

Digitalisation in the Water Sector

Smart Water Metering & Non-Revenue Water Reduction

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European Investment Bank

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Background – Water Services & Metering in Ireland in 2012



Smarter Metering – The Irish Water Domestic Metering Programme (2013-17)



Added Value – Smart opportunities & Leakage Management



Next Generation – Smart Metering and Smart Network Technologies



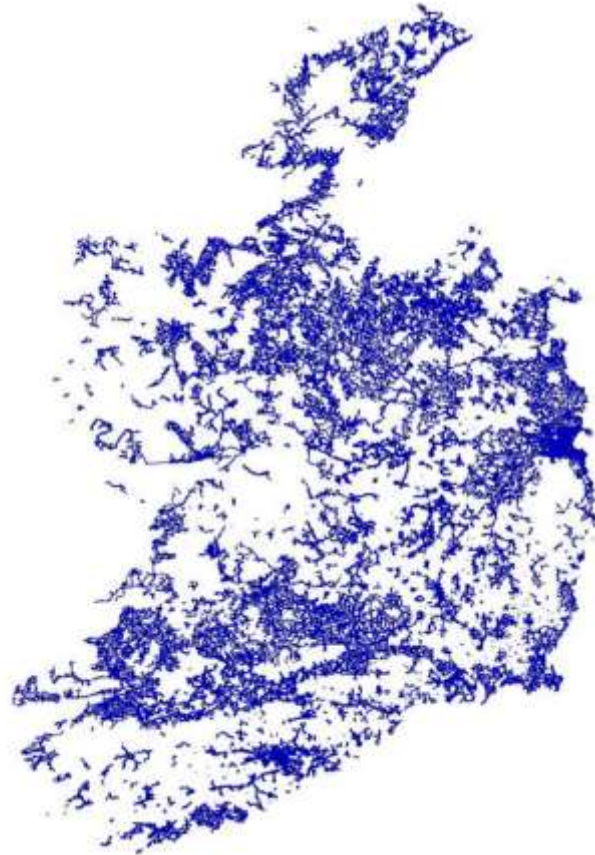
Future Challenges – Smart Networks, DWD & Sustainability

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Background



Irish Water – Asset Base



Waste PE Treated

5.4 million

waste water PE total
combined domestic & non
domestic population served

Waste Population Served

3.1 million

waste water domestic
population served

Waste Treatment Plants

1,060

waste water treatment
plants

Waste Pump Stations

2,231

waste water pump stations in
the sewer network

Waste Water Sewer

26,000 km

waste water sewer length which
includes foul & combined sewers,
figure is an estimate as data
collection still ongoing

Water Population Served

3.9 million

drinking water population
served

Water Production Plants

728

operational Irish Water - water
treatment plants

Water Reservoirs

1,402

drinking water reservoirs in
the network

Water Pump Stations

1,712

water pumping stations in
the water distribution
network

Water Supply Zones

747

Water Supply Zones

Water Production

1,776 MLD

national water production

Water Production GDA

555 MLD

GDA water production

Water Network

63,000 km

water mains captured in the
IW GIS

Water DMA Count

4,514

total number of district
metered areas in the IW GIS.

Water Valves

532,026

Total number of water
valves

Date Produced. 23/07/2020- Asset Management

What was the driver for metering?

- **EU/IMF**
 - *EU Water Framework Directive (User Pays Principles)*
 - *Introduce domestic water charges by “end of the bail out programme”*
- **Programme for Government**
 - *Domestic Water Charges*
 - *Based on Metered Consumption*
 - *Pay directly for water services*
 - *Customers can manage their bills if metered*
 - *Fairer way to pay*
- Newly conceived Irish Water given responsibility for a domestic metering programme in April 2012
- Budget €539million (ex. VAT) for phase 1 programme of works of 1.05 million meters by end of 2016.

Water Metering in Ireland (2012)

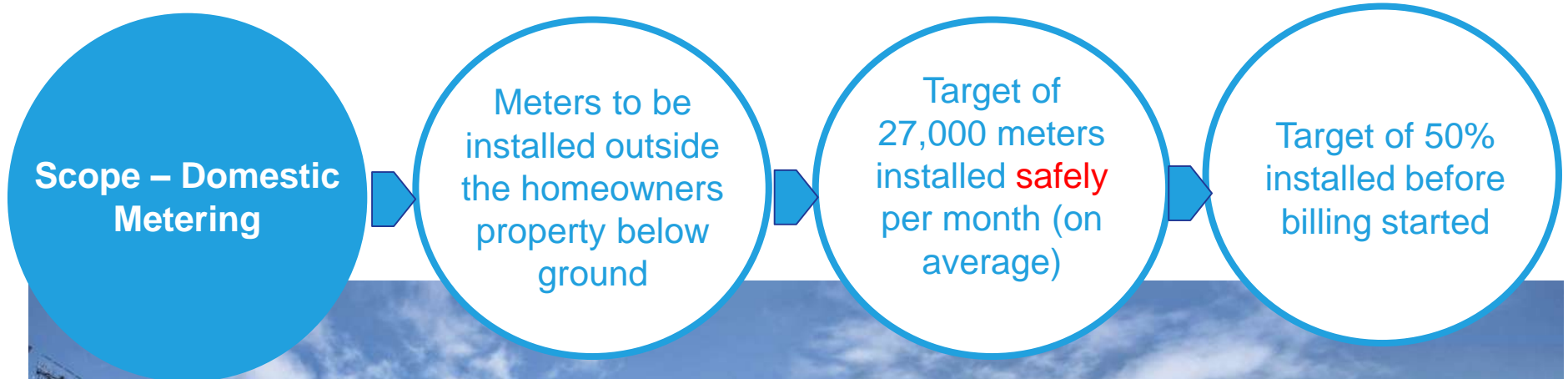


- Domestic Sector
 - *No measured revenue*
 - *Some meters for water conservation*
 - *UFW reliant on estimates*
- Non-Domestic Sector
 - *Commercial*
 - *Institutional*
 - *Agricultural*
 - *Over 200,000 non-domestic customers*
- Group Water Schemes
 - *Consequence of upgrades*
 - *Response to leakage*

