Meeting water challenges for the next decade with digital tools

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Main challenges for the next decade

- Lack of water;
- Lack of land;
- Impact of Climate Change;
- Management of micro-pollutants;
- Maximising reuse of water and waste;
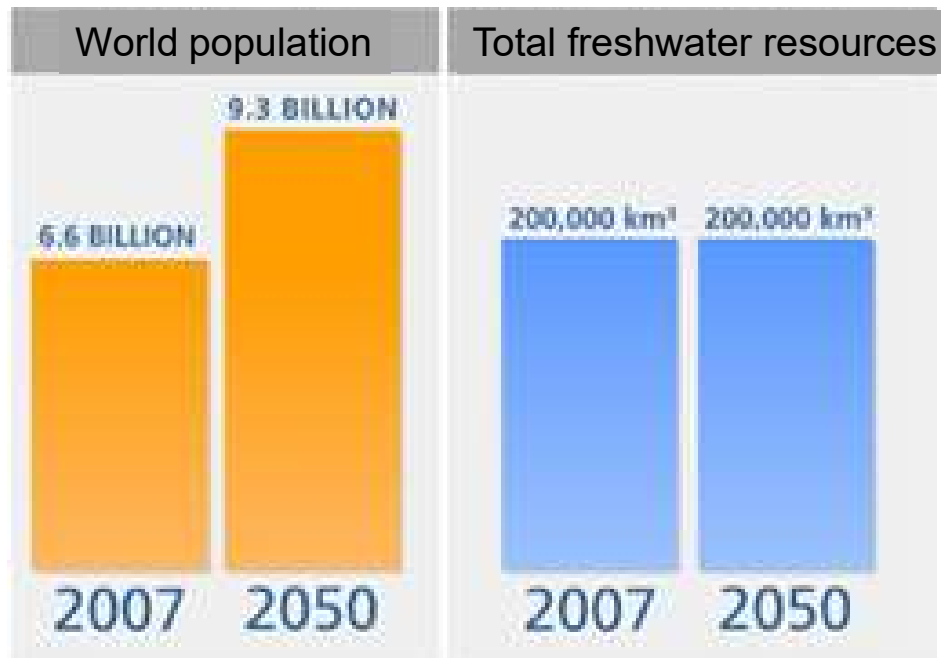- Managing rapid digitalisation

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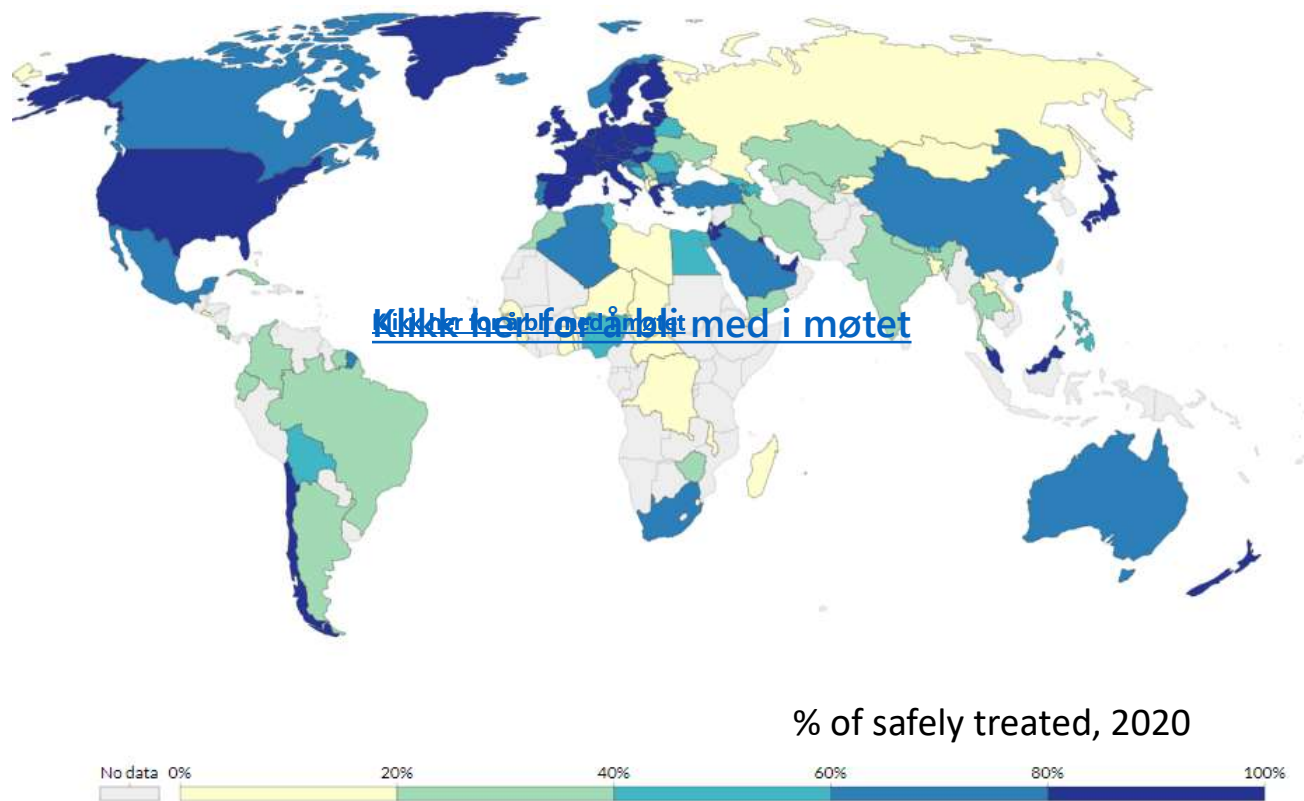
Is there a scarcity of water?

