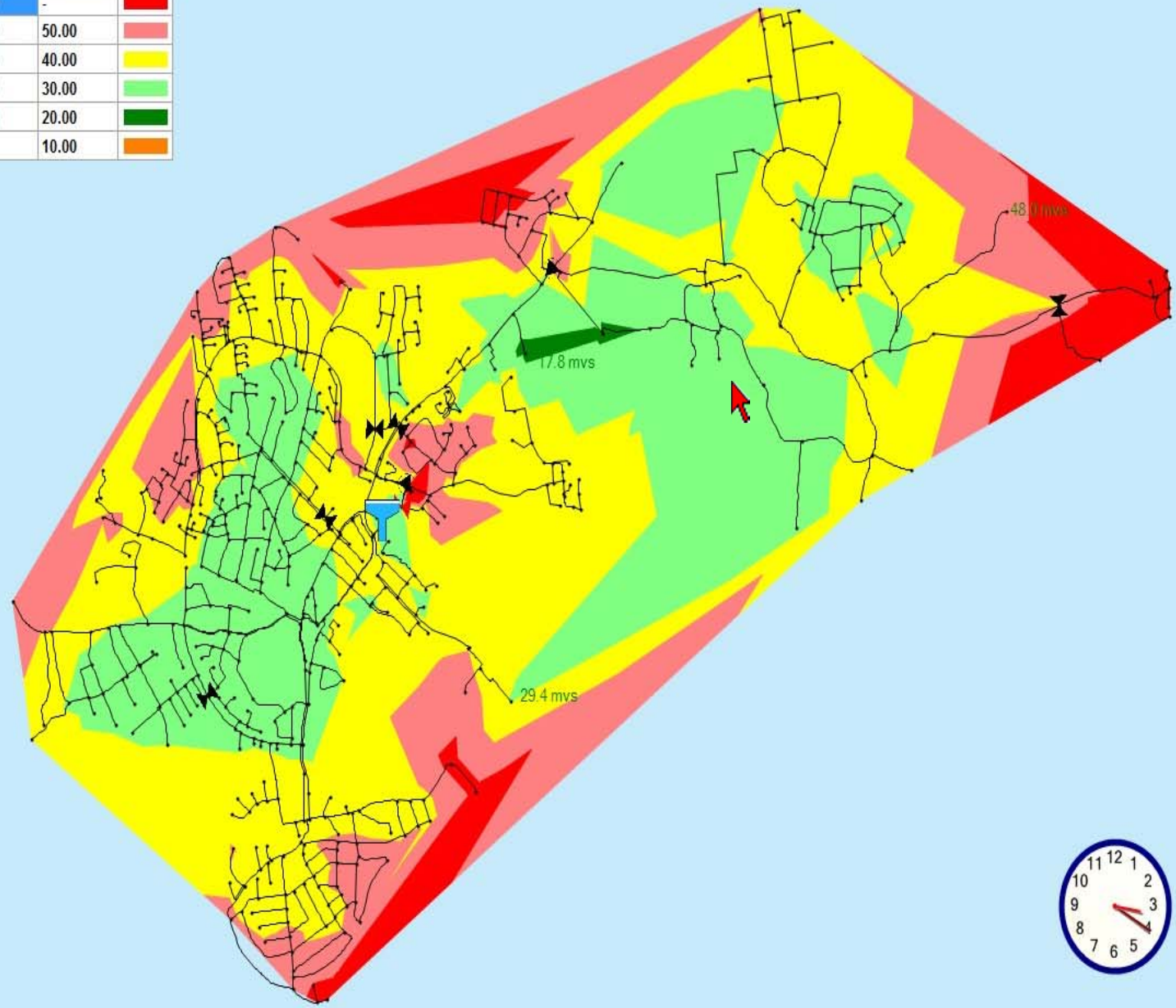
Consumer | Graphs

Arrows | Reports

Simulate | Messages

Pressure [mwc]

50.00	-	
40.00	50.00	
30.00	40.00	
20.00	30.00	
10.00	20.00	
-	10.00	



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SCADA + AMR / AMI

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

SCADA + AMR / AMI

- 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)

