Running Dry: Smart Water and Leak Detection

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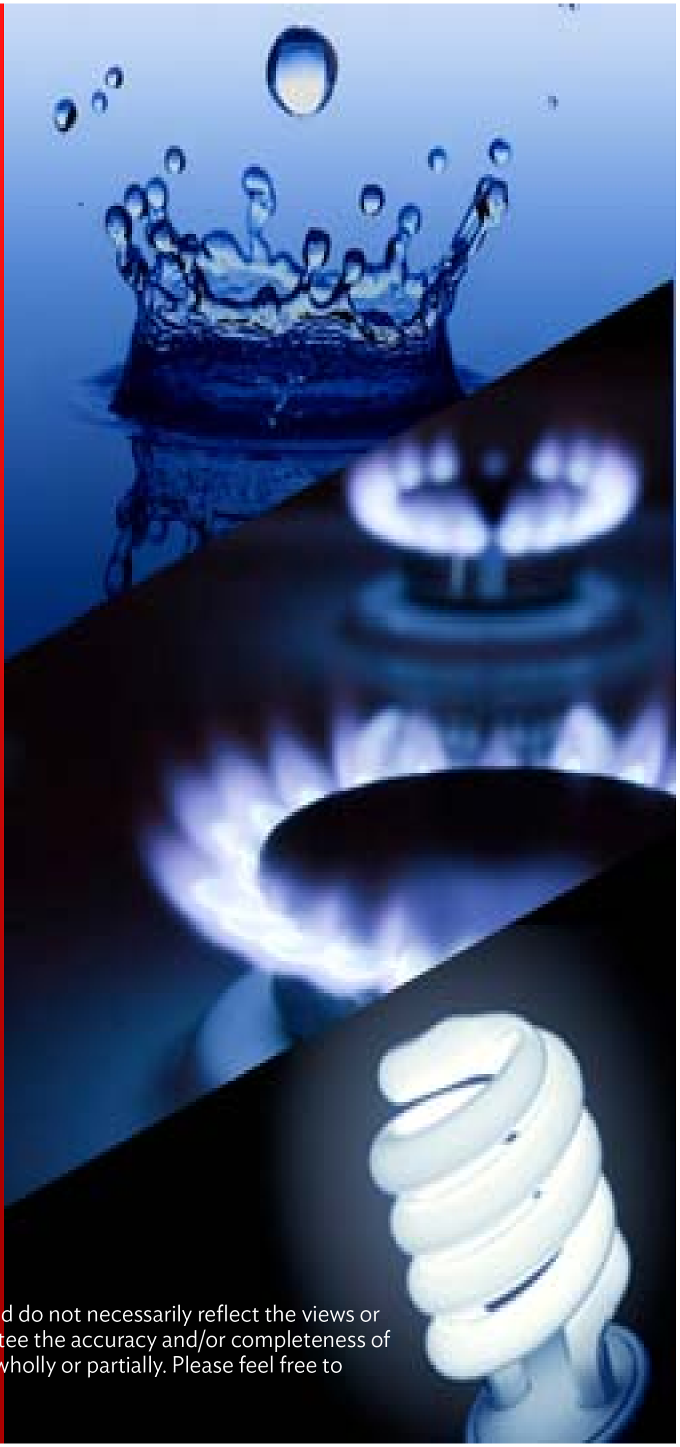
March 2013



Agenda

- Global Survey: Water stress, barriers & answers
- Defining “smart water”
- The analytical foundation
- Detecting leaks – reducing losses
- The business case

Survey Details

The Economist Intelligence Unit conducted a survey of 244 senior water utility executives across the ten countries under review.

All respondents hailed from the management function of their businesses, with close to one-half (45%) consisting of C-suite executives.

Organizations of all sizes were polled: 13% have annual revenue in excess of US$1bn, while 40% are firms with under US$250m in revenue.

Nearly one-half (48%) are owned by either the state or a local municipality; the balance are privately owned, barring 6% which operate as public-private partnerships.

Increased water stress is a foregone conclusion

For most water utilities, increased water stress by 2030 is a foregone conclusion.

About four in ten executives (39%) polled for this report think that, given current trends, national water demand in their countries will outstrip supply by 2030.

A further 54% think such a risk is moderately likely. But the nature of such stress varies hugely, depending on local circumstances.

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Increased water productivity is the core

To ensure sufficient supplies, utilities are making wide-ranging productivity improvements—everything from plugging leaks to recycling more water.

Investments are rising as well.

Across the ten countries polled, 93% of respondents say they are increasing their investment in water production facilities.

More than one in five (22%) utilities surveyed will increase investment by 15% or more in the next three years.

Wasteful consumer behavior is largest barrier

Across much of the world, water flows out of taps at almost no cost to the user.

Nearly half (45%) of utilities—especially in developed markets—see this as their biggest barrier to progress, while a further 33% believe that tariffs are too low to stimulate greater investment..