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Smarter Metering

Metering Programme



- Two Framework Suppliers
 - *Fusion and Mains to Meters*
- One Manufacturer (Talis)
 - *Talbot Matrix and Ebco brands*
- Features
 - *Manifold; Stop Tap; NRV; Watertight;*
 - *600mm deep; Telescopic*
- Standards
 - *BS5834:2 & WIS 4-37-01*
- Covers:
 - *Grade B Metal Option*
 - *Grade C Plastic Option*
 - IW Grade C covers have > 2t load capacity;
 - Min Grade C requirement is 0.5 t load capacity.



- Two meter types selected
 - *Diehl Sappel Altair Composite Concentric*
 - DN 15 & DN20
 - Radio Unit – Izar 868 IW (868 MHz) **one way**
 - *Itron Aquadis Concentric*
 - DN15
 - Everblu cyble (433 MHz) **two way**

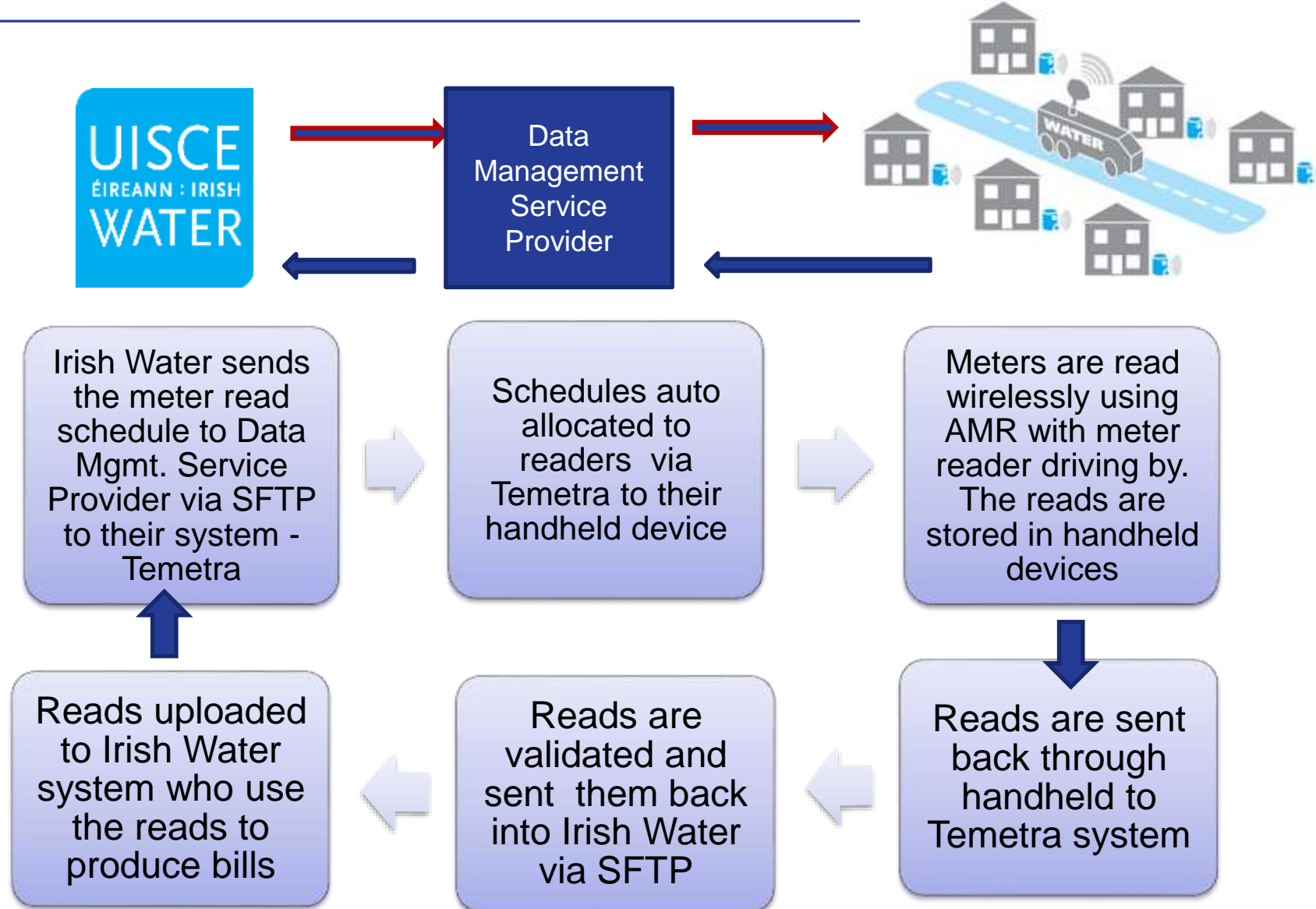


Radio Units

- “Read” from spinning metal target on top of meter
 - *Each rotation (pulse) = 1 litre*
- Store historic reads and alarms
- Low Power Radio Units
- 433 MHz or 868 MHz Frequency
- Battery = 3.4v
 - *Same as iPhone but lasts 12 years without recharging.*
- 1-way and 2-way communication
 - *Data Packages*
- “Potted”
 - *Water Proof to IP68*

