



TOOLS & TECHNOLOGIES for NON REVENUE WATER

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Centre Technique Distribution



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CTD

CENTRE TECHNIQUE DISTRIBUTION



ASSISTANT

HYDRAULIC
PERFORMANCE
DEPUTY MANAGER



NETWORK GLOBAL
PERFORMANCE
MANAGER

PROJECTS DELIVERY



OPERATIONAL ENGINEERING
R&D OFFICER



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TECHNOLOGY OFFICER



INVESTMENT PLANNING
KM OFFICER



ASSET PERFORMANCE
PROJECT MANAGER



INTERMITTENT SUPPLY
SCIENTIFIC OFFICER



SMART METERING
DIGITAL OFFICER



WORKS & OPERATION
PURCHASE OFFICER



NRW
SENIOR EXPERT

PROJECTS DEVELOPMENT



NRW
PERFORMANCE MANAGER



OPERATIONAL EFFICIENCY
SENIOR EXPERT



HYDRAULIC DESIGN
SENIOR EXPERT



PRESSURE MANAGEMENT
SOLUTIONS MANAGER



OUR MISSIONS

EXCELLENCE CENTER

- CONSOLIDATE AND DISSEMINATE KNOWLEDGE AND GOOD PRACTICES
- BE AT THE CUTTING EDGE OF TECHNOLOGY AND SCIENCE
- STEER AND EXECUTE INNOVATION ROADMAP
- PROMOTE NEW SOLUTIONS

SUPPORT CENTER

- PROVIDE TECHNICAL ASSISTANCE TO ALL BUSINESS UNITS
- SUPPORT PERFORMANCE IMPROVEMENT AND BUSINESS DEVELOPMENT
- COVER THE WHOLE VALUE CHAIN (STRATEGY, DESIGN, OPERATIONS AND MAINTENANCE)
- COLLECT AND REPORT OPERATORS NEEDS

CTD'S EXPERTISE =



Assess, diagnose,
forecast and build
action plan for global
network performance

Diagnosis

Forecast

Action plan



Organize day to day
maintenance and
curative actions
(short-term actions)

Leak research and
detection

Maintenance

Flushing



Improve hydraulic
and quality
management

Sectorisation

Pressure
management

Smart networks



Manage service
connections with end
user

Customer losses

Strategic meter

Customer meter



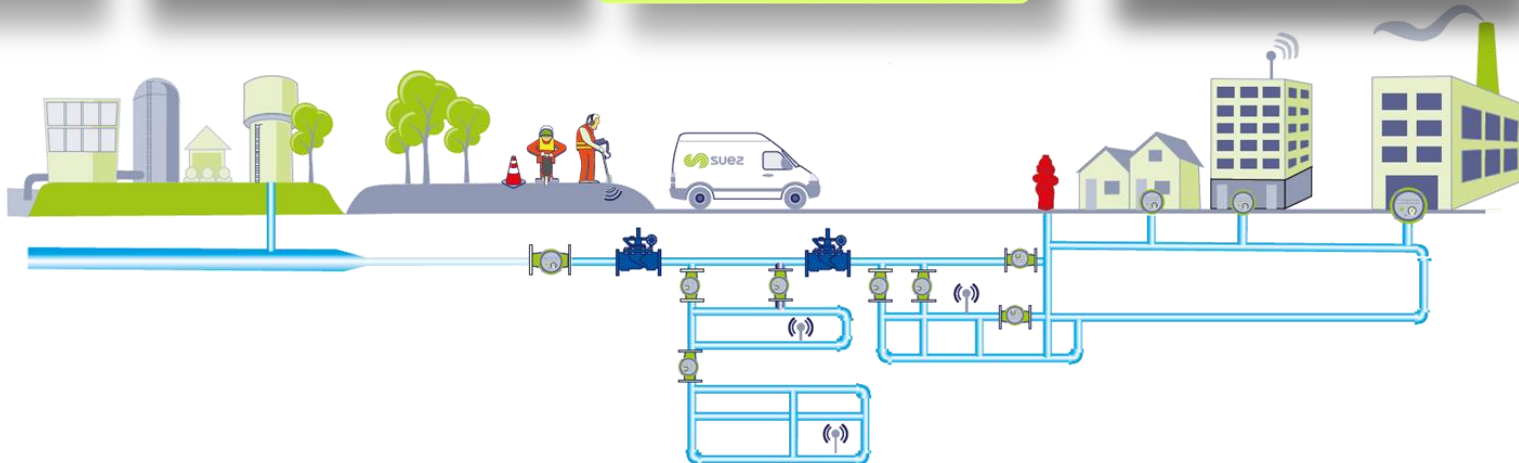
Investment plans
with a mid-to-long
term vision