In developing countries, a lack of capital for investment tops the list of concerns (selected by 41%), while worries over climate change are close behind (38%).

Regulatory difficulties, along with persistent difficulties in attracting the right skills, further deepen the challenge.

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A far greater focus on demand management is expected

The historical response to rising water demand has been to build up supply and distribution networks, but much more emphasis is now being put on cutting water use.

From both a strategic and technological perspective, new metering and usage awareness programmes top the measures utilities believe will help reduce use.

Such measures are effective: research suggests a 10-15% average drop in usage once a meter is installed.

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The water industry is experiencing a quiet boom in innovation

Worldwide, utilities are experimenting with new techniques, such as improved desalination and aquifer recharging methods.

Desalination innovations are appearing in far-flung locations, from California to Queensland.

Network sensors and smart meters, which often link back to consumers' smart phones, are helping utilities both to moderate demand and to find costly leaks more accurately.

Nonetheless, more than one in three (36%) utilities surveyed say they are generally unaware of the innovation options available to them.

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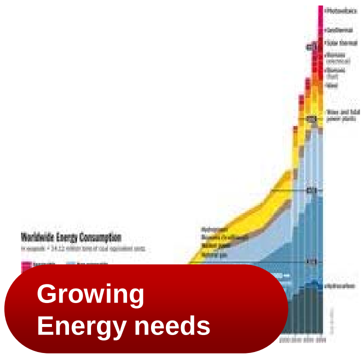
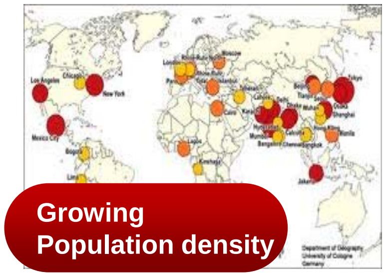
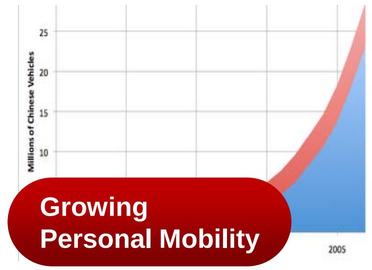
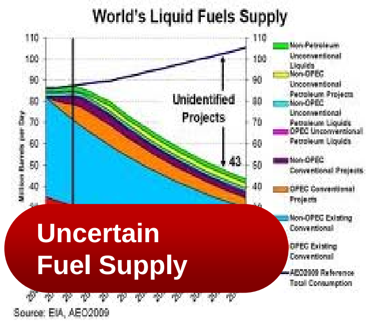
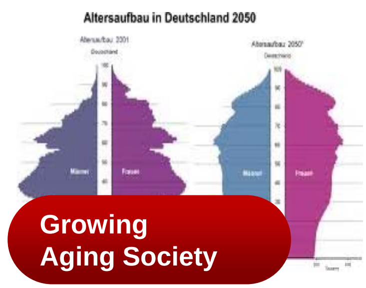
Water Interdependencies

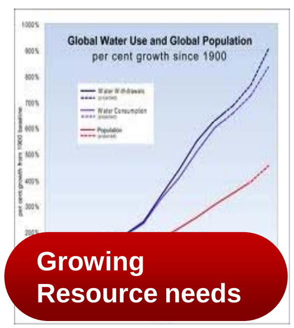


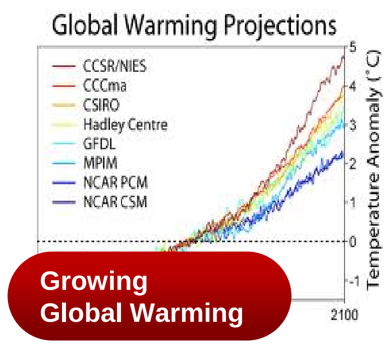












Sustainability & Climate

- Water & Waste Cycle
- Energy conservation
- Emissions management

Urbanization & Mobility

- Smart Homes
- Smart Transport
- Always connected

Energy & Resources

- Smart Grid & Meters
- Renewable energy
- Demand management

The history of smart water

For the past 20 years, water monitoring has included real-time control and supervision, and advanced hydrological modelling.

But technology, and needs, have grown. We now have:

- Ubiquitous availability of IT and Communication resources
- Continous deployment of advanced sensing and actuators
- More data enabling new services and actionable insights
- Constantly increasing demand and expansion of distribution
- Regulatory compliance of water quality and sustainability and CO_2 emissions,
- Need CAPEX/OPEX balancing and long-term investment & maintenance planning