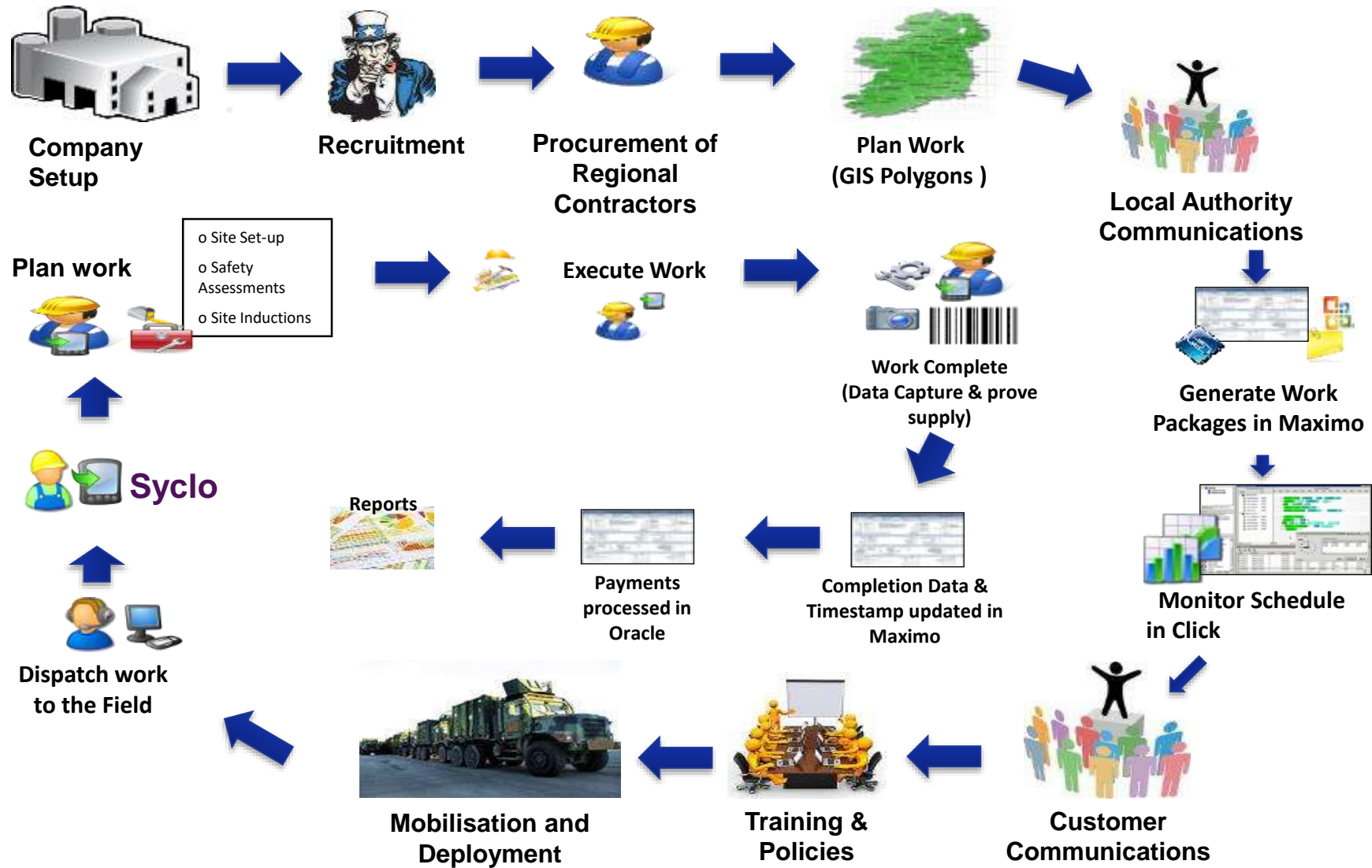


Meter Reading Technology



Metering Mobilisation & Workflow

- *Underpinned by IT Systems*

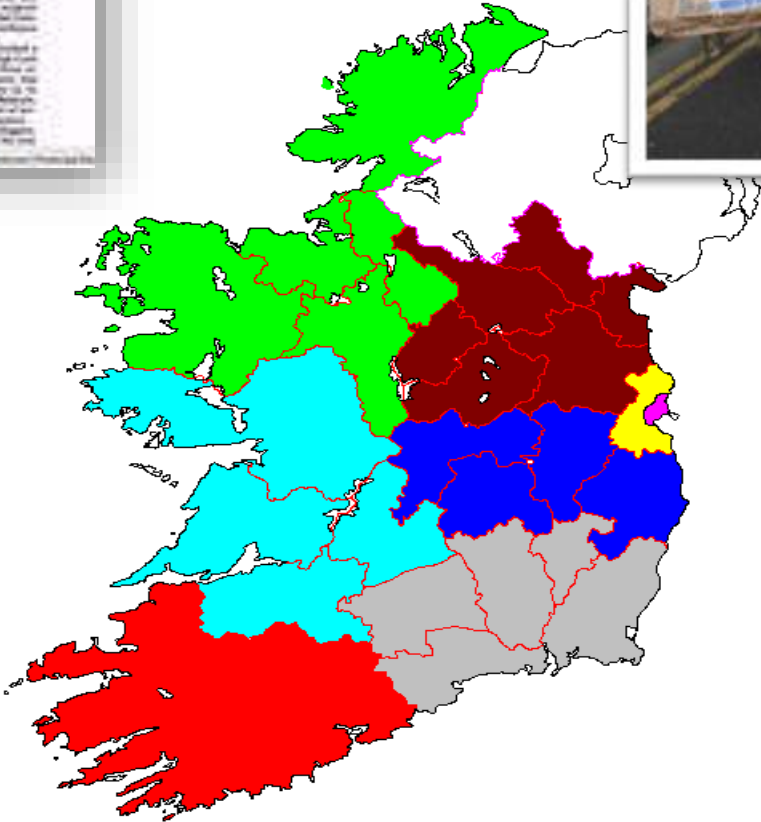


Public Challenge



Water meter staff getting death threats, court told

Water meter staff have been threatened with death, a court has heard. The judge said the threats were made by a group of people who were angry about the introduction of water meters. The judge said the threats were made by a group of people who were angry about the introduction of water meters. The judge said the threats were made by a group of people who were angry about the introduction of water meters.



Police attempt to control a water charge protest in Dublin



Domestic Water Metering Programme

- Over 894,000 domestic meters installed between 2013 and 2017;
- 100% Drive-by AMR technology.
 - *RF Clip-on Radios*
 - *Diehl Meters (1-way)*
 - *Itron Meters (2-way)*
 - *Temetra Reading System*



Output Data:

- Construction:
 - *Pipe depth & material*
 - *Connection location*
- Usage Data:
 - *Current Reading*
 - *Month-end Reads (3)*
- Alarms:
 - *Continuous Flow*
 - *Backflow*
 - *Low Battery*
 - *Tamper*
- Skip Codes:
 - *Manually collected*



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Added Value

3a

Consumption Data

- Construction:
 - *Pipe depth & material*
 - *Connection location*
- Usage Data:
 - *Current Reading*
 - *Month-end Reads (3)*
- Alarms:
 - *Continuous Flow*
 - *Backflow*
 - *Low Battery*
 - *Tamper*
- Skip Codes:
 - *Manually collected*



- Quarterly Reading Output:
 - *Jan/Feb 2018 (10 vans)*
 - *Attempted to read 884,098 domestic meters;*
 - ***Wireless reading from 869,280 meters (98.3%)***
 - *Drive-by = 97.0%; Walk-by = 1.3%;*