The challenge

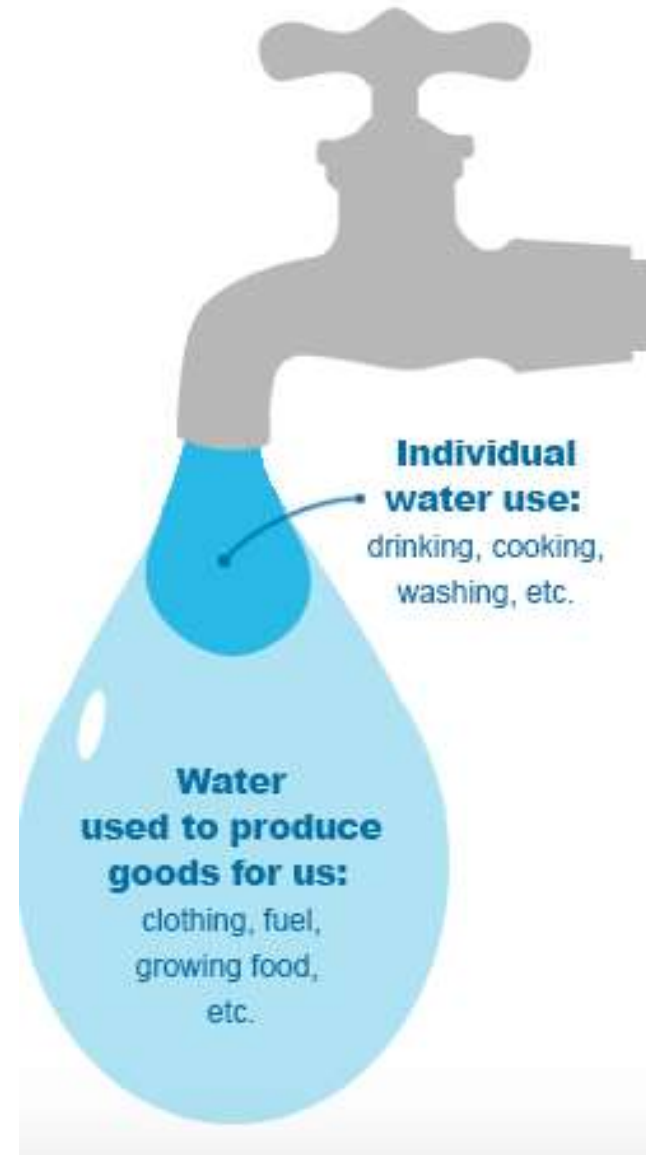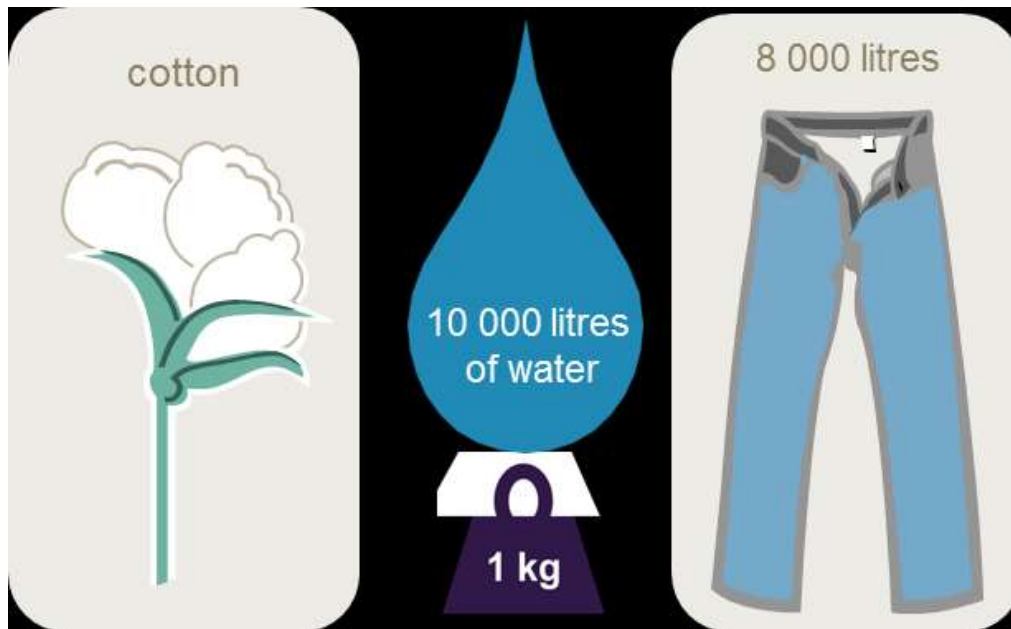| World population	Total freshwater resources
9.3 BILLION	200,000 km³ 200,000 km³
6.6 BILLION	
2007 2050	2007 2050