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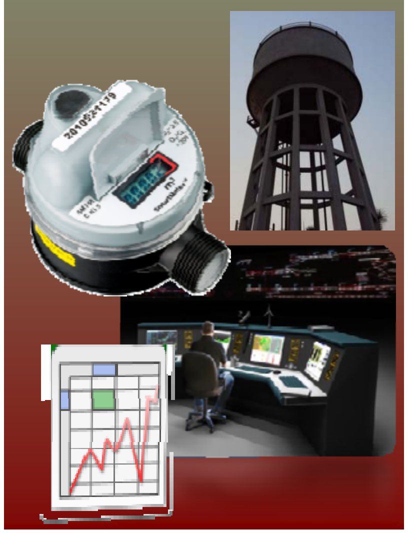
Defining Smart Water: A System of Systems

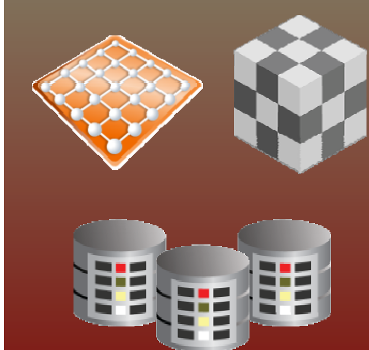
Network:	Sensors, Meters and actuators deployed throughout the grid
Communication:	Low latency, Multi-Modal, real-time communication links
Data Acquisition:	Validation, supervision and complex event processing
Information:	Dashboards of Key Performance Indicators, Trackers
Asset & Service:	Maintenance strategies, field service and schedule optimization
Simulation:	What-If scenario analysis, weather, network planning

Setting The Analytical Foundation

Any Data, Any Source



Full Range of Analytics



Integrated Analytic Applications

On Tablet On Mobile On Device

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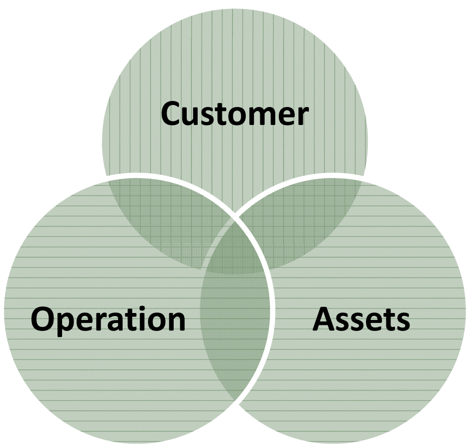
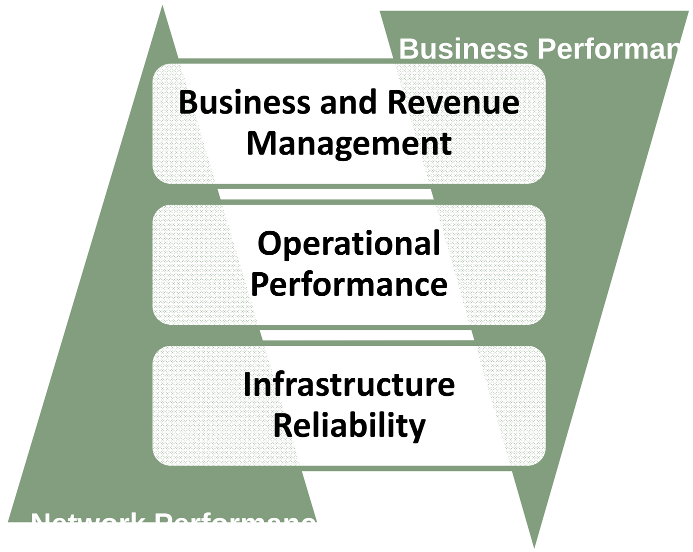
Defining The Analytical Objectives





Defining the dashboard for the different lines of business:

- Customer: Interactions, satisfaction, revenue, days sales outstanding
- Service: Number of complaints, issue resolution, escalations
- Finance: Cost recovery, plan/actual deviation, project performance
- Operation: Response time, schedule adherence, service complaints
- Maintenance: Availability, pipe breaks, Unaccounted for Water, order completion