Trunk mains

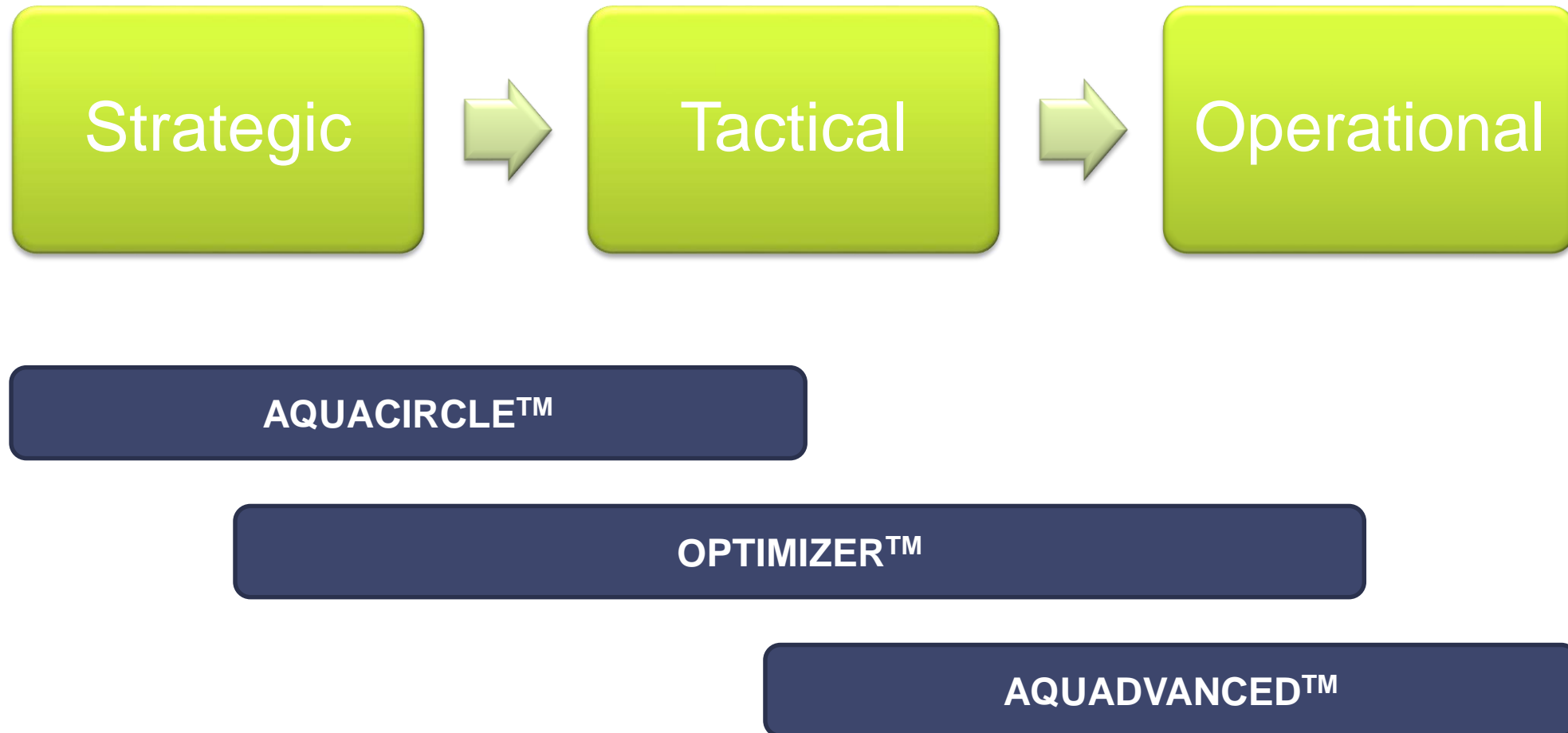
Distribution mains

Connections

Accessories



OUR TOOLS FOR NRW MANAGEMENT





DIAGNOSIS & FORECAST TOOL FOR NRW MANAGEMENT

ready for the resource revolution



WHAT IS IT?



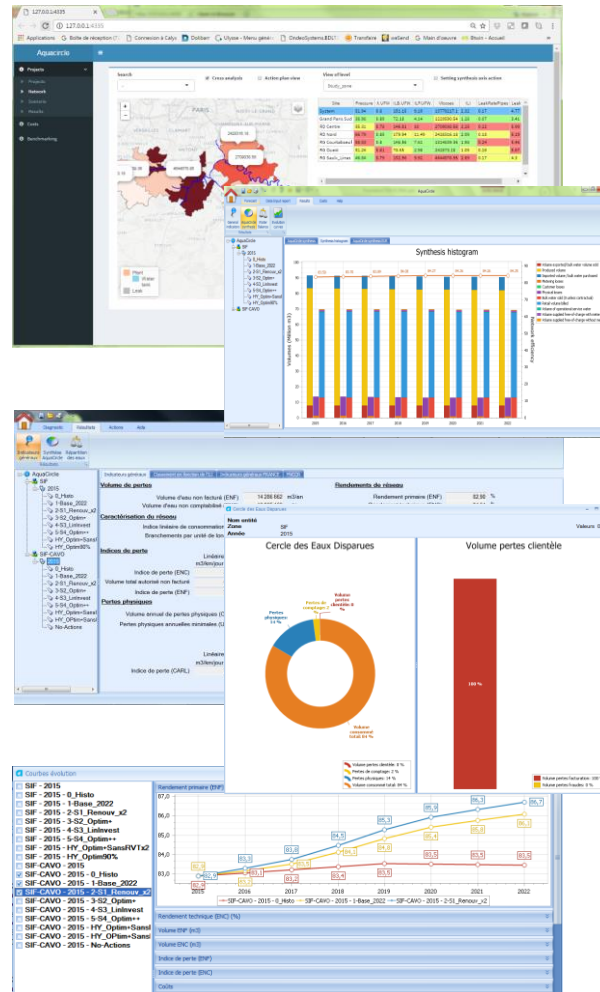
Aquacircle is an **expert** tool to support **NRW assessment** and **simulate** the **potential impact** of possible actions based on hypothesis and contractual objectives

It is used for decision-making at **strategic level** mostly, even though it can be extended to tactical planning.

AquaCircle™: a unique tool going beyond simple performance assessment

AquaCircle™ Tool

Diagnosis & Forecast



1

Complying with national and international regulations on water networks and water quality

- The Association of French Mayors
- The International Water Association (IWA)
- The International Organization for Standardization (ISO)

2

Demonstrating its added-value on the ground since 2011 all around the world

- More than 220 missions worldwide
- Algiers, Oman, Bordeaux, Casablanca, Addis Ababa, Macao, etc.

3

Forecasting the evolution of non-revenue water and going beyond simple performance assessment

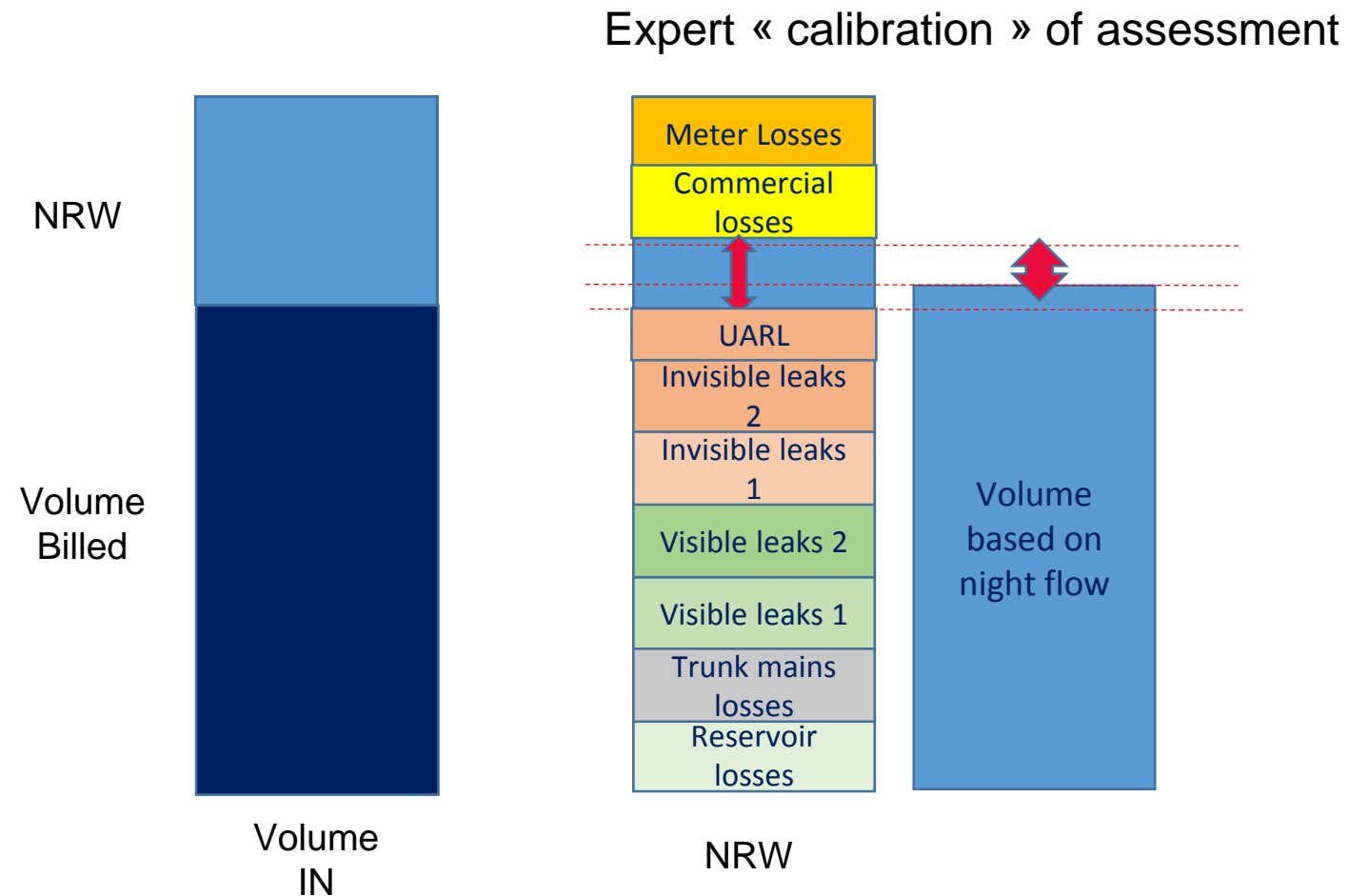
- A calibrated model with hypothesis on network deterioration
- Simulating multiple scenarios
- Carrying out cost-benefit analysis on each scenario

