Digital Transformation for Water Utilities

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Cape Town’s drought

May 20, 2018

Day Zero is “day zero”, when the City of Cape Town expects taps to be turned off and residents will have to queue for water.

871

is what the city has asked residents to cap their daily usage at.

At this target, consumption will drop to 500m litres/day, from 600m today.

40%

of Capetonians have dropped their usage to below 871.

May 20 is when the average water level of dams supplying the city is expected to drop to 13.5%, making it difficult to draw water.

Source: City of Cape Town Water Directorate

Source: https://bit.ly/35iLooT
Utilities are Complex… and Siloed

**Sources & Environment**
- Watershed
- Surface, Groundwater and Water Reuse
- Wastewater Effluent

**Collection, Treatment & Distribution**
- Water Collection, Treatment and Distribution
- Wastewater and stormwater Collection and Treatment

**End Customers**
- Residential
- Agricultural
- Commercial and Industrial
- Water for Nature

**Example Critical Physical Assets**

**Example Data Siloes**
- SCADA & Telemetry
- Hydraulic Model
- Integrated Resource Plan

- Enterprise IT Systems
- Network Monitoring & Management
- System Modelling & Production Forecast

- Customer Information Systems
- Meter Data Management
- Billing System
- Customer Engagement Channels
A Transformation is needed happening...

Durban, South Africa, has used digital technology to better manage its water resources and protect its customers from the same fate as Cape Town residents. *Hydrologic models paired with monitoring devices* have allowed the Durban water utility to optimise storage levels in dams and reservoirs.

Las Vegas Valley Water District has harnessed *digital technology* to reduce non-revenue water, improving conservation and optimising water supply for customers.

Shenzhen, *water quality monitoring sensors and hydraulic modelling systems* implemented by Shenzhen Water Group have resulted in *vast improvements to surface water quality.*
The Digital Transformation

“Right Information to the Right People at the Right Time”

“Bringing together all of the data that we collect to give the industry, at least operationally, something called "Situational Awareness" allowing us to know what is going on within the operational framework in order to make an informed decision.”
Defining Digital Water

Digital Water.
Smart Water.
Internet of Water.
Water 4.0.
...
...
Enabling Technologies

- Secure Cloud & AI
- Digital Twin
- Asset and Enterprise Data
- Communications
- Sensing & GIS
Digital Solutions across the Smart Water Cycle

Sense
- Distributed sensor networks
- Enterprise systems
- Data lakes

Predict
- Advanced data analytics
- Digital twins and models
- Anomaly detection

Act
- Visualization and simulation
- Recommendations
- Real-time control

WATER DISTRIBUTION
- Leak & Burst Detection
- Surge Monitoring
- Demand Forecasting
- Water Balance
- Scenarios Planning
- Integrated Network Analytics

WATER TREATMENT
- Energy Optimization
- Digital Twin
- Smart Pumps
- Water Age Optimization
- Water Quality Monitoring
- Asset Management

PUMP STATION
- Metering Analytics
- Smart Meters
- Asset Management
- Revenue Management
- Water Loss Monitoring

COMMERCIAL & INDUSTRIAL
- Consumption

RESIDENTIAL
- Consumption

STORMWATER
- Drainage Network Optimization
- Digital Twin
- Overflows Prediction

SANITARY SEWER
- Combined Sewer

WASTEWATER TREATMENT
- Process Optimization
- Digital Twin
- Real-time Control

LIFT STATION
- Network Monitoring
- Digital Twin
- Overflows Prediction
- Real-time Control

TREATED EFFLUENT

SOURCE WATER
- Water Quality Monitoring
- Demand Forecasting

STORMWATER DRAINAGE

RECLAIMED WATER
“Since [the turn to digital solutions such as] the use of sensors, smart meters, and pressure control systems has improved water conservation, providing relief to a water-stressed city. As a result, the greater Taipei area has not experienced a water shortage in 17 years,” Chen Jiin-Shyang, CEO of Taipei Water Department.
The Digital Architecture

USE ANALYTICS TO DELIVER ACTIONABLE INFORMATION

DATA SOURCES
- Acoustic logger
- Customer meters
- Transient loggers
- WQ Sensors
- Flow meters

Sensors
- Background Leakage
- Demand & Balance
- Water Surges
- Water Quality Issues
- Inflow and Outflow

IoT

Artificial Intelligence

Other Enterprise Data
- GIS
- Hydraulic Model
- MDMS
- SCADA
- Billing
- Database

BUSINESS FUNCTIONS
- Maintenance
- Network Ops
- Customer Demand
- Asset Management
Adelaide CBD Water Network IoT – why and what?