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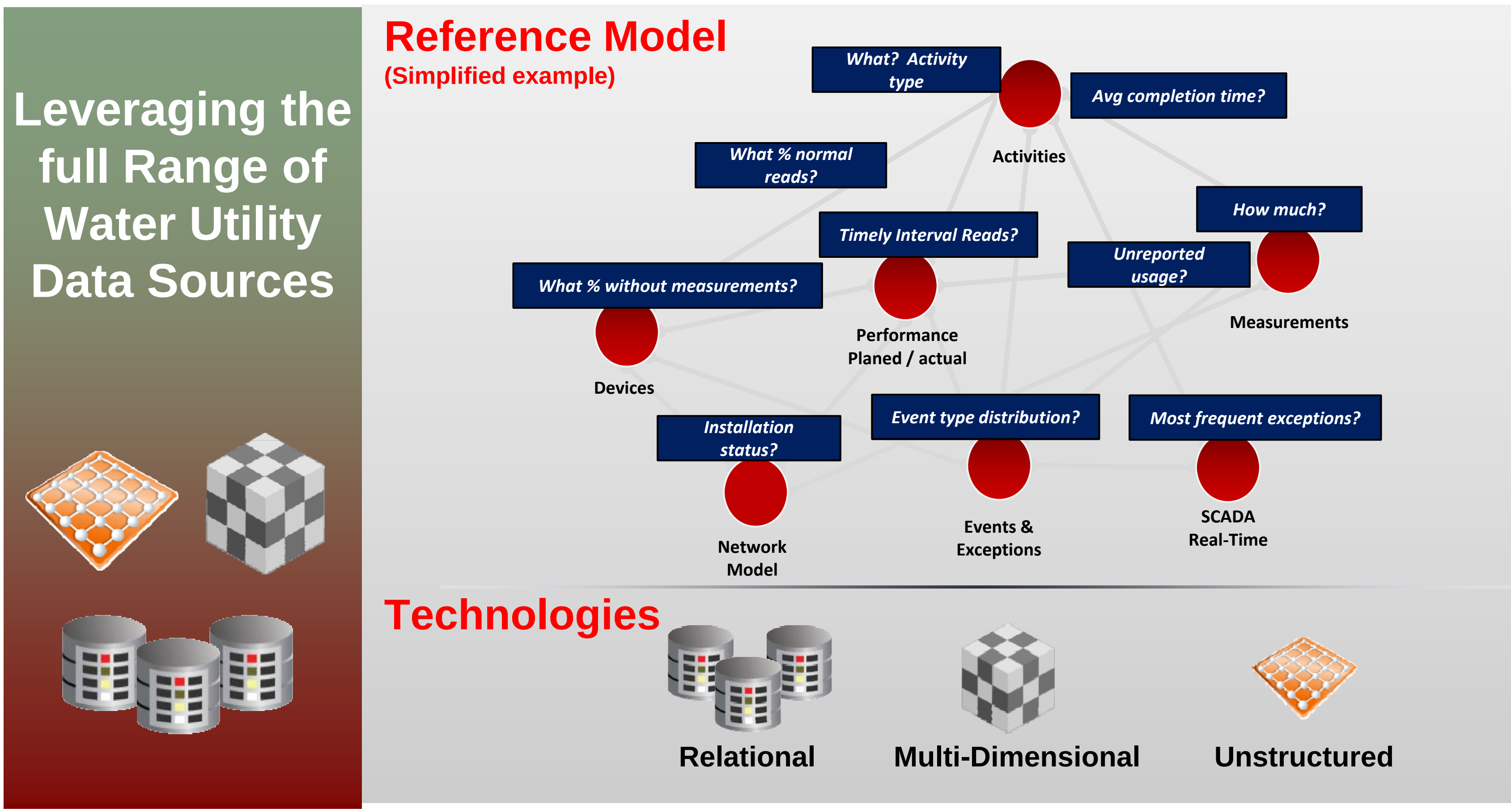
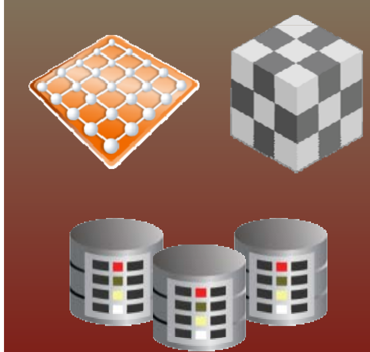
Defining The Reference Model



Moving from Insights to Action

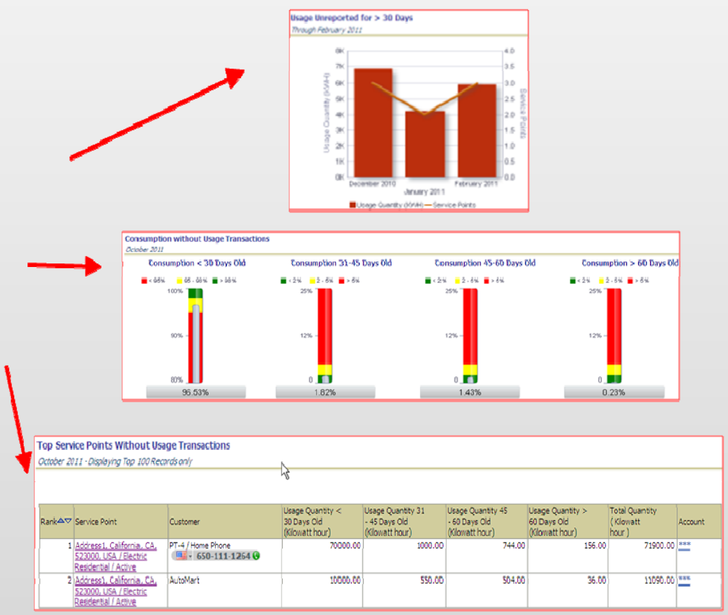
Leveraging the full Range of Water Utility Data Sources