 - *Manual Reads = 4,056 (0.5%)*
 - *Skip Codes = 10,759 (1.2%)*
 - *Included > 1,000 unread due to adverse weather.*
 - ***Continuous Flow Alarms = 65,553 (7.4%)***
 - *Top 10 average equivalent of 20 houses each;*
 - *Top 100 average equivalent of 12.5 houses each.*

2015 Consumption per Property *(l/prop/day)*

Region	+/- CFA	Yearly Mean	Peak Month	Min Month
National	Gross	364	386	357
	<i>(Excl CFA)</i>	248	259	240
Eastern	Gross	364	389	358
	<i>(Excl CFA)</i>	269	282	263
Southern	Gross	374	401	360
	<i>(Excl CFA)</i>	227	236	221
Nor/Western	Gross	337	356	336
	<i>(Excl CFA)</i>	194	196	206

*NB: Yearly Mean is the applicable figure for leakage calculation.
Peak month is more appropriate to strategic storage and resilience design.*

Domestic Use for Leakage Calculation

- **Primary Data:**



- **365 litres/prop/day**
 - *Includes properties not permanently occupied*

- *Secondary Data:*



- **130 litres/hd/day**
 - *Registered Occupied*
 - *Apply only with 2.69-person occupancy.*
- **105 litres/hd/day**
 - *CFA properties excluded*

Billing Objective

- Domestic water meters were mandated to support the introduction of domestic water charges.
- Charges were controversial and were suspended in 2016 by the Government pending an independent review.
- Legislation was enacted in Nov 2017 to issue refunds to those that had paid.
- Excess use charges due to apply from 2022.



- First Fix Free Programme
 - *Up to Q2/2017*
 - *41,431 leak investigations*
 - *36,524 customer repairs*
 - *8,097 repairs by IW*
- Lead Replacement Programme
 - *36,000 lead services identified.*
- Non-return Valve Replacement
 - *Backflow alarms led to replacement of NRV's.*



3b

Leakage Reduction

Where we started from



49% Leakage nationally
(*estimated 2014)