- Uneven distribution of water in the world
- Climate Change will make things worse

80% of wastewater goes untreated

% of safely treated, 2020

Water footprint

cotton

10 000 litres of water

1 kg

8 000 litres

Individual water use:
drinking, cooking, washing, etc.

Water used to produce goods for us:
clothing, fuel, growing food, etc.

We might be forced to change our traditions…

Water for food
Volume of water required to produce one kilogram of...

■ 100 litres

Rice
Soybeans
Wheat
Maize
1Kg
Potatoes
Beef

Source: Hoekstra, A. Y., *Virtual Water Trade*, IHE Delft, 2003.
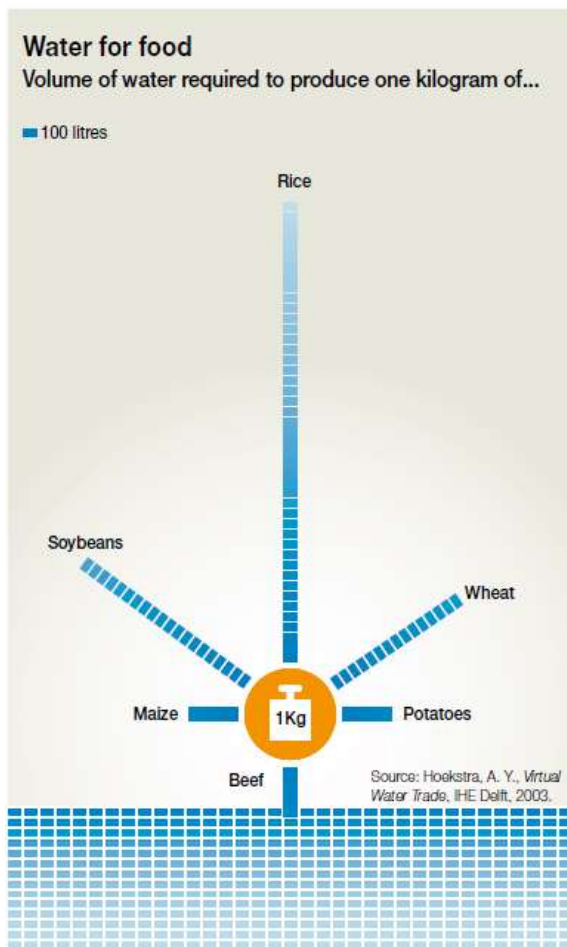
It takes...

10 liters of water to make one sheet of PAPER

40 liters of water to make one slice of BREAD

70 liters of water to make one APPLE

80 liters of water per dollar of INDUSTRIAL PRODUCT

91 liters of water to make half a kilogram of PLASTIC

120 liters of water to make one glass of WINE

140 liters of water to make one cup of COFFEE

1,300 liters of water to make one kilogram of WHEAT

4,800 liters of water to make one kilogram of PORK

10,855 liters of water to make one pair of JEANS

15,500 liters of water to make one kilogram of BEEF

16,600 liters of water to make one kilogram of LEATHER

No water – no food!

Agriculture accounts for **70%** of the world's water use

Population will reach **9.7 BILLION*** by **2050**

To meet food demand, global ag output will need to increase by as much as **70%**

Source: U.N. Dept. of Economic & Social Affairs

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Need to increase treatment capacities (and efficiencies)
vs
Plant footprints

Increased use of fine Sieves (<0.1 mm)