Content

Business Objectives/ Issues → Gain Insights → Take Action

- Identify Unbilled Energy
- Is there consumption that does not have Usage Transaction (UT)
- Is consumption out of range?
- Identify the top Service Points in this group with Billing Related UTs
- Drill back into MDM
- Analyze reason for missing UT and take action to Issue UT



Tools

- Reporting & Analysis
- Modeling & Planning
- Unstructured Analytics
- Predictive Analytics

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Understanding the Water Balance

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-Revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Commercial / Apparent Losses	Unauthorized Consumption	
			Customer Meter Inaccuracies, Data, Billing and Accounting Errors	
		Physical / Real Losses	Leakage on Transmission and Distribution Mains	
			Leakage and Overflows at Reservoirs	
			Leakage on service connections up to metering	

Non-Revenue Water = System Input Volume – Billed Authorized Consumption

Reasons for Apparent Losses

- Customer meter inaccuracies
- Unauthorized consumption and illegal connections, theft and fraud
- Data analysis errors between historical, actual and billing data
- Data collection and transfer errors between meter and billing system

Current Annual Apparent Losses

Economical Level

Unavoidable Apparent Losses

Analytical Insight Transforming Data into Reduction of Apparent Losses

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Managing Real Losses

- Active leakage management
- Improving speed and quality of ALR Awareness, Location, Repair
- Optimization of the pressure management in the system
- Increased asset reliability and economical maintenance strategy

Potentially Recoverable Real Losses

Economical Level of Real Losses

Unavoidable Real Losses

Analytical Insight Transforming Data into Reduction of Real Losses

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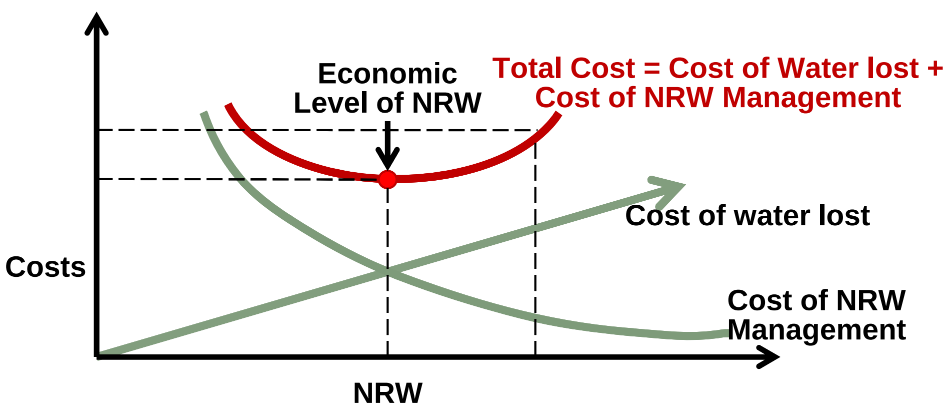
Strategies for Reducing Losses

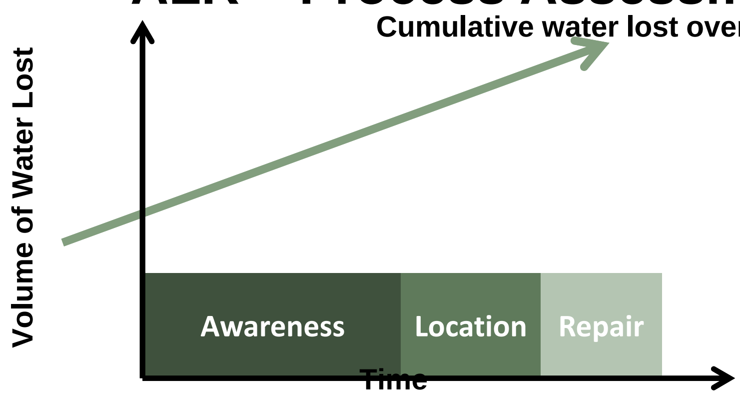
Rationalizing the criteria and priorities toward a NRW reduction strategy:

- **Economics**: Determining the cost of NRW versus the cost of water
- **Process**: Assessment and analysis of business processes and best practices
- **Integration**: Integration of business, engineering and operational areas
- **Data Analytics**: Transforming data silos into actionable business insights

NRW – Cost Assessment



ALR – Process Assessment



DMA – District Metering Area

Improving the Network Topology

FROM: Open Water Network System

Water is fed from different water treatment plants into an interconnected pipe network. NRW can only be approximated for the entire system.

TO: Zoned Water Network Systems (DMA)

The pipe network is divided into smaller and hydraulically isolated zones which allow a more accurate and manageable NRW calculation.