4

Allowing for easy visualization with a user-friendly interface



THE ASSESSMENT

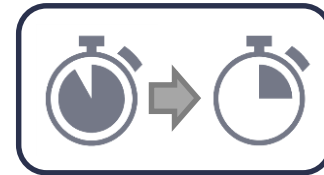


THE FORECAST: REAL LOSSES APPROACH

$$V_{m3} = n \times Q \times t$$

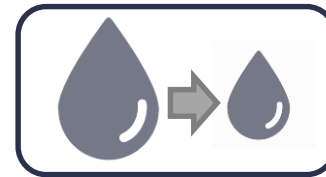
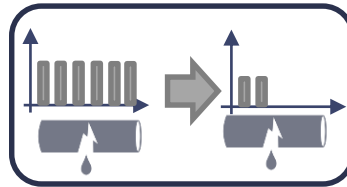
leakage detection

t



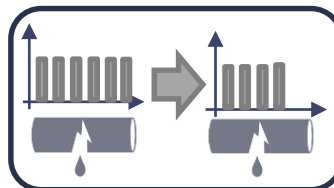
pressure control

n, Q

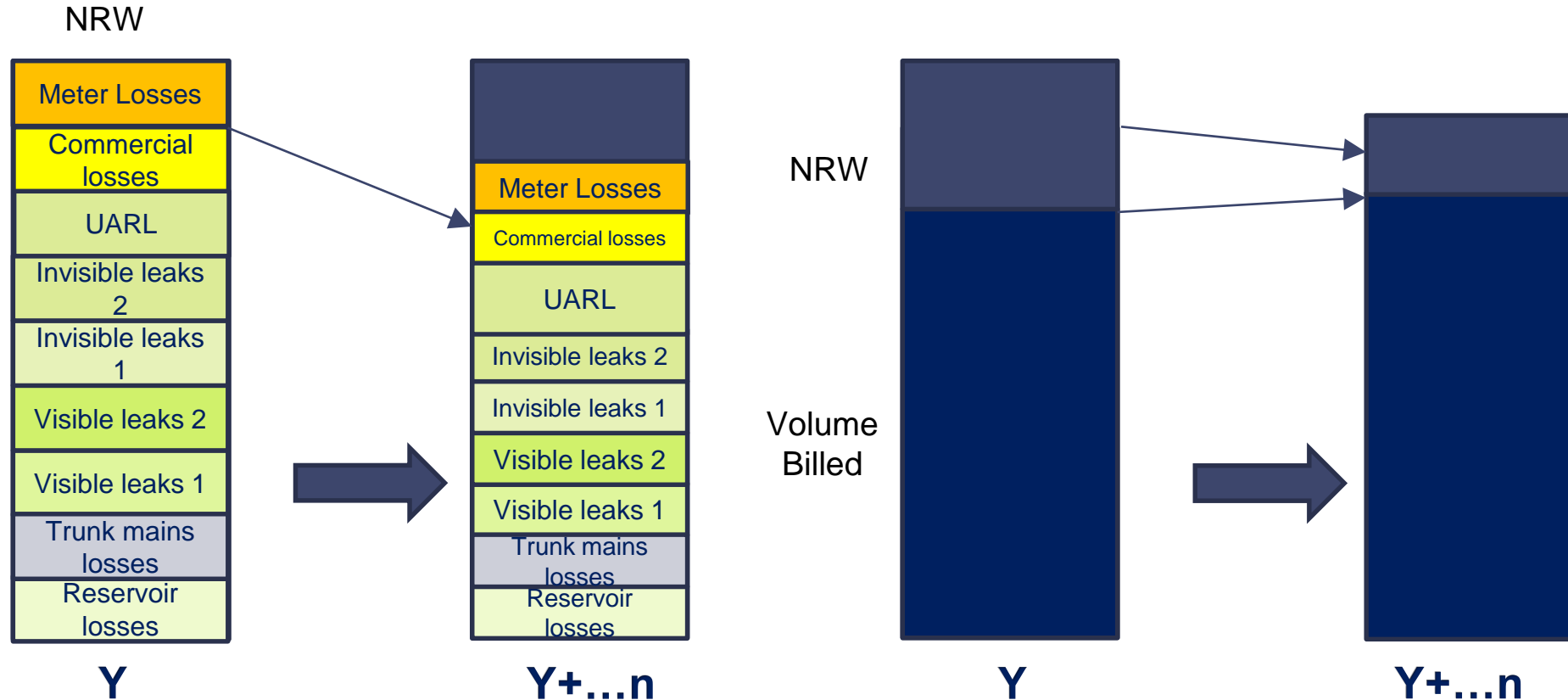


pipes renewal

n



THE FORECAST



AQUACIRCLE™

DEMO

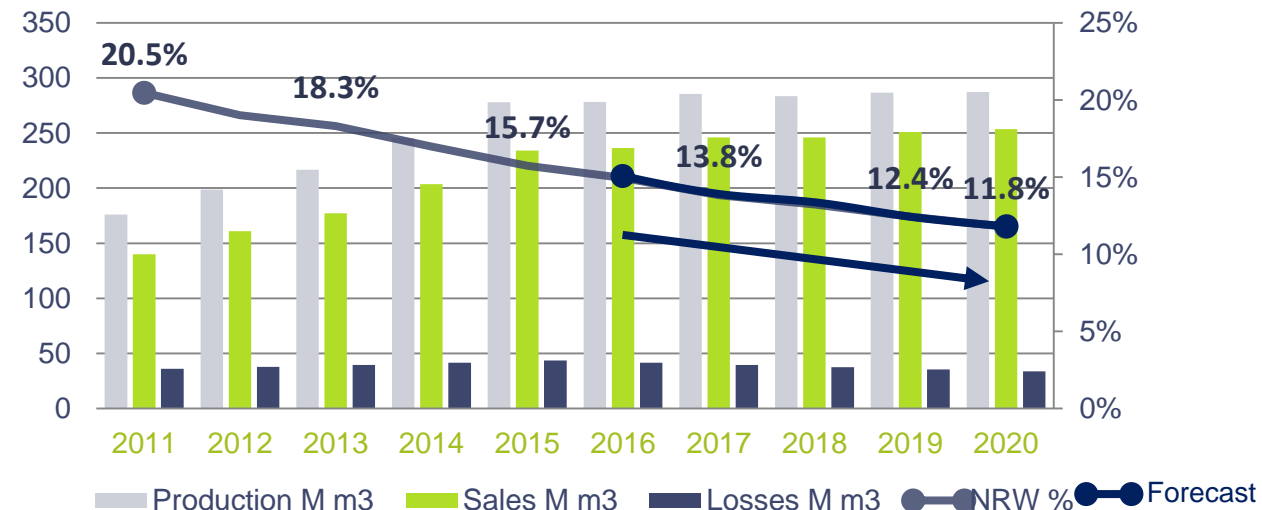
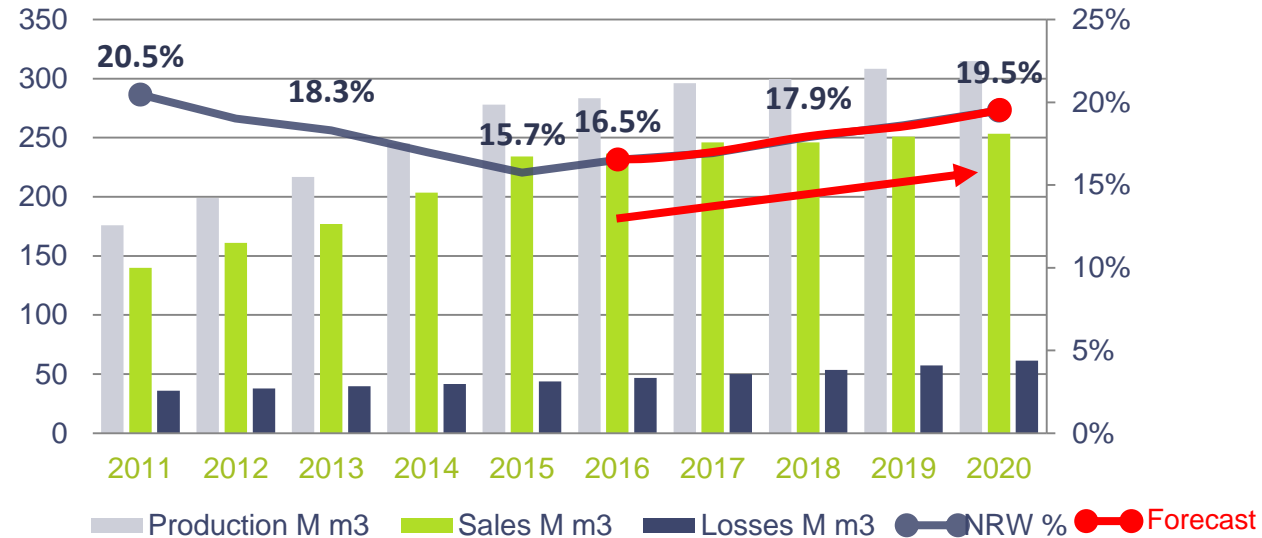


AquaCircle™ Diagnosis & Forecast: Success story in Asia

In 2016, the CTD's experts undertook an assessment of water network performance in Asia. The city in question had successfully reduced its