Salsnes/Trojan: 50% TSS & 20% BOD removal

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Less precipitation:
Climate Change will worsen the situation
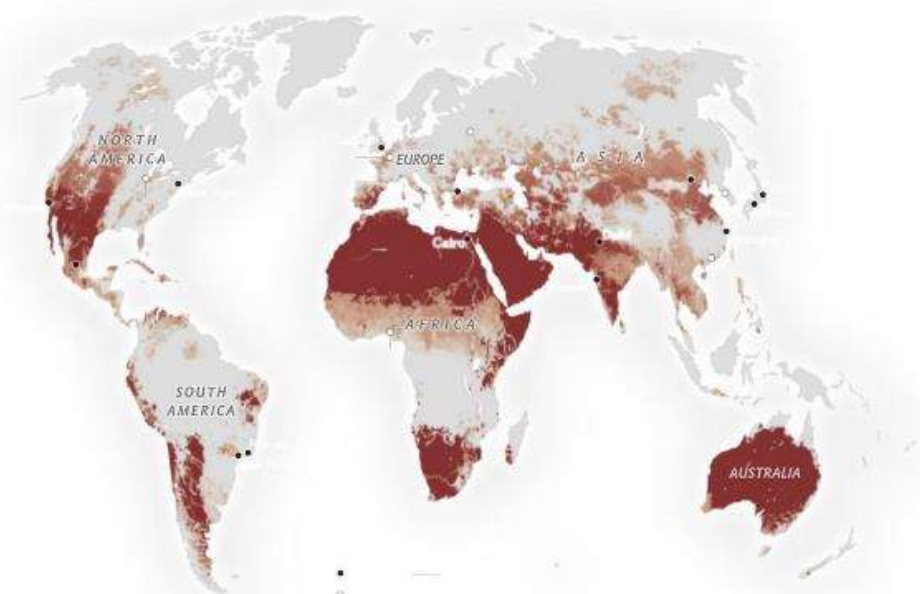
70% of population is affected by drought 1 month / year

More precipitation
More frequent
….more frequent overflows and floods

330 mm rain within 4 hours??

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Emerging pollutants

Emerging micropollutants

WHO launches health review after microplastics found in 90% of bottled water

Researchers find levels of plastic fibres in popular bottled water brands could be twice as high as those found in tap water