DMA design consideration

- Size of the DMA (number of connections, pipe length, etc.)
- Network configuration (number of flow meters, number of valves)
- Topographic features (urban, rural, ground level variations, etc.)
- Data Loggers (flows, pressure, legitimate night flows, sonar, etc.)
- Establishing and calibrating a hydrological flow model

NRW: Active Management

SCADA / GIS	NETWORK	ERP / EAM/ CIS
Telemetry Feeds	Work & Service Performance	Customer Billing Records
Dispatch Tracking	**Grid Model / Geo-Coding**	Meter Data and Location
Storm and Weather	Hydrological/Pressure Model	**Link Consumption & Address**
Hydrologic / Pressure Data	District Metering Area	**Financial & Tariff Information**
Sanitation levels	Loggers & Asset conditions	**Asset History & Performance**
Valve/Pump/Reservoir Feeds	**Meter testing & Certification**	

Water Cycle and Water Balance Insight

Model Updates

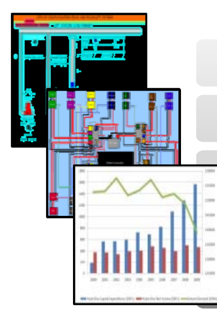
GIS

CAD

Planning System

Manual / One-Lines

Real-Time



SCADA / Weather

Field Operations & Mobile

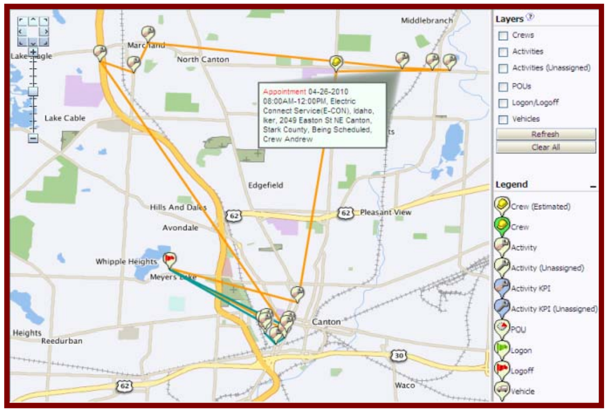
Enterprise Asset Performance

Grid Sensors / Valve Controls

Customer Information System

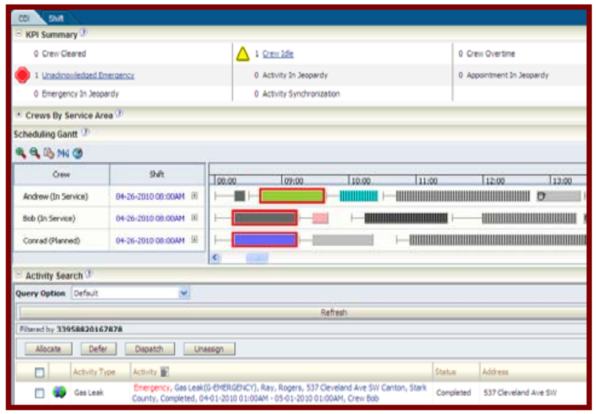
ALR: Awareness – Location – Repair

Resource Planning and Scheduling



- Real-time scheduling for optimal assignments and routing
- Takes into account complex factors and rules such as skills, timing, location, cost goals, etc
- Scheduling without boundaries