non-revenue water to 15.7%. However in 2016, after five consecutive years of decline, it slightly increased again.

Our experts ran an AquaCircle™ **Forecast** and realized that **if the city carried on with its current action plan, non-revenue water would increase to 19.5% by 2020** and previous achievements would have been lost.

The experts analysed the impact of past non-revenue water actions, ran simulations and designed a new action plan that would **bring down non-revenue water at 11.8% in 2020**.



Optimizer™

CAPEX/OPEX Optimization



prêts pour la révolution de la ressource

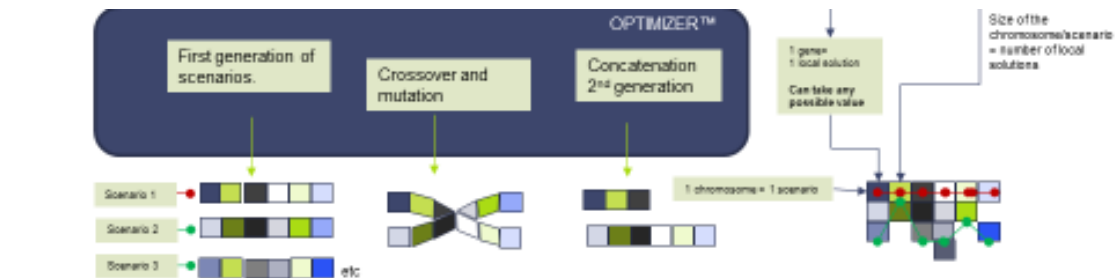
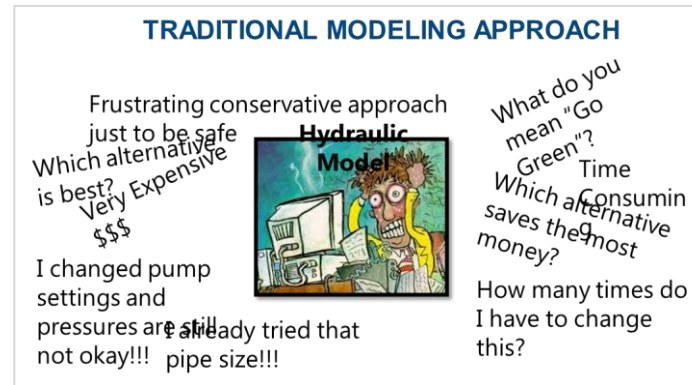
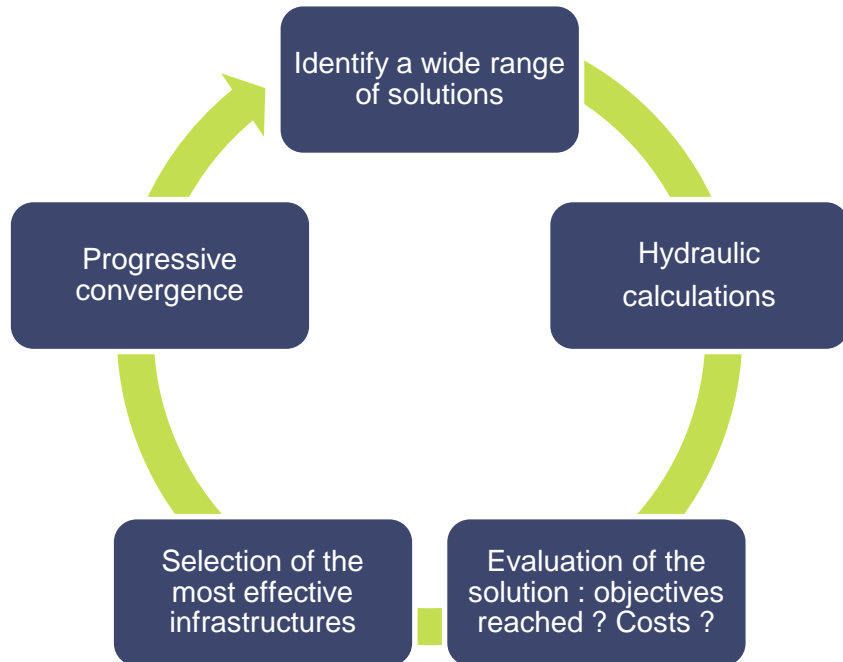
Optimatics
PLAN SMARTER