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Recovery, Reuse, Recycle

KEY
- potable water
- wastewater
- non-potable water
- resources

Raw Water Sources

Water Treatment

Industry Municipal Agriculture

Wastewater Treatment

Nutrients — for agricultural purposes

Energy — for industrial and urban applications

Others: microplastics cellulose chemicals — for industrial and manufacturing use

© Water Reuse Europe

UN WATER
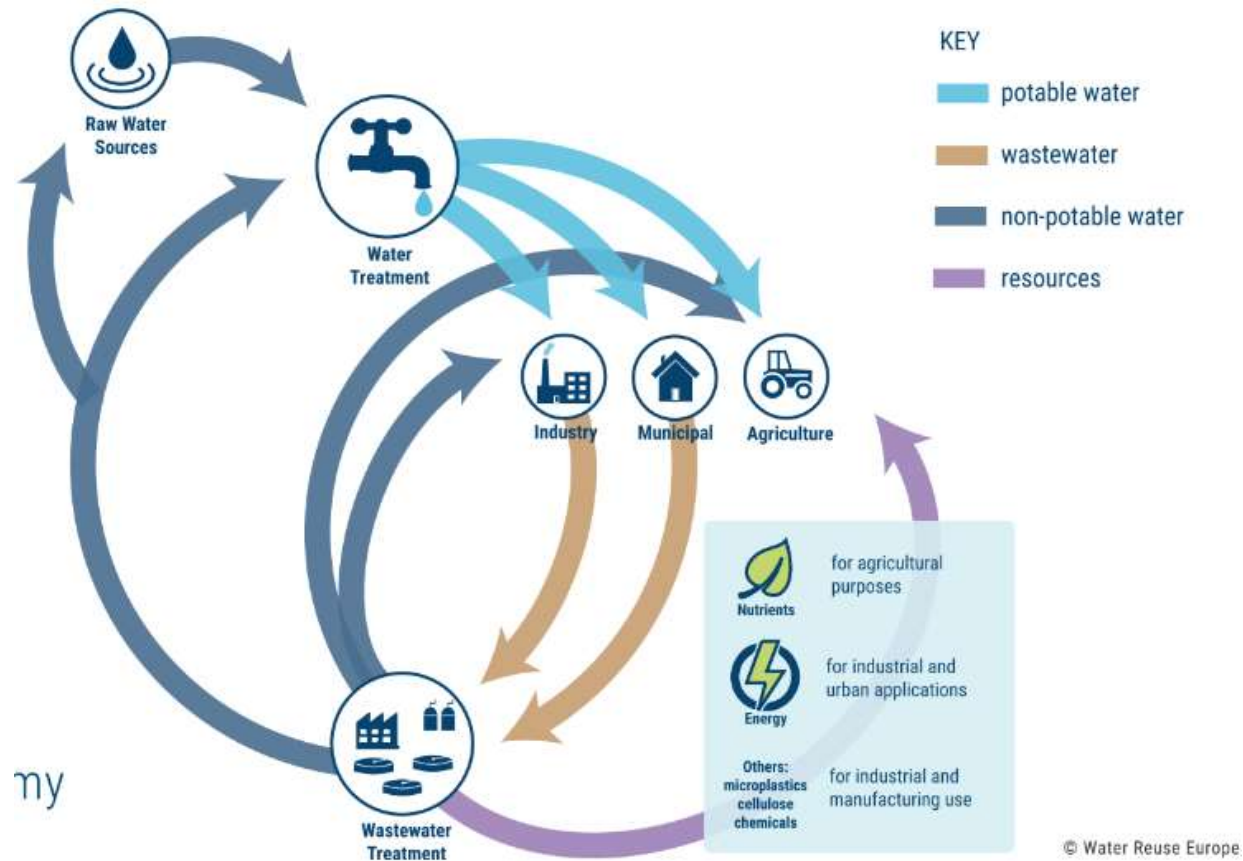
Report

The United Nations World Water Development Report 2017

WASTEWATER
THE UNTAPPED RESOURCE

WWDR 2017

United Nations
Educational, Scientific and
Cultural Organization

World Water
Assessment
Programme

FAO

UNDP

UNITED NATIONS

UNECE, UNECLAC,
UNESCAP, UNESCWA

UNEP

United Nations
Educational, Scientific and
Cultural Organization
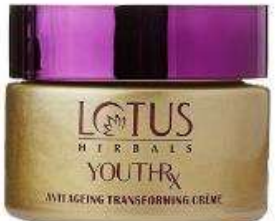
UN-HABITAT
FOR A BETTER URBAN FUTURE

UNIDO

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Digitalisation – opportunities in the water sector

Status and potential of digitalisation in the water sector
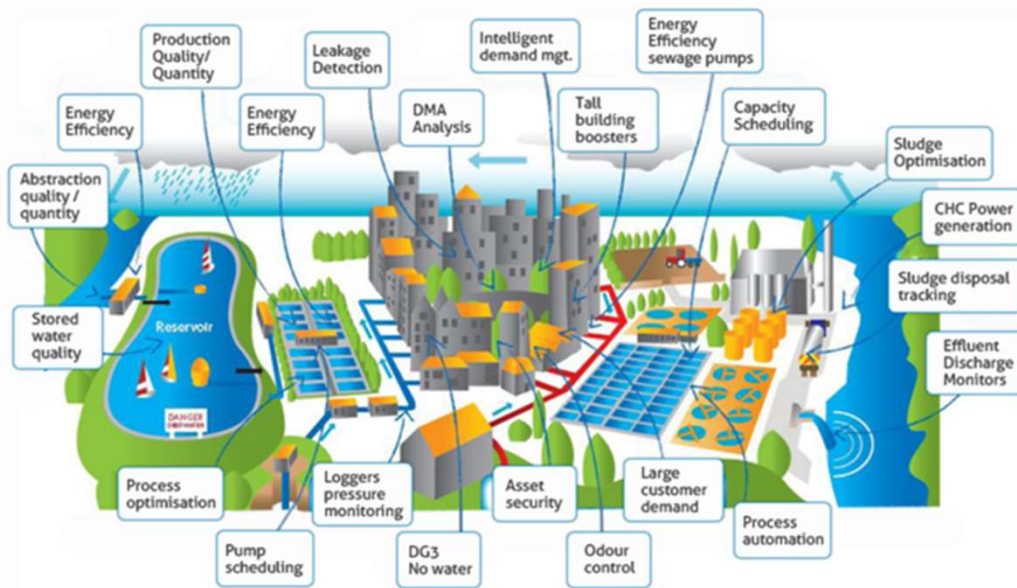
Smart by design - adaptive, distributed, advanced
Smart use - doing more with less
Smart control - sensors, analytics, OT-IT integration

Benefits of digitalisation

Community Benefits

INCREASED AFFORDABILITY
- Improved long-term affordability of rate structure
- Greater transparency in the use of proceeds from water tariffs
- Reduced likelihood of bill shock, non-payment and cut-offs

CUSTOMER EXPERIENCE
- Increased customer engagement and responsiveness to customer inquiries
- Reduced disruptions in water service
- Reduction in the volume of disruptive construction projects