- **3** Water Quality Sensors
- **305** Acoustic Sensors
- **11** Mass Flow Meters
- **100** Smart Meters
- **11** Mass Pressure Sensors
- **23** Pressure Transient/Hydrophone Sensors

Images:
- Transient/hydrophone logger
- Water quality logger
- Acoustic (accelerometer) loggers
- Smart customer meter
Ten year main break average for the Adelaide CBD varies from four – five per month.

Total main breaks since 1 July 2017 follows the ten year main break rate.

Proactive repairs (currently 52 per cent, at end March 2019) exceed reactive.
Reduce System Losses: Real Losses

**Challenge**
Help global utilities reduce water that is pumped and not accounted for – especially in Asia, where utilities average 30% losses daily.

**Solution**
- 2000 pressure and acoustic sensors installed on trunk mains
- Billions of data points per day!!
- Real-time data analytics to monitor the water network for anomalies such as leaks and bursts
- Identify sources of pressure surges to mitigate damaging water hammer effects, thereby prolonging asset life

**RESULTS**
50 million litres of water saved per day
(Major Southeast Asia Utility serving multi-million accounts)
**Challenge**
How to reduce meter-related revenue loss, which averages 3% a year in the U.S. and much more globally.

**Solution**
- Since 2016 the CCWA, known for innovation and sustainable water sourcing, has deployed solution to focus on apparent losses
- The online cloud-based analytics solution helps identify and rank customer meters that are losing revenue, enabling a prioritized meter testing and replacement program

**RESULTS**
More than $700,000 of revenue recovered in 6 months
(Clayton County Water Authority, Georgia, USA)

**Operator KPI:**
$6.37 saved per residential meter and $67.60 per commercial meter
Manage Flood and Overflows

Challenge
How to reduce combined sewer flows into the St. Joseph River, estimated at 1-2 billion gallons annually, costing more than $860 million

Solution
- An intelligent sewer solution, utilizing a combination of sensors and artificial intelligence to provide real-time decision support and coordinated real-time system control
- Since 2012, the monitoring sites (currently 152) and 13 automated gates and valves have reduced combined sewer overflow (CSO) by more than 70 percent

RESULTS
Overflows reduced by over 70% — capital savings of $500 M over 20 years (South Bend, IN, USA)
Stakeholders

1. Regenerative Water Services
2. Water Sensitive Urban Design
3. Basin Connected Cities
4. Water-wise Communities

Source: https://bit.ly/3k3m2iD
Reorganizing for Digital Water

Linear

Transitioning

Dynamic & Fluid
Leadership

CxO Lead Drive → Holistic Roadmap → Culture of Innovation → Leverage Pilots → Think Data → Think Collaboration
Scaling the Adoption & RoI

Organizational Scaling

Geographical Scaling

- Low Value Across Org., High RoI, Least Org. Changes
- High Value Across Org., Medium RoI, Most Org. Changes
- Max Value Across Org., Max RoI, Gradual Org. Changes

Value Indicator

Secure Cloud & AI
Digital Twin
Asset and Enterprise Data
Communications
Sensing & GIS
My Job?

Data Detective
Cyber Security Officer
Man-Machine Teaming Manager
Chief Trust Officer
Machine Learning Analyst
Personal Data Broker
Personal Memory Curator
Augmented Reality Assistant
The Starting Point

We believe in equal access to water and wastewater service for all, rich as well as poor.

We believe in measurement, that is to monitor every single process that we are in charge of to make sure that everything is at it should be all through our urban water cycle.

We believe in a symbiotic community where one industry’s by-product is another industry’s input and we want to find good ways to ensure that our utility connects in that large symbiotic system in all possible ways.

We believe that the water should stay where it falls when it rains, we do not believe in waging war against it and pump it full steam ahead out of our area. Therefore we encourage local rain systems and local discharge of highly purified wastewater to local streams where it will support aquatic life and preserve nature.

We believe that in dialogue with private and industrial customers we can co-develop the best suited solutions for everybody.

We believe that beautiful nature around our city is good for the spirit of all its inhabitants, so we make sure to protect our streams, lakes and the ocean from the otherwise harmful debris in wastewater from our city.

We believe that clean water for everybody will be a primary safeguard against illnesses.

We believe that our “reason to be” is to deliver the best possible quality of water product to our customers.

We believe the most important way to keep our stakeholders happy is through the lowest possible prices.
The Next Step… a Trusted Partner

- Bespoke consultation to define your priorities and goals.
- Understanding your technology investment step-by-step.
- Industry-leading technology aligned with your vision.
- Help you understand and solve the true source of issues.
Thank You!