Significant underinvestment over many decades. No dedicated national budget



No domestic meters – no accurate consumption data



Broken bulk meters & missing signals. DMAs not working



No national approach to leakage



No single view of leakage. No Leakage Management System

National Leakage Reduction Programme

2017 – 2021 Plans



Reduction of leakage from 47% in 2017 to 38% by 2021



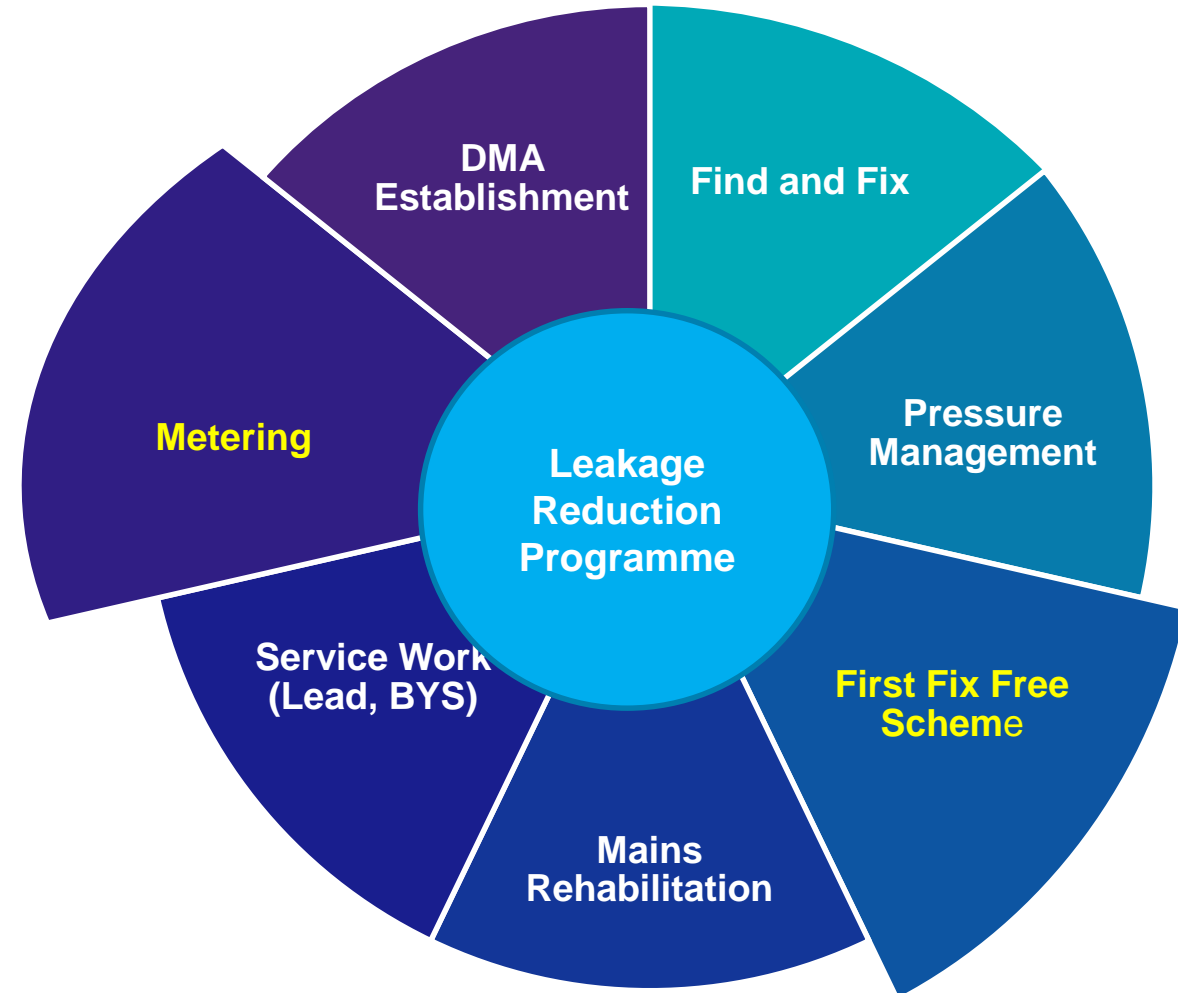
Find and repair leaks on public network



Over €500m to replace and repair leaking pipes



To save 166 million litres of water per day



Achievements to date (2020)