The process

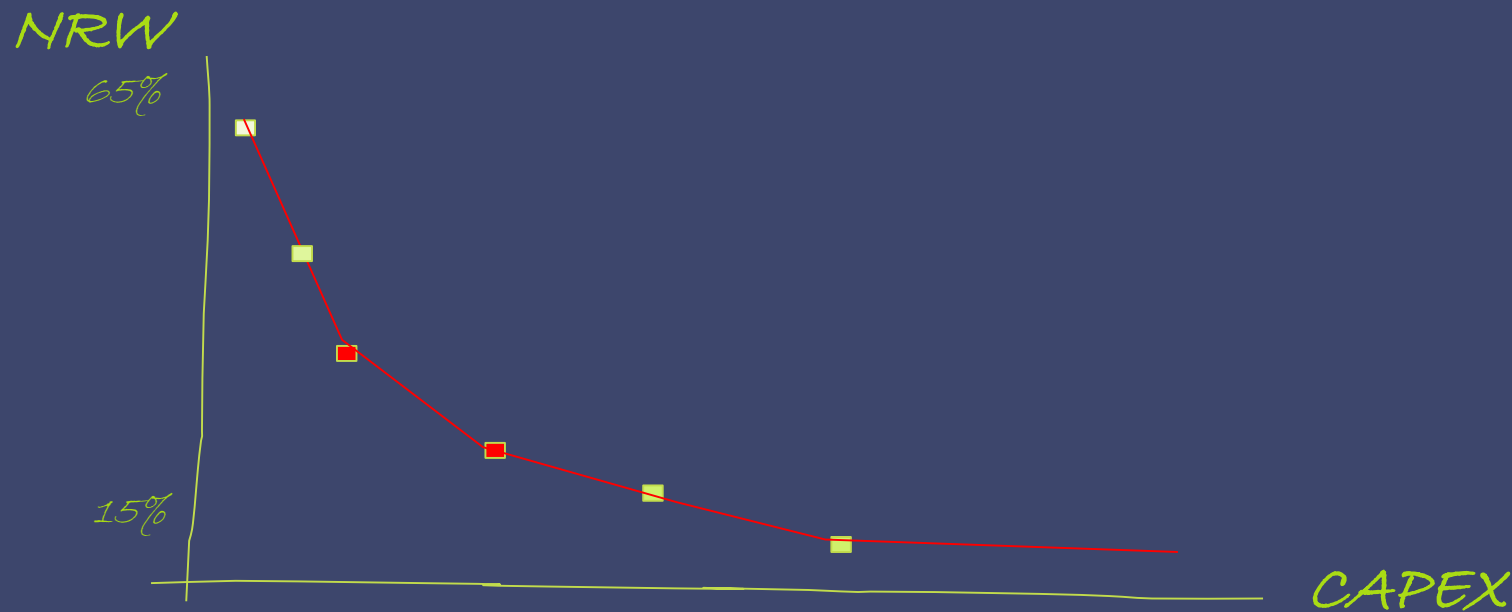
Automation of the fastidious manual trials

→ 100 000s of scenarios tested with genetic algorithm



The outcomes

An exhaustive vision of the cost/performance efficiency of the potential solutions



PERFORMANCE/COST OPTIMIZATION TOOL



The applications

Operation enhancement

- Pumping strategy
- Flushing strategy

Optimization of investments

- Renewal planning
- Hydraulic design (sectorisation, pressure zoning, pipe sizing...)

Multiobjective optimization

- OPEX/CAPEX balance
- Cost/performance balance



An aerial photograph of a city, likely Amsterdam, showing a dense grid of streets and buildings. A large river, the Amstel, flows through the center of the city. The entire image is covered with a semi-transparent blue overlay. The text 'AQUADVANCED®' is written in large, white, bold, sans-serif capital letters across the middle. Below it, the phrase 'The water solution suite for sustainable cities' is written in a smaller, green, sans-serif font, with 'The water solution suite' on one line and 'for sustainable cities' on the line below.

AQUADVANCED®

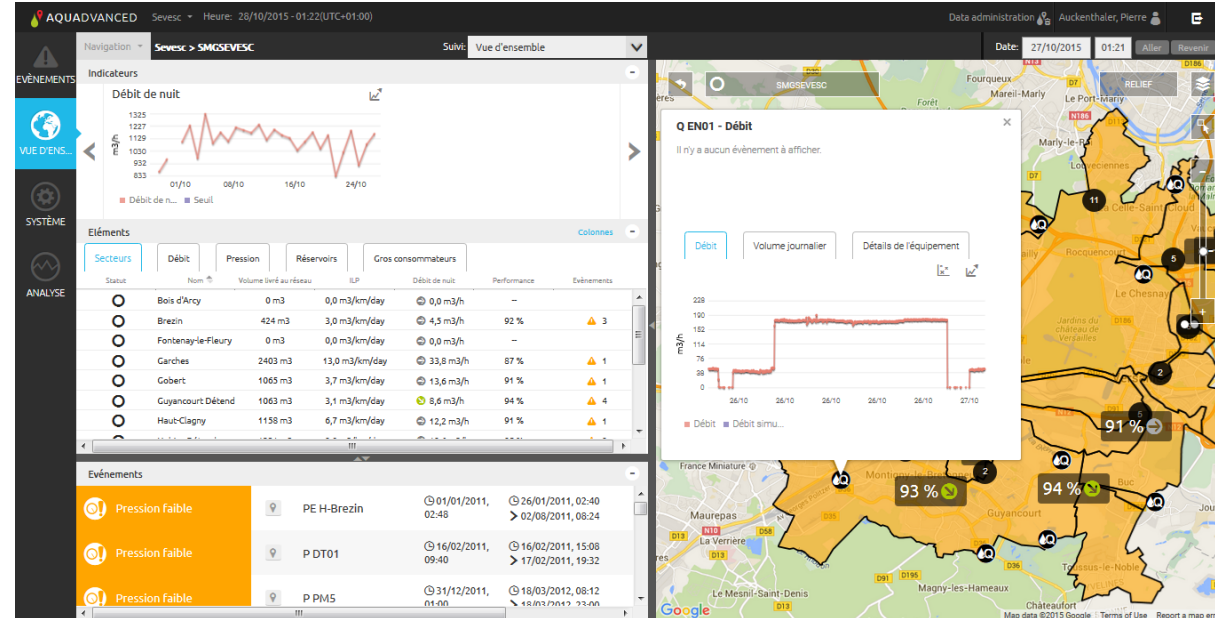
The water solution suite
for sustainable cities