ENVIRONMENTAL PROTECTION
- Reduced risk of sewage overflows into the environment
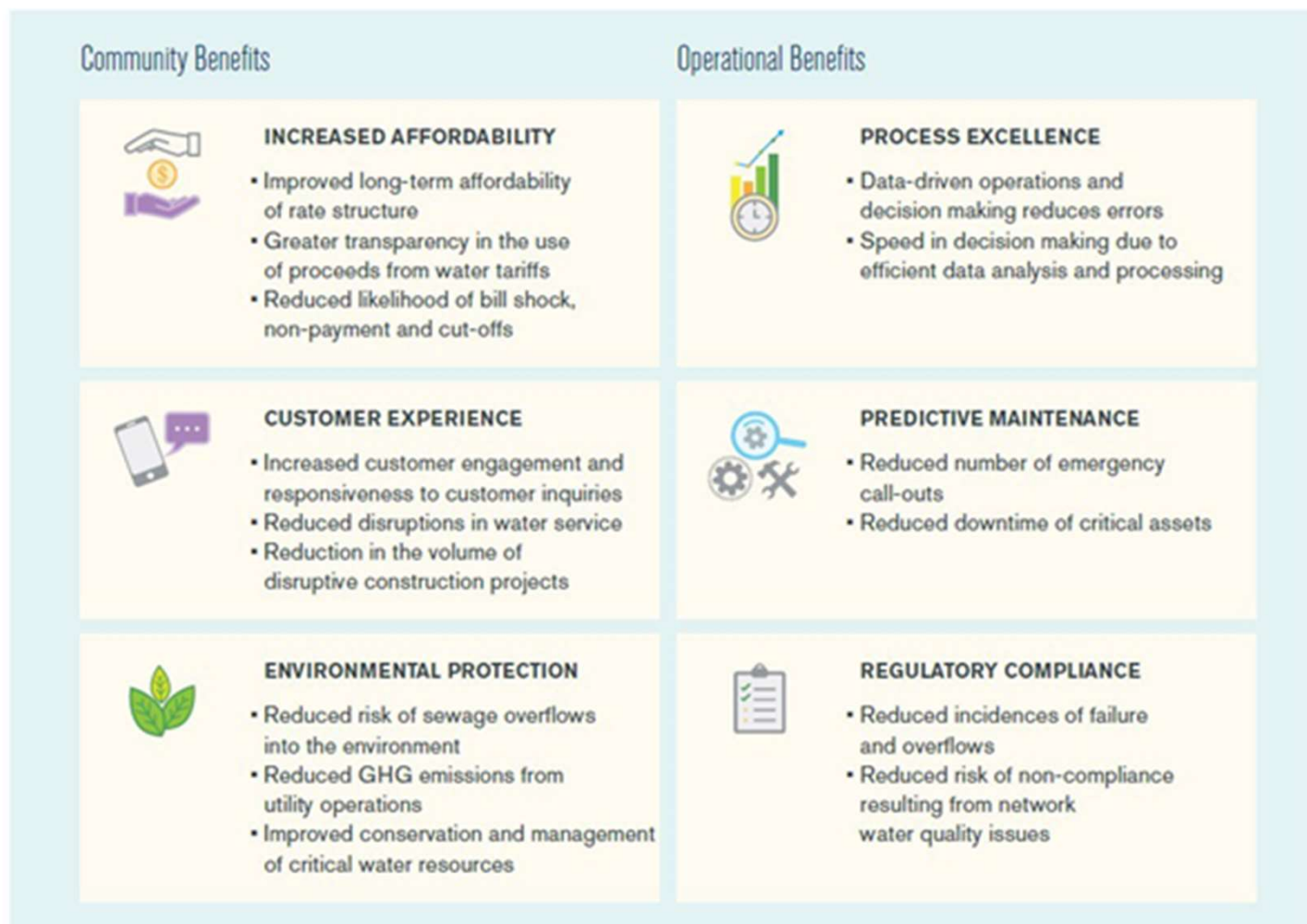- Reduced GHG emissions from utility operations
- Improved conservation and management of critical water resources

Operational Benefits

PROCESS EXCELLENCE
- Data-driven operations and decision making reduces errors
- Speed in decision making due to efficient data analysis and processing

PREDICTIVE MAINTENANCE
- Reduced number of emergency call-outs
- Reduced downtime of critical assets

REGULATORY COMPLIANCE
- Reduced incidences of failure and overflows
- Reduced risk of non-compliance resulting from network water quality issues

Benefits of digitalisation

Financial Benefits

REDUCED OPERATIONAL EXPENDITURE

- Optimised operations reduce energy and maintenance costs
- Reduction in costs and risks associated with ad-hoc field maintenance

INCREASED CAPITAL EFFICIENCY

- Improved cash flow as a result of targeted rehabilitation of faulty infrastructure
- Reduced liability and costs from unexpected water main breaks and sewage overflows

INCREASED REVENUE

- Targeted interventions with faulty meters increases revenue
- Value-added digital services available to bulk water customers

Long-term Resiliency Benefits

INCREASED RESILIENCE

- Improved operational flexibility from changing climate and demographics
- Increased safety through rapid customer engagement on public safety concerns

WORKFORCE DEVELOPMENT

- Improved cross-department collaboration through systems integration
- Reduced safety risk to workforce through fewer emergency call-outs
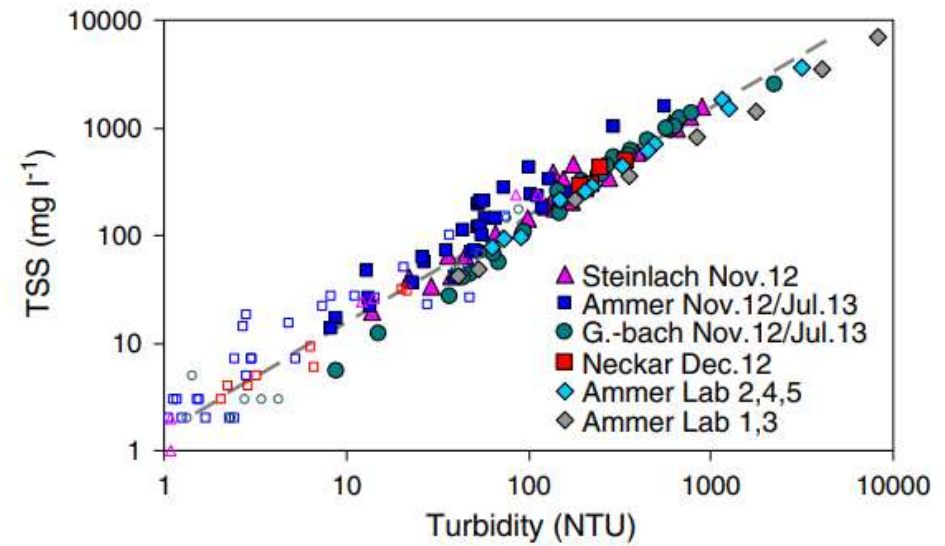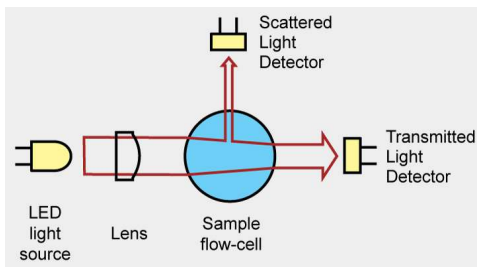
BRAND AND INNOVATION