Private side total leakage savings 138.3 ML/day



Public side total leakage savings 103.5 ML/day



5,531 backyard services replaced



21,288 public side lead service connections replaced



607km of water mains laid or rehabilitated

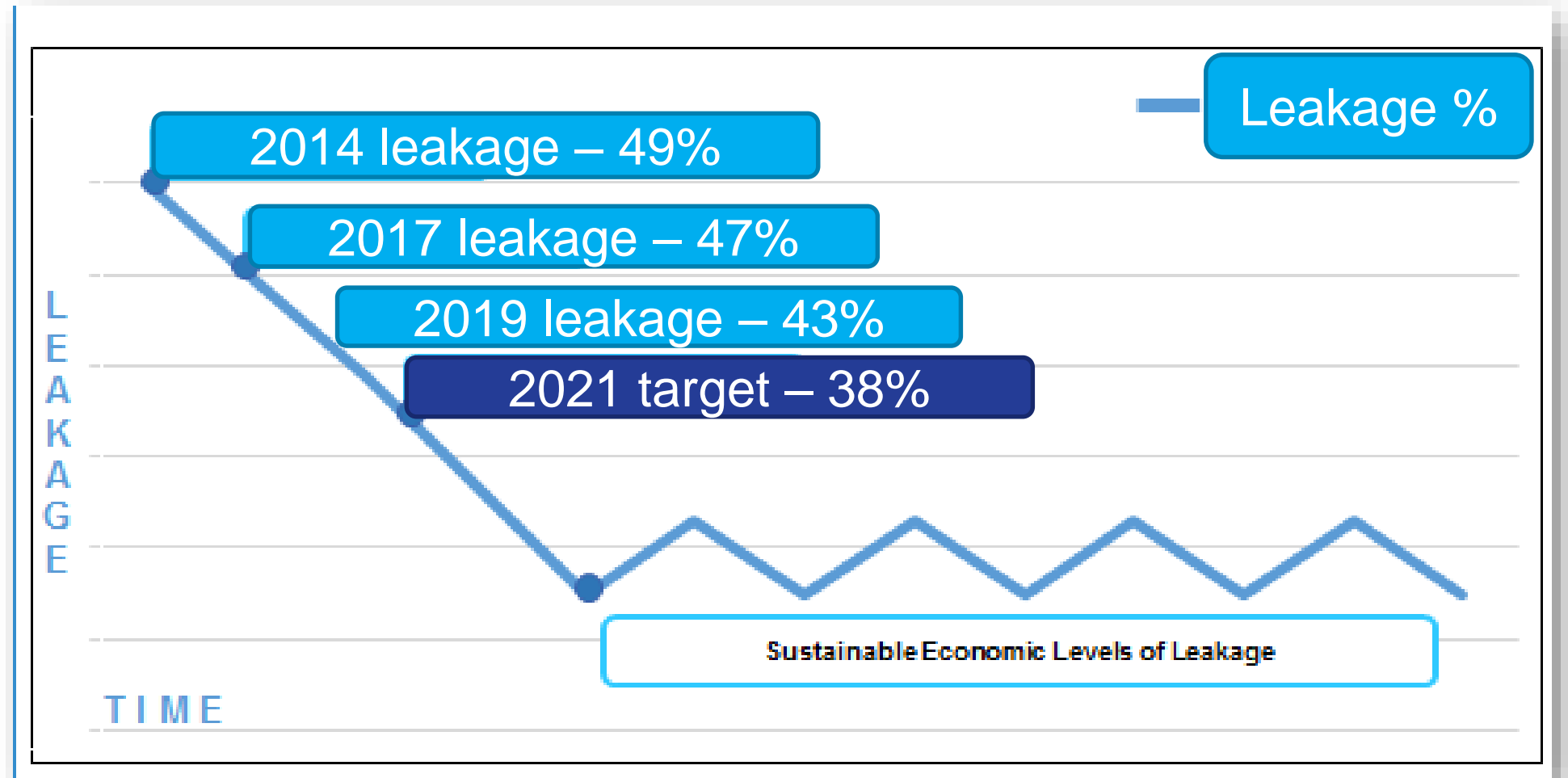


Leakage Awareness Campaign



Branded Site Signage

Achievements against targets



Beast from the East & Storm Emma

- **Ice & Snow event:**
 - 28th Feb - 4th March 2018
 - Bursts & Water Outages
 - Supply restrictions in Dublin;
- **Meter Reading**
 - Vans deployed 5th March
 - Quick results (6th March)
 - First batch (5,500) showed leaks increased from 196 to 467 houses
 - Top 20 in Dublin used 943 m³/day in 6 days since 1st March (= 3,772 houses)
 - Reading continued for 2 weeks nationally
 - Results fed into leak repair activities



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Next Generation

4a

Apartment Metering Trials

Innovation: Apartment Metering Trials



- CRU (Economic Regulator) Innovation Fund
- Consortia including technology providers
- Apartment Buildings nominated by the consortia
- Pre-installation surveys and design
- Investigate installation challenges
- Fixed-radio systems and data collection solutions (GPRS, Sigfox, LORA)
- Operational phase and data analysis
- Added value services
 - *Access to data*



- No installation is easy; even service shafts;
- Technology works generally;
- Data transfer works on all modes;
- Bulk meter and sub-meter comparisons;
- Apartment usage data available;
 - *Leakage & Consumption trends*
- Data presentable to management companies and occupiers

4b

Smart Network Trial

Smart Water Network Trial

Project Summary

The project is a Proof of Concept to deploy a sample number of sensors into Irish Water's network to better understand the functionality of smart networks. The project will be deployed into a small part of a water treatment & distribution network.

The scope of the project is to design, install and decommission a network infrastructure to gather data from Irish Water's water network and assets. The data collected will be analyzed and visualized for Irish Water.

The primary focus of the project is on the performance and reliability of the communication network and the data presentation. The sensors are of secondary importance for this trial.

Project partners are Cisco, Connexin, Davra & Water Control Ireland. The project is funded through the Cisco Digitisation Fund.