AQUADVANCED® software suite for water cycle management

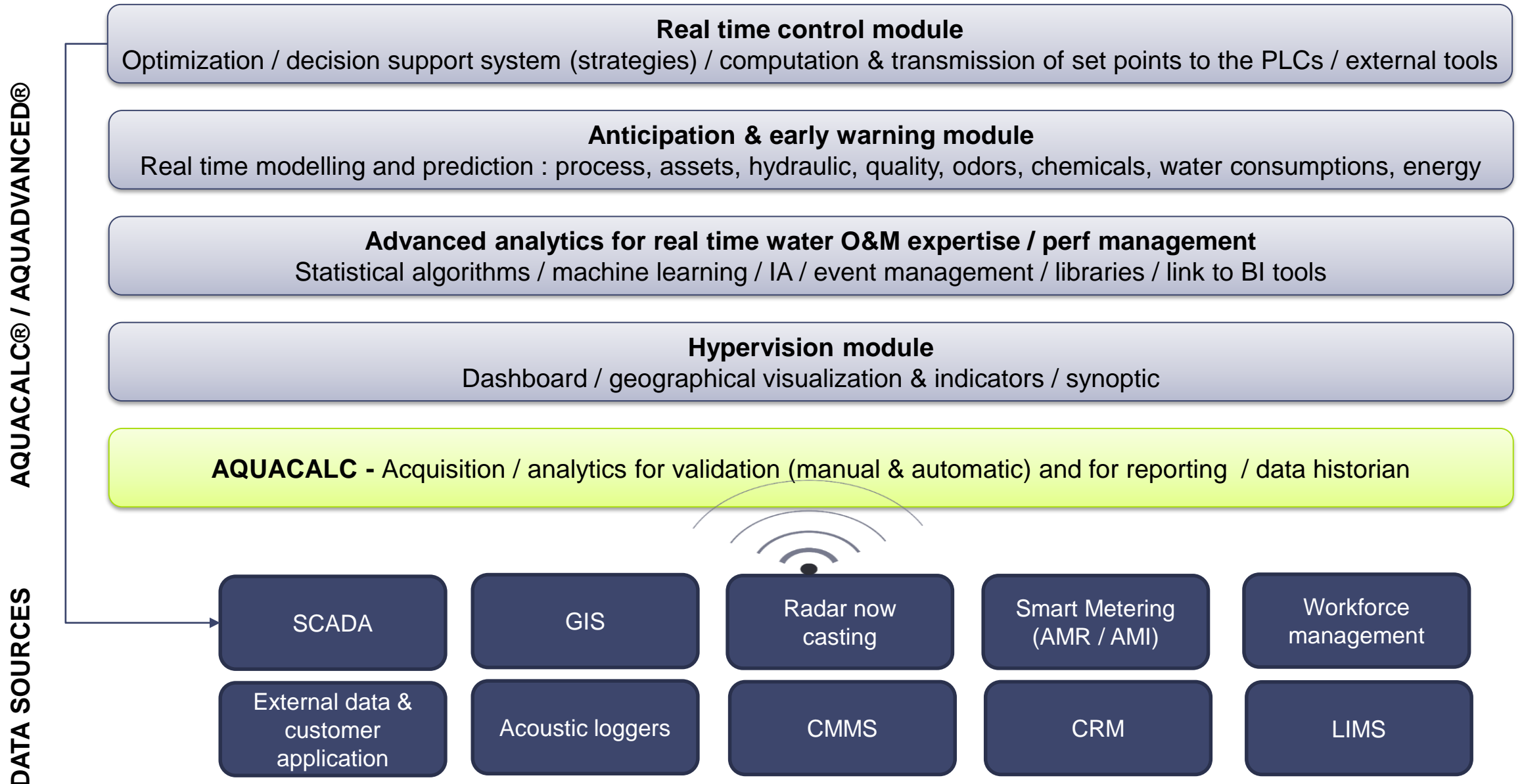
DRINKING WATER				WASTE AND STORM WATER			
AQUADVANCED® Wells Real time performance of wells INCREASE LIFETIME OF WELLS	AQUADVANCED® Energy Real-time energy management system for water distribution SAVE UP TO 20% OF ENERGY EXPENDITURES	AQUADVANCED® Water Networks Real time performance of drinking water distribution networks NRW MANAGEMENT FROM 2% TO 5% OF NETWORK EFFICIENCY	AQUADVANCED® Drinking Plants Efficiency of Drinking water plants UP TO 15% SAVINGS ON CHEMICALS (COAGULANT)	AQUADVANCED® Urban Drainage Monitoring real time monitoring of sewer networks COMPLIANCE WITH NEW REGULATIONS	AQUADVANCED® Urban Drainage Early warning flood and natural environment pollution risks FLOOD RISK DETECTION AND WARNING TRIGGERED MORE THAN 20 HOURS IN ADVANCE	AQUADVANCED® Urban Drainage Advanced control optimized control and automatic monitoring of sanitation system UP TO 45% REDUCTION IN THE TOTAL VOLUME DISCHARGED PER YEAR	AQUADVANCED® WWT Plants Efficiency of waste water treatment plants 3% TO 7% ENERGY SAVING ON AERATION 2,5% TO 5% SAVINGS ON SLUDGE DISPOSAL
AQUACALC - DATA HISTORIAN & ANALYTICS							

AQUADVANCED® WATER NETWORKS

- A tool grouping data from different sources
- Flow, pressure, quality sensors, reservoirs, but also AMR, acoustic loggers, complaints and interventions
- Simple interface with cartography and graphs
- Showing aggregated indicators, but possibility to drill down to see the more detailed raw data



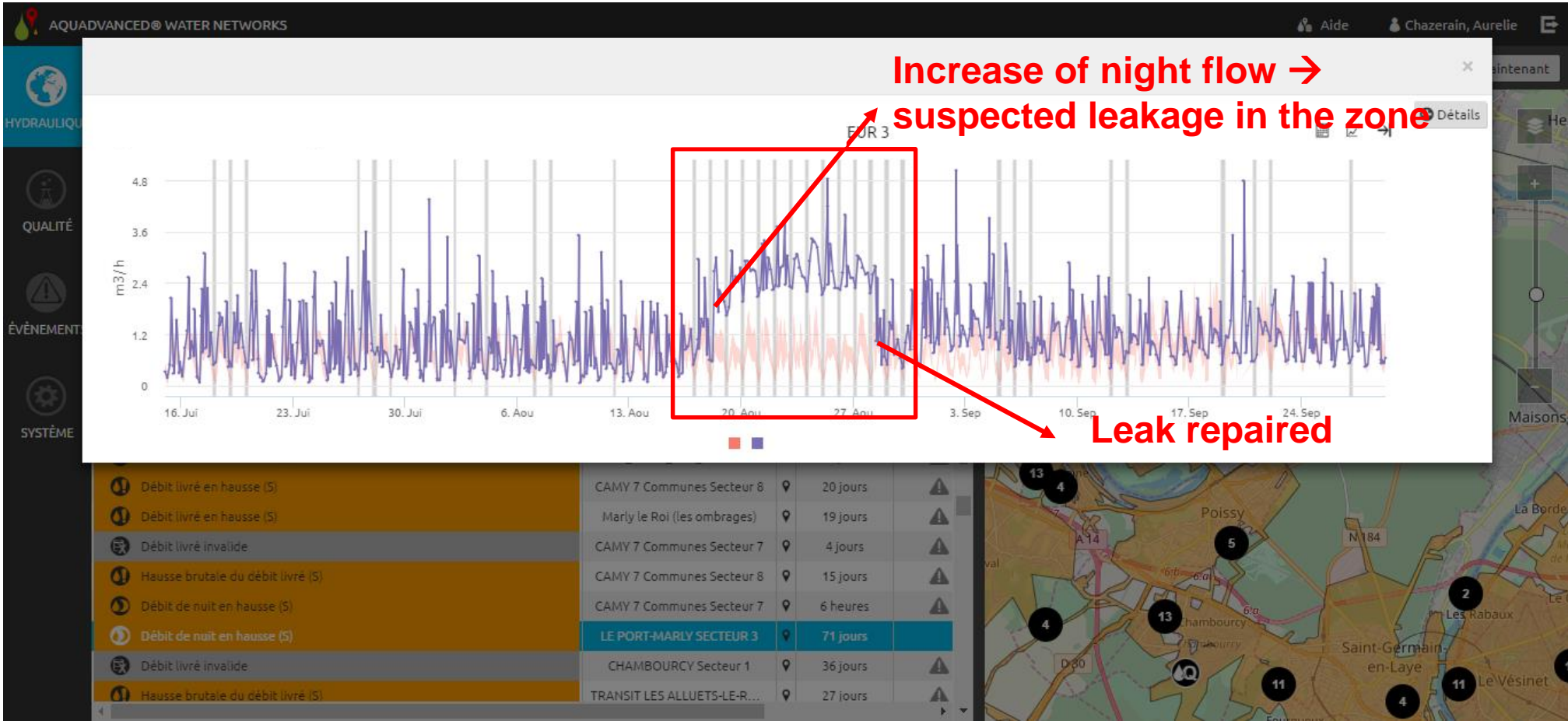
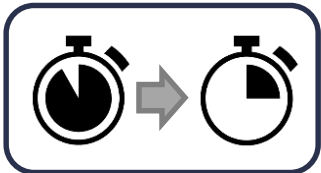
AQUADVANCED® / AQUACALC® software suite for water cycle management