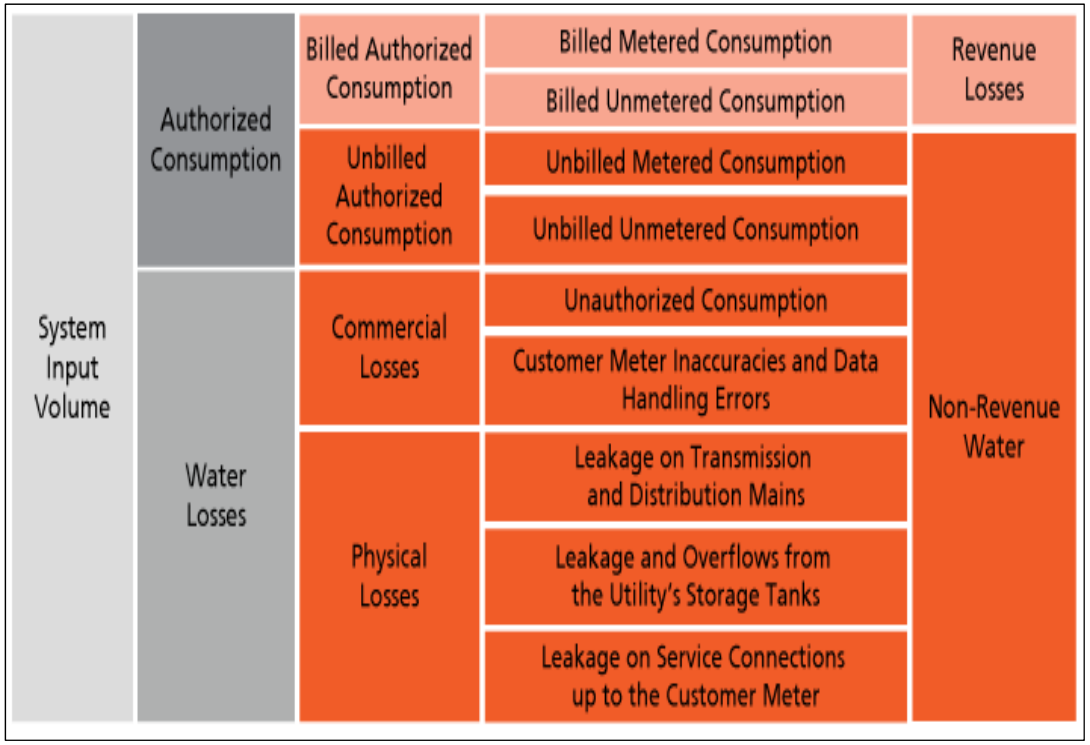
SCADA + LEAK MANAGEMENT

Leak Management

Reduction of Non-Revenue Water

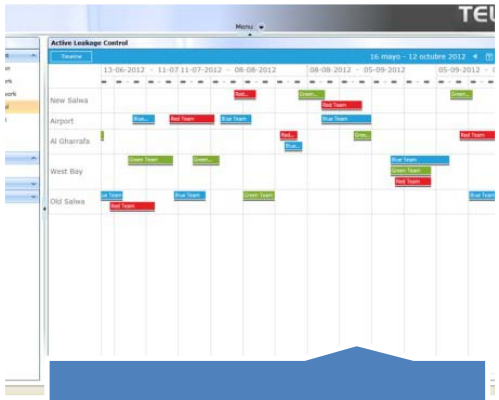
- **Problem:** Lost revenue due to aging infrastructure and meter inaccuracies. Bad public image and increasing regulation add stress to the problem.

- Water utilities average 15%-25% non-revenue water.

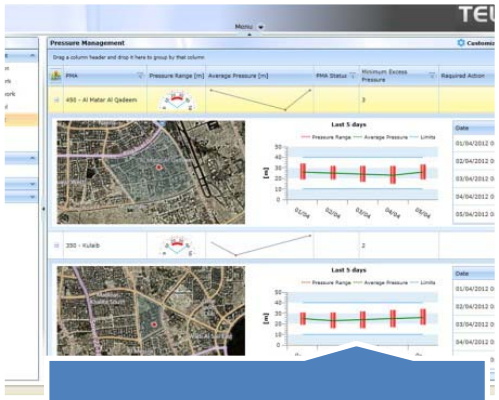


Leakage Management Modules

Leakage Calculation

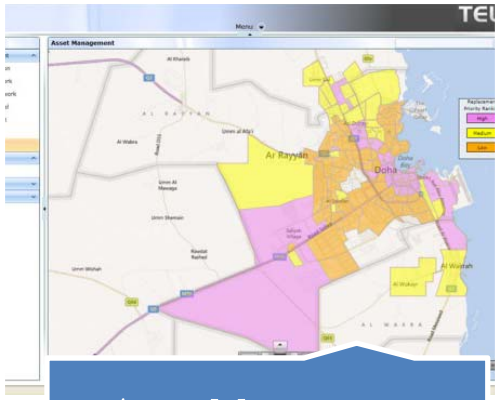


Active Leakage Control

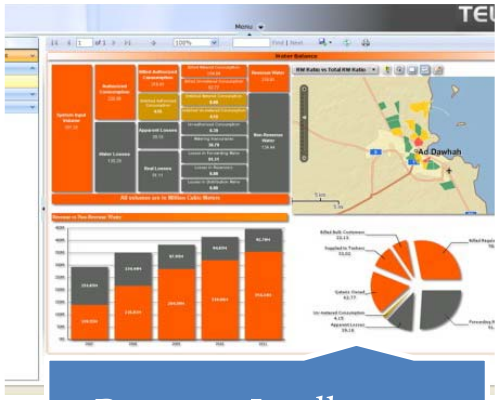


Pressure Management

Repair Management



Asset Management



Business Intelligence

CLOSING THOUGHTS

You Can’t Manage What You Can’t Measure

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.

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

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

Summary

- 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?

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