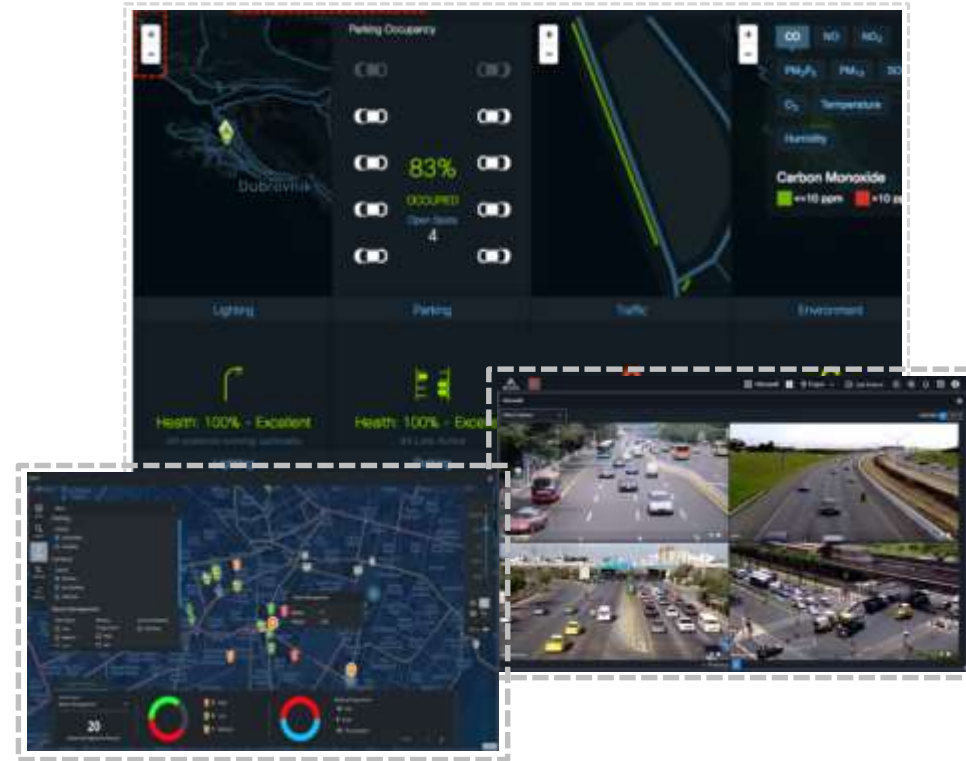


Gateways (LoRa)

Gateways

The LoRaWAN® specification is a Low Power, Wide Area (LPWA) networking protocol designed to wirelessly connect battery operated 'things' to the internet in regional, national or global networks, and targets key Internet of Things (IoT) requirements such as bi-directional communication, end-to-end security, mobility and localization services.

These Gateways will be installed at high level in a WTP with installation involving a small cabinet and antenna mounting to the roof of the WTP main building.



Sensors

Pump House

At a Pump House, temperature, vibration, occupancy and electrical current sensors will be deployed.

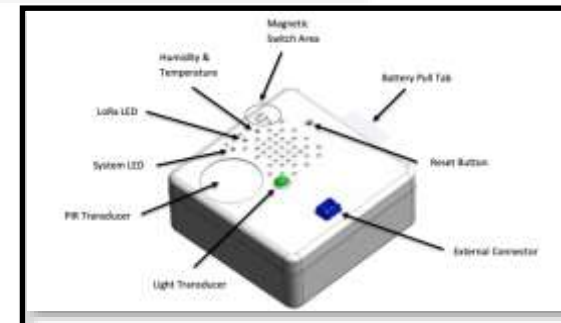
These sensors can indicate patterns that might inform preventative maintenance, failure or fault.



DMA's

In kiosks and chambers around the surrounding DMA's, small occupancy/temperature sensors will be attached to the door.

Pressure sensors with LoRa capability will be placed on a number of hydrants around the two DMA's and a number of acoustic loggers will also be deployed using NB-IoT.



Data Platform



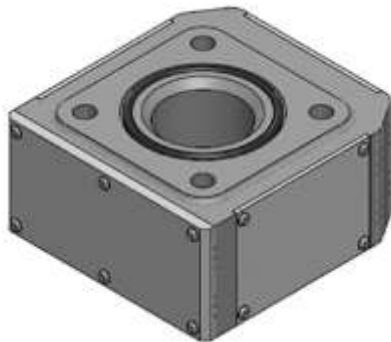
DavraTM

4c

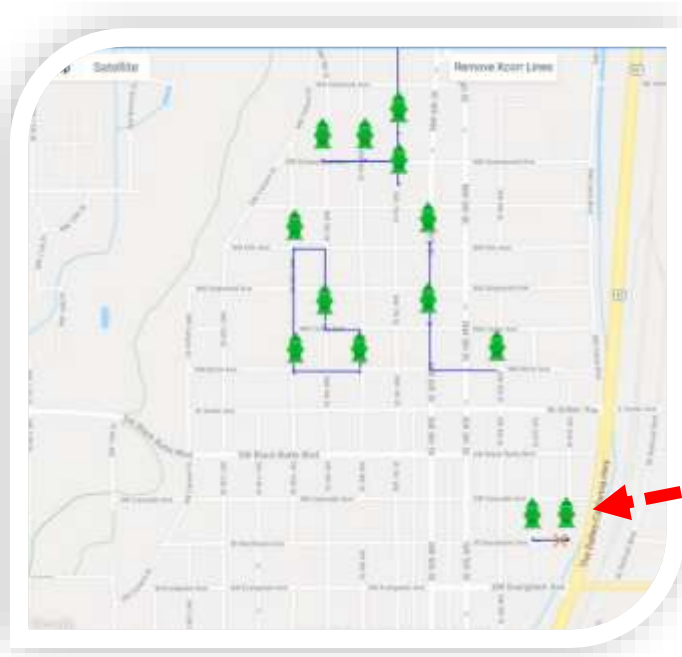
Smart Hydrants & Standpipes

Smart Hydrant Technology

- Flow and hydrant usage alerts
- Tamper alerts
- 2G/3G Communication
- Leak detection capability
- Secure and discrete
- Simple to use analytics