AQUADVANCED® WATER NETWORKS

Increased efficiency of leakage detection

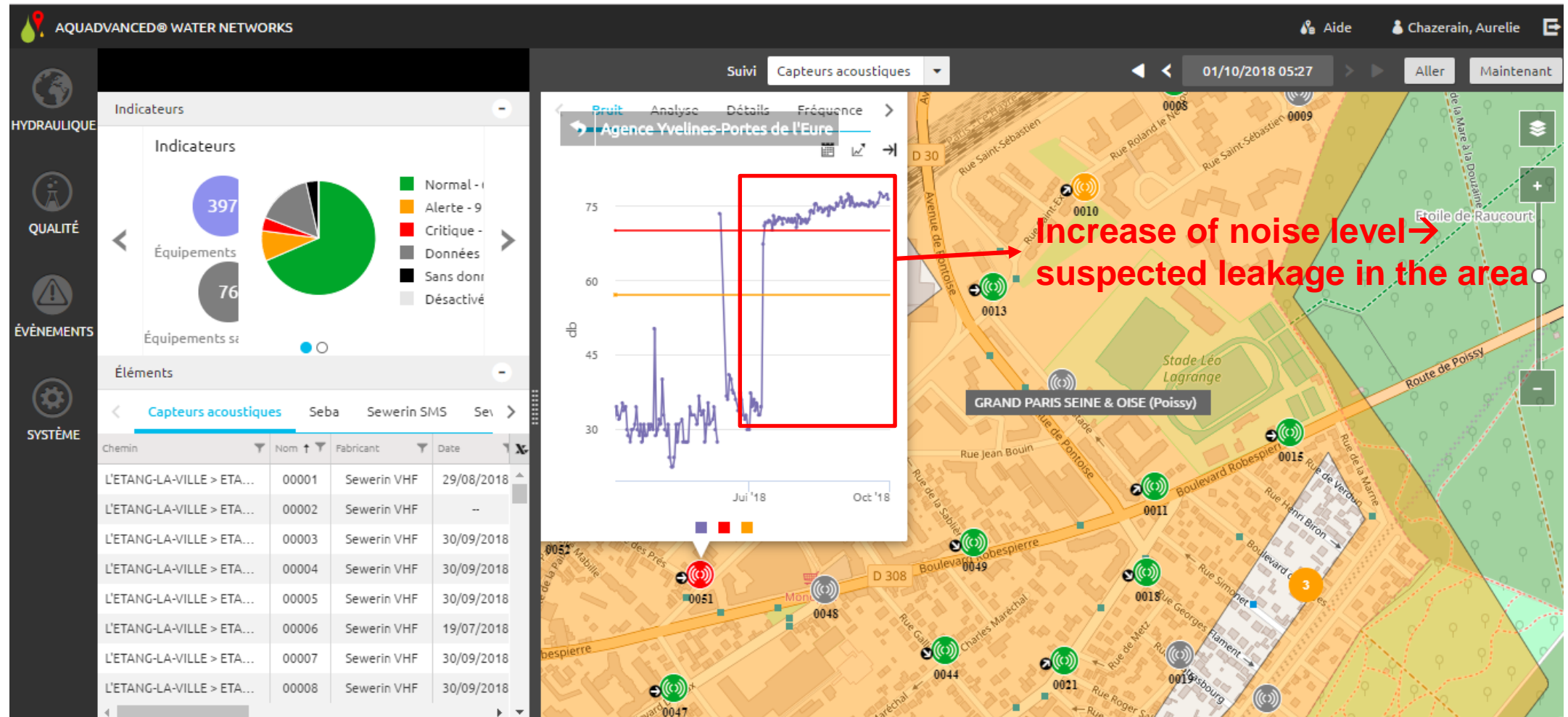
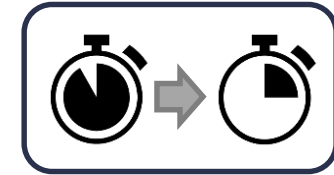
Automatic detection of night flow increases



AQUADVANCED® WATER NETWORKS

Increased efficiency of leakage detection

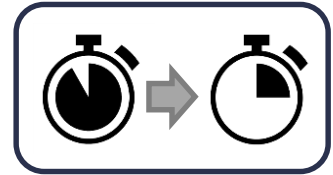
Acoustic loggers visualisation at one glance