- Elevates utility brand and engagement in the water industry
- Enables the utility to more easily pilot and adopt latest technologies

Virtual sensors (software/surrogate sensors)

Typical example: measurment of SS via turbidity

Challenges with digitalisation

Scream – Edward Munch

1910, A Norwegian

20 years of attacks….

Florida water treatment facility hack used a dormant remote access software, sheriff says

By Alex Marquardt, Eric Levenson and Amir Tal, CNN
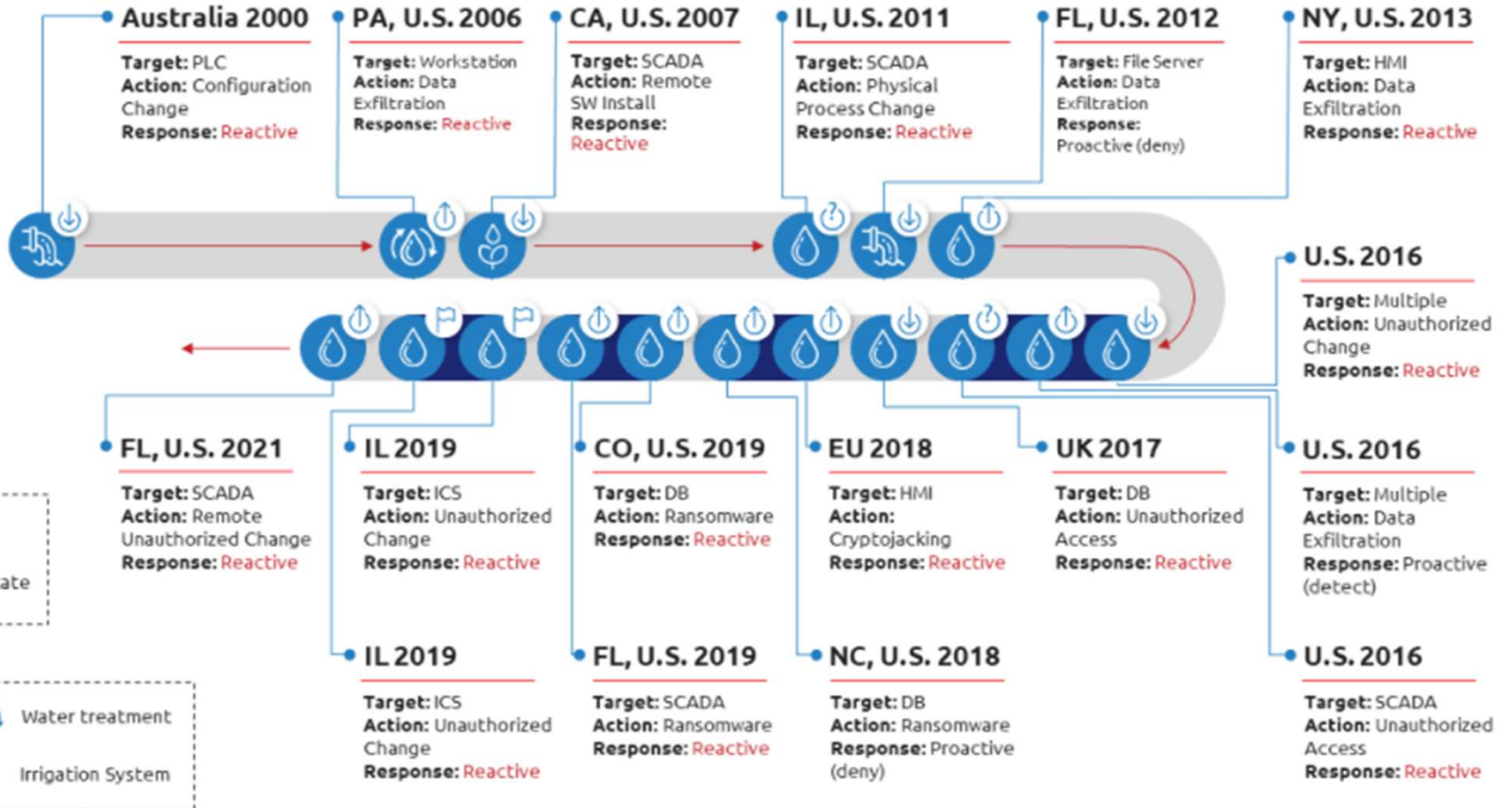Updated 2203 GMT (0603 HKT) February 10, 2021