Common Dispatching Functionality

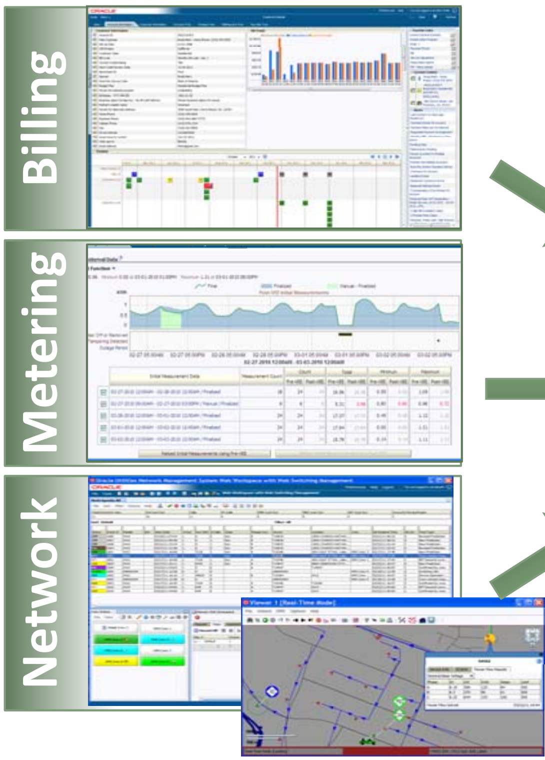


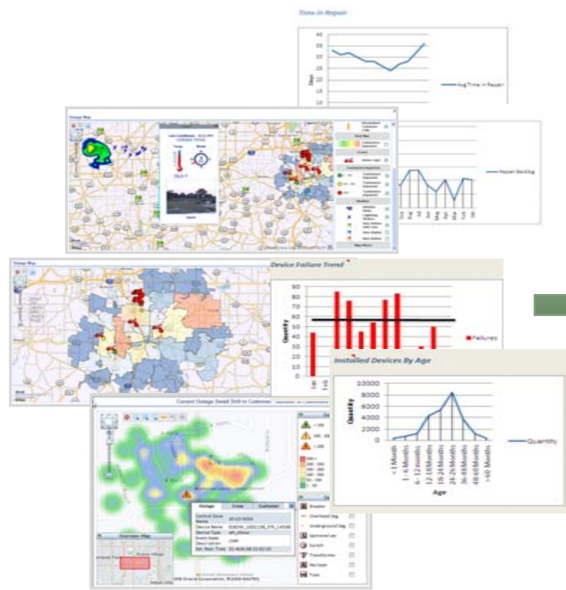
- Web browser based Dispatcher interface
- Context driven KPI's and alerts to allow for exception based Dispatching
- Map Viewer to show crews, their activities, their routes

Mobile Communication Platform

- Best practice workflows for field resources using a wide variety of mobile devices
- Secure asynchronous communication
- Store and forward for disconnected completions when necessary

District Metering Area: Analytical Approach





Actionable insight:

- Reducing NRW Levels
- From leak detection to pipe rehabilitation
- Prioritization of budgets and investments
- Improved asset life via pressure management
- Safeguarding continuous supply and water quality

Data → Inform → Act

Suggestions on Where to Start

First Step:

- Establishing high level cost / benefit matrix
- Technical assessment of current situation and performance
- Organized processes for collecting, normalizing, geo-tagging and associating data

		Implementation Costs		
		High	Medium	Low
NRW Volume Impact	High	•Leakage on mains •Leakage on service connections	•Unauthorized consumption	•Unbilled metered consumption
	Medium	•Customer meter replacement	•Customer metering inaccuracies and data handling errors	•Pressure Management
	Low	•Reservoir leakage	•Unbilled unmetered consumption	•Reservoir overflows

Second Step:

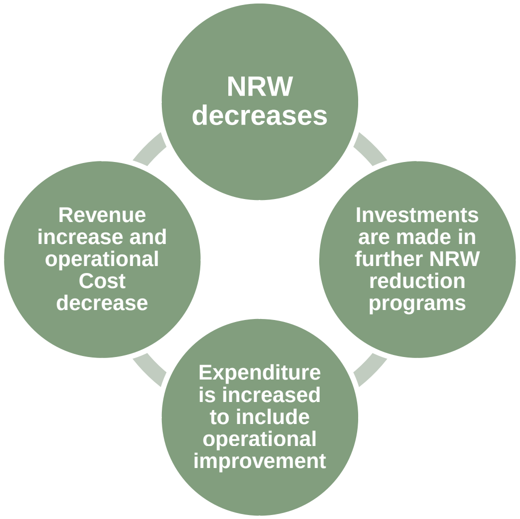
- Validating /adjusting data with real measurements
- Calibrating network model
- Reviewing analytical approach and integrity of NRW-calculations
- Improving ALR and billing processes

Third Step: Monitoring and institutionalizing continuous improvement process

Key figures for business justification

Water – Loss Reduction

- Reduced costs from water loss and increase revenues
- Reducing energy and chemical consumption
- Increase billing accuracy