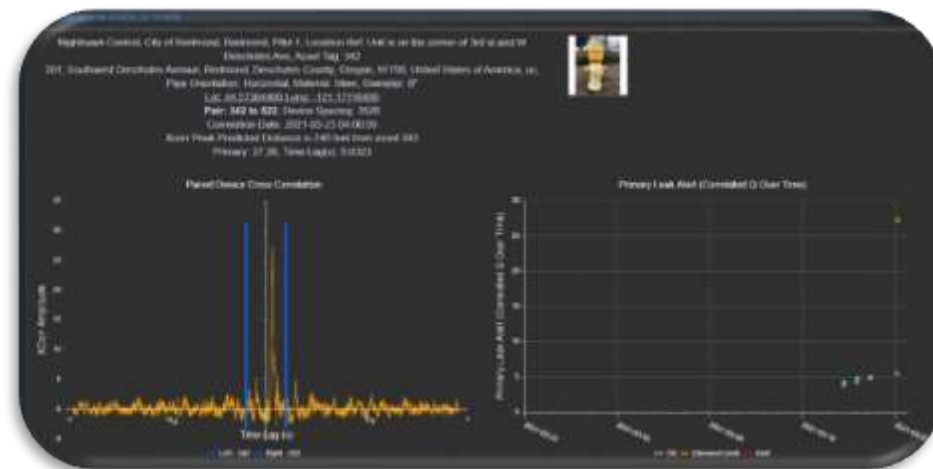


Data Portal



Automatic Map pinpointing

Drill Down into raw data



Smart Standpipes

FEATURES	
Flow measurement	✓
Non-invasive	✓
GPS position	✓
Live upload of usage events	✓
Live wireless cellular connectivity	✓
Battery powered	✓



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Future Challenges

Challenge & Opportunity

- **Sensors:**
 - *Small and cheap sensors*
 - *RF radio units are cheaper and more powerful*
- **Communications:**
 - *Sigfox, LoRa, NB-IoT, etc*
- **Big Data:**
 - *More data sets with powerful analytics*
- **Smart Utility Metering:**
 - *EU Smart Metering Rollout*
- **Risks:**
 - *Data Security & Protection (GDPR)*
 - *Hacking and external control*

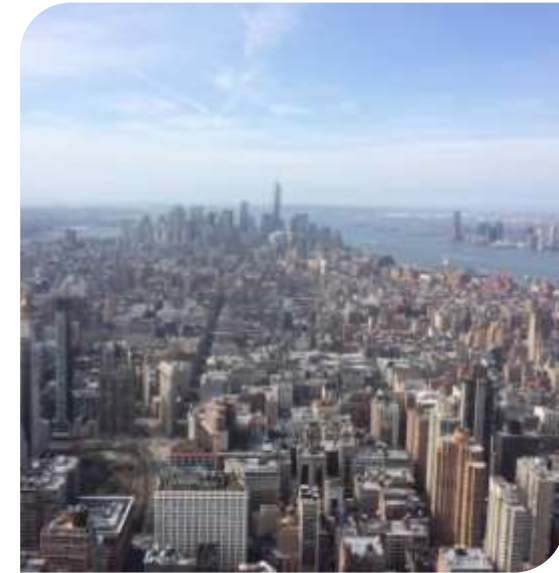


Connection metering is no longer “dumb” or an isolated activity.

Smart connection metering is increasingly about leakage control and water network management.

Water Authorities need to plan for smart metering within a wider smart architecture.

- Smart Cities Movement
 - *IoT Architecture*
 - *Shared Communications Infrastructure*
 - *Integrate at the cloud*
- Data Dashboards
 - *Open source data (anonymised)*
 - *Promote responsible behaviours*



- Customer Information (DWD)
 - *Leak Alarms;*
 - *Remote controls;*
 - *Data triggers;*
 - *Water Quality*
- Energy (Sustainability)
 - *Hot water costs*

1. *Physical Assets*
 - Pipes, Valves, Hydrants, etc
2. *Sensors*
 - Meters, Acoustic loggers, pressure loggers, etc
3. *Data Collection*
 - LoRa, NB-IoT, etc
4. *Data Platform*
 - Collect, store and display data
 - Dashboard
5. *Data Analysis*
 - Combine and use the data to create insight
 - Feed into actions.



[Smart Water Networks Forum \(SWAN\)](#)

Smart Metering & Smart Networks for Leakage Management *UKWIR 19/WM/08/70*



1. Water companies should recognise that the value in smart water management has the potential to **revolutionise customer engagement** and experience.
2. Water companies need to understand **which smart solutions are most relevant for adoption** and be included in their future plans. Technology requires regular upgrades, replacement and investment to prevent obsolescence.
3. Using lessons learnt and the best practices of other utilities such as energy will help in the development of the water utility smart network infrastructure.
4. Smart network management data can supply end-use information needs, critical to refining demand forecasting models and **identifying efficiency opportunities**.
5. Water companies must work with regulators, customers and suppliers to ensure that any data harvesting is of positive benefit and anonymising data provided to external contractors and **organisations**.
6. Regulatory bodies and water companies need to ensure that the broad scale introduction of smart networks occurs with a **focus on the needs of both customers and water companies in the longer term**, public good must prevail over shorter term profits for vendors of technology and data.
7. Providing **access to live networks as proving grounds for new technologies** can have an early influence on suppliers in developing new innovative applicable technologies.
8. Accelerating **adoption of data science** in the water sector will provide access to new information and increase business knowledge and efficiency.

Closing Comments

- A vision for smart networks starts with asset knowledge and information.
 - *Maintain Asset Register;*
 - *Live Asset Information;*
 - *Insights & Analysis;*
 - *Predictive, Proactive & Prompt;*
 - *Evidence-based decision making.*
- Smart Metering is on a journey that is giving an insight into the possible.
 - *Automatic meter reading with alarms;*
 - *Network benefits leveraged from data;*
 - *Future opportunities to adopt smart technologies.*
- Observations:
 - *The connected network is emerging in practice;*
 - *The intermediate communication options are a challenge;*
 - *Smart water networks will integrate with wider smart infrastructure.*



Thank you

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ervia

Aurora
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More Information



For info or further questions on this webinar please contact the JASPERS Networking Platform team:

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