U.S. Water Supply System Being Targeted By Cybercriminals

Iranian Hackers Access Unprotected ICS at Israeli Water Facility

Water – the 3rd most targeted sector for cyber threats

According to ICS-CERT (ICS-CERT, 2016b), WWS is the third most targeted sector.

Many cybersecurity incidents either go undetected, and consequently unreported or are not disclosed because doing so may jeopardize the victims reputation, customers trust, and, consequently, revenues.

Attacker:
- Insider
- N/A
- Outsider
- Nation/State

Vertical:
- Waste Water
- Water treatment
- Water
- Irrigation System

Australia 2000
Target: PLC
Action: Configuration Change
Response: Reactive

PA, U.S. 2006
Target: Workstation
Action: Data Exfiltration
Response: Reactive

CA, U.S. 2007
Target: SCADA
Action: Remote SW Install
Response: Reactive

IL, U.S. 2011
Target: SCADA
Action: Physical Process Change
Response: Reactive

FL, U.S. 2012
Target: File Server
Action: Data Exfiltration
Response: Proactive (deny)

NY, U.S. 2013
Target: HMI
Action: Data Exfiltration
Response: Reactive

U.S. 2016
Target: Multiple
Action: Unauthorized Change
Response: Reactive

FL, U.S. 2021
Target: SCADA
Action: Remote Unauthorized Change
Response: Reactive

IL 2019
Target: ICS
Action: Unauthorized Change
Response: Reactive

CO, U.S. 2019
Target: DB
Action: Ransomware
Response: Reactive

EU 2018
Target: HMI
Action: Cryptojacking
Response: Reactive

UK 2017
Target: DB
Action: Unauthorized Access
Response: Reactive

U.S. 2016
Target: Multiple
Action: Data Exfiltration
Response: Proactive (detect)

IL 2019
Target: ICS
Action: Unauthorized Change
Response: Reactive

FL, U.S. 2019
Target: SCADA
Action: Ransomware
Response: Reactive

NC, U.S. 2018
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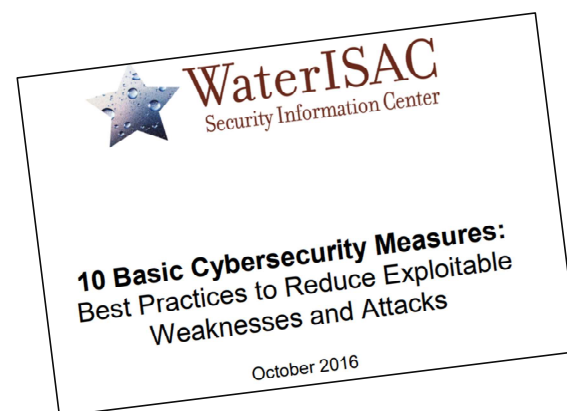
What can cyber attacks do?

- Interfere with operations – over/under dosage

- Unauthorised changes to programmed instructions; reduced pressure, overflow of sewage, malfunction of unit processes

- Modify control systems to produce unpredictable results

- Block data or send false information to operators

- Change alarm thresholds or disable them

- Prevent access to account information

- Access to personal information (GPDR directive)

- Ransomware

The biggest threat….

Unawareness

Unpreparedness

Vulnerability is possible to reduce!

- Keep an inventory of control system & reduce exposure

- Segregate networks and apply firewalls

- Use secure remote access methods

- Establish roles to control access levels and log users

- Require strong passwords & password management

- Avoid vulnerabilities, implement patches, updates

- Enforce policies on the security of mobile devices

- Have an employee cyber security training program

- Involve utility executives in cyber security

- Monitor network intrusions and have a response plan

- Report and share information on incidents for developing coordinated common actions (NIS directive, etc)

WaterISAC
Security Information Center

10 Basic Cybersecurity Measures:
Best Practices to Reduce Exploitable Weaknesses and Attacks

October 2016

New EU cyber security regulations

Post-attack response and recovery

Detection

- Systems to identify attacks

Response

- Emergency response plans
  - Disconnect compromised computers; Assess the scope of the compromise and isolate; Contact security service specialist; Assess any potential damage; Initiate manual operation; Keep relevant agencies informed

Recovery

- How to reduce the impact and recover ASAP

Awareness, Prevention, Detection, Response, Recovery

The key to reduce risks

- Know your risks!

- Preventive measures work!

- So does preparedness when dealing with post-attacks!

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