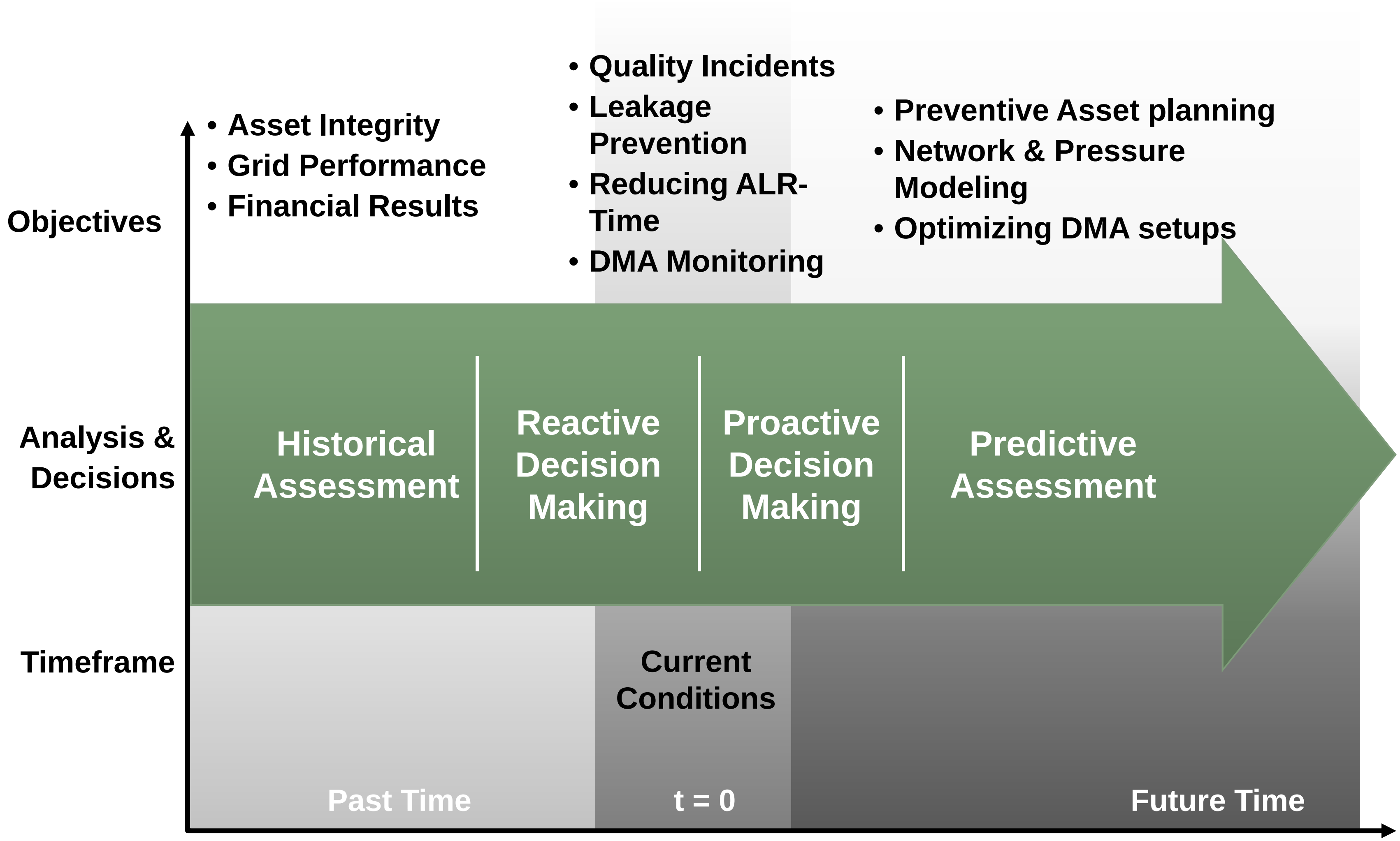
Increased Asset Performance

- Increase asset longevity and lower cost of maintenance
- Improved Infrastructure leakage Index (ILI)
- Reduced pipe breaks / faster ALR turnaround time

Better Service

- Guaranteeing continuous quality water supply
- Reduction of waterborne diseases (biological, mineral, chemical contamination)
- Improved water service quality (pressure, coloration, odor, salination, etc.)

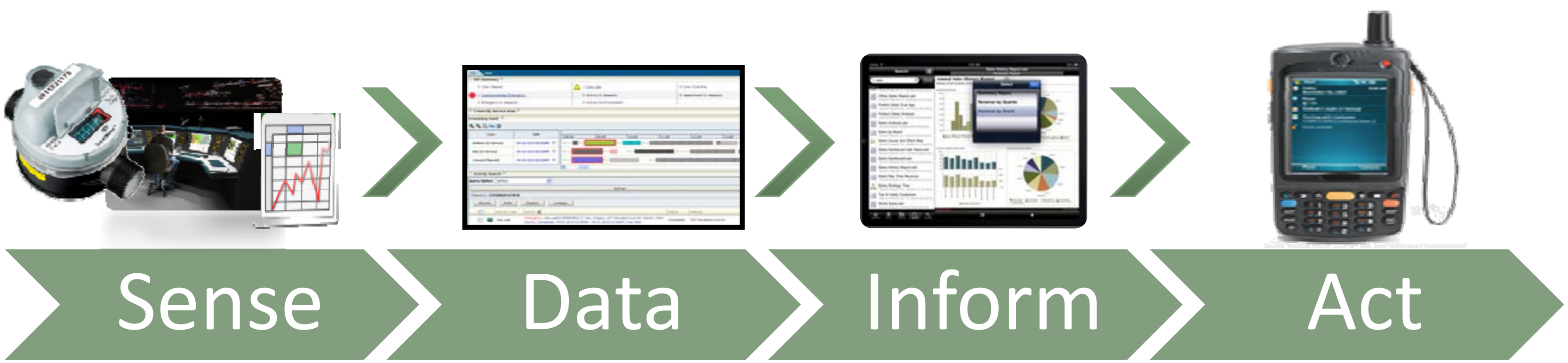
Moving from Reactive to Proactive



Moving beyond 2013

- Smart Water Networks exist, but still need to become standard and widely adopted
- AquaEconomics – investments into intelligence are understood & largely ROI positive
- Communication and communication links are becoming part of Smart City platforms
- Data acquisition is benefitting from IoT, electricity and ICT innovations
- Analytics has evolved from a passive data holder into a new business resource

BUT
A Solid ICT Platform and high fidelity Data Analytics are needed to achieve sustained NRW reductions, active leakage prevention and real-time Water Balance insight.



Questions

When the well
is dry, we know
the worth of
water.

Benjamin Franklin
(1706-90)

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