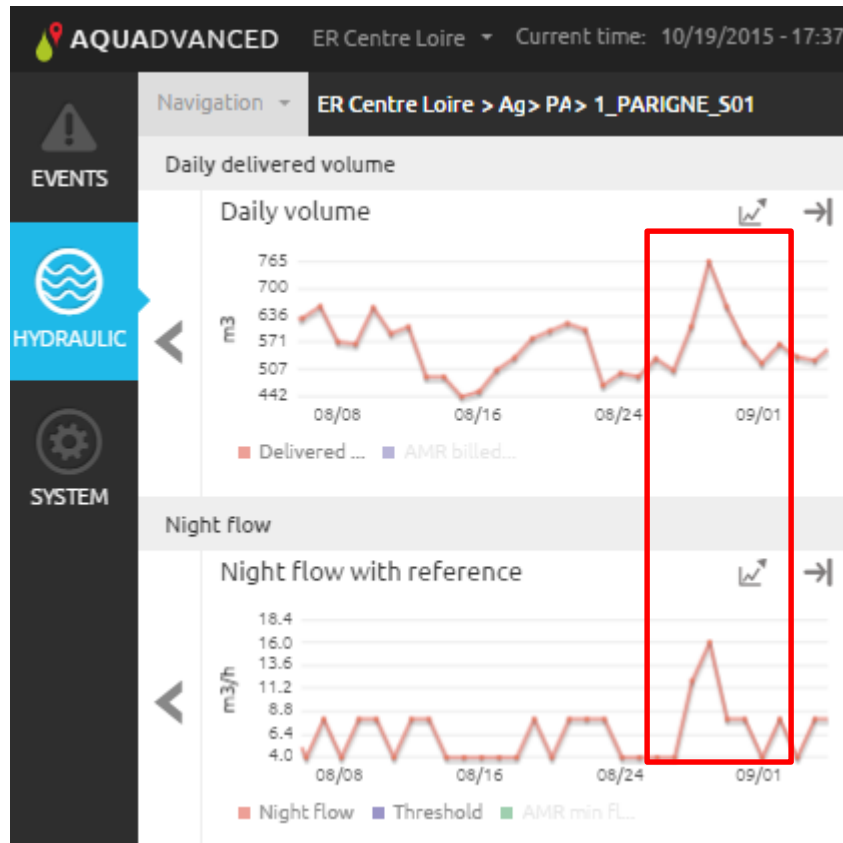
AQUADVANCED® WATER NETWORKS

Increased efficiency of leakage detection

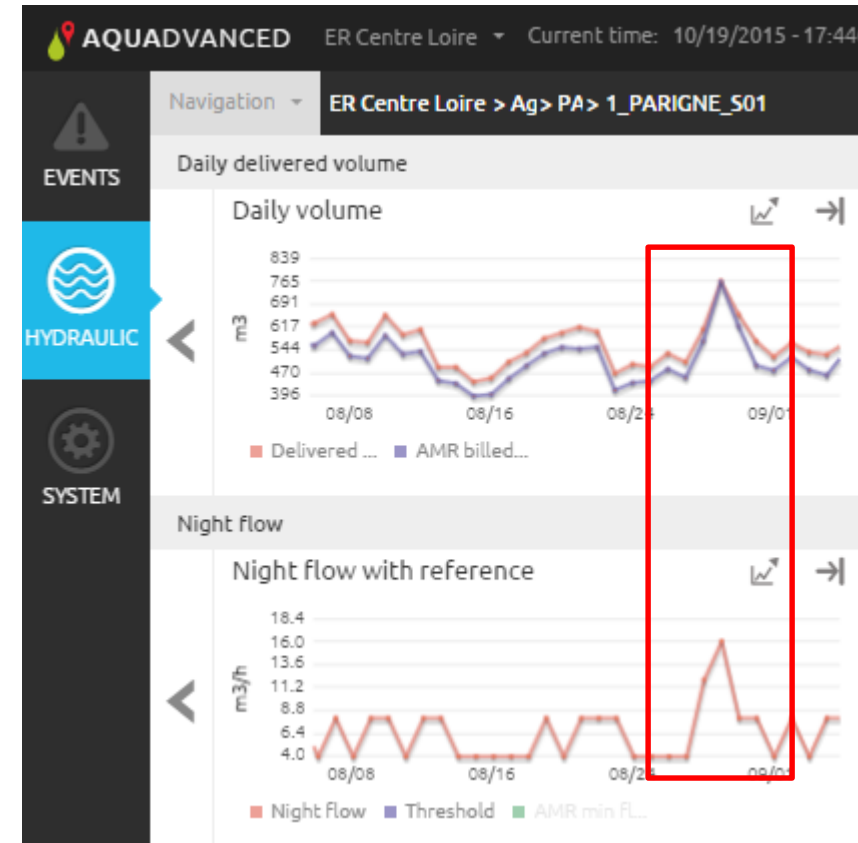
Comparison between delivered flow and AMR data



LET'S PLAY: DO YOU THINK THERE'S A LEAK?



Without the AMR Data

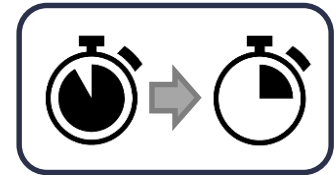


With the AMR Data

AQUADVANCED® WATER NETWORKS

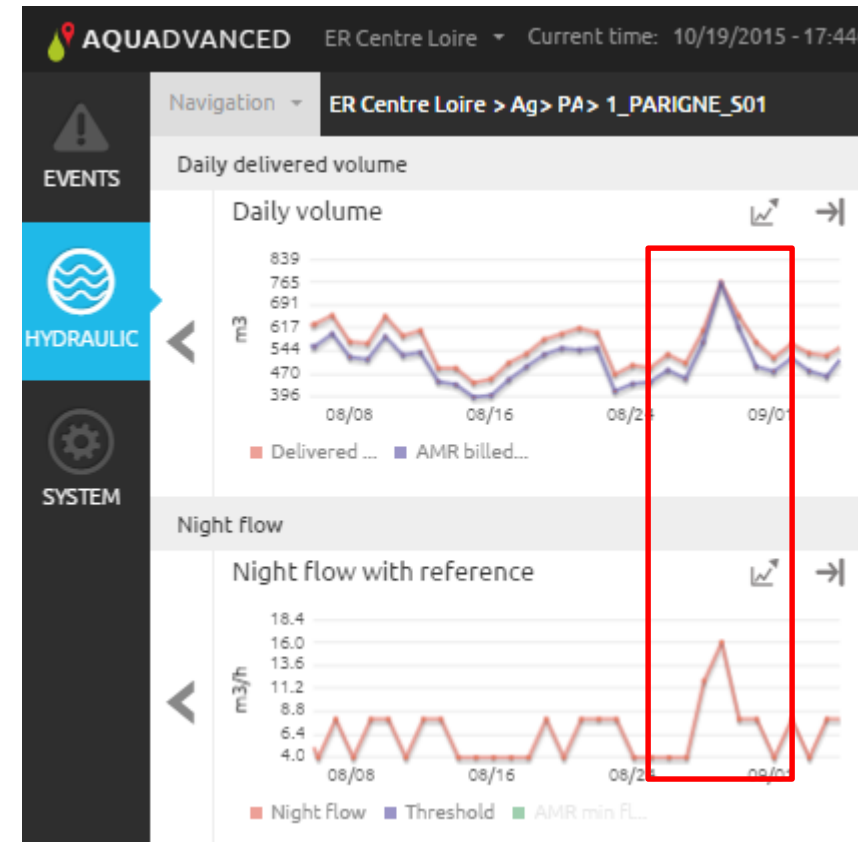
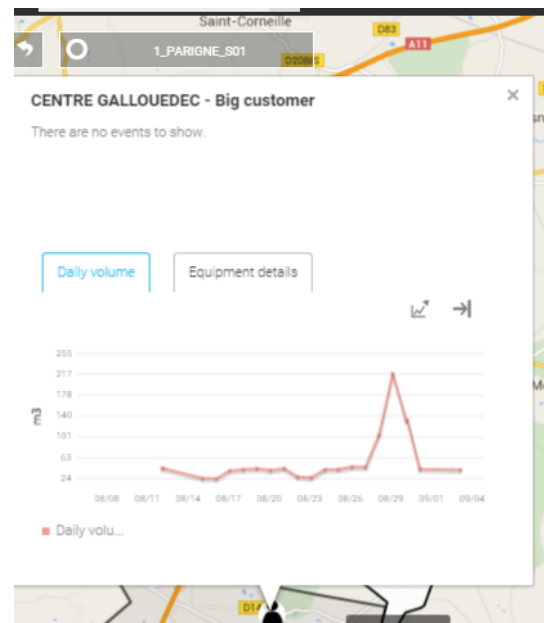
Increased efficiency of leakage detection

Comparison between delivered flow and AMR data



LET'S PLAY: DO YOU THINK THERE'S A LEAK?

**No leak...
but abnormal big
customer consumption**

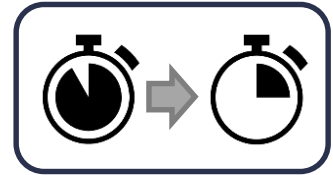


With the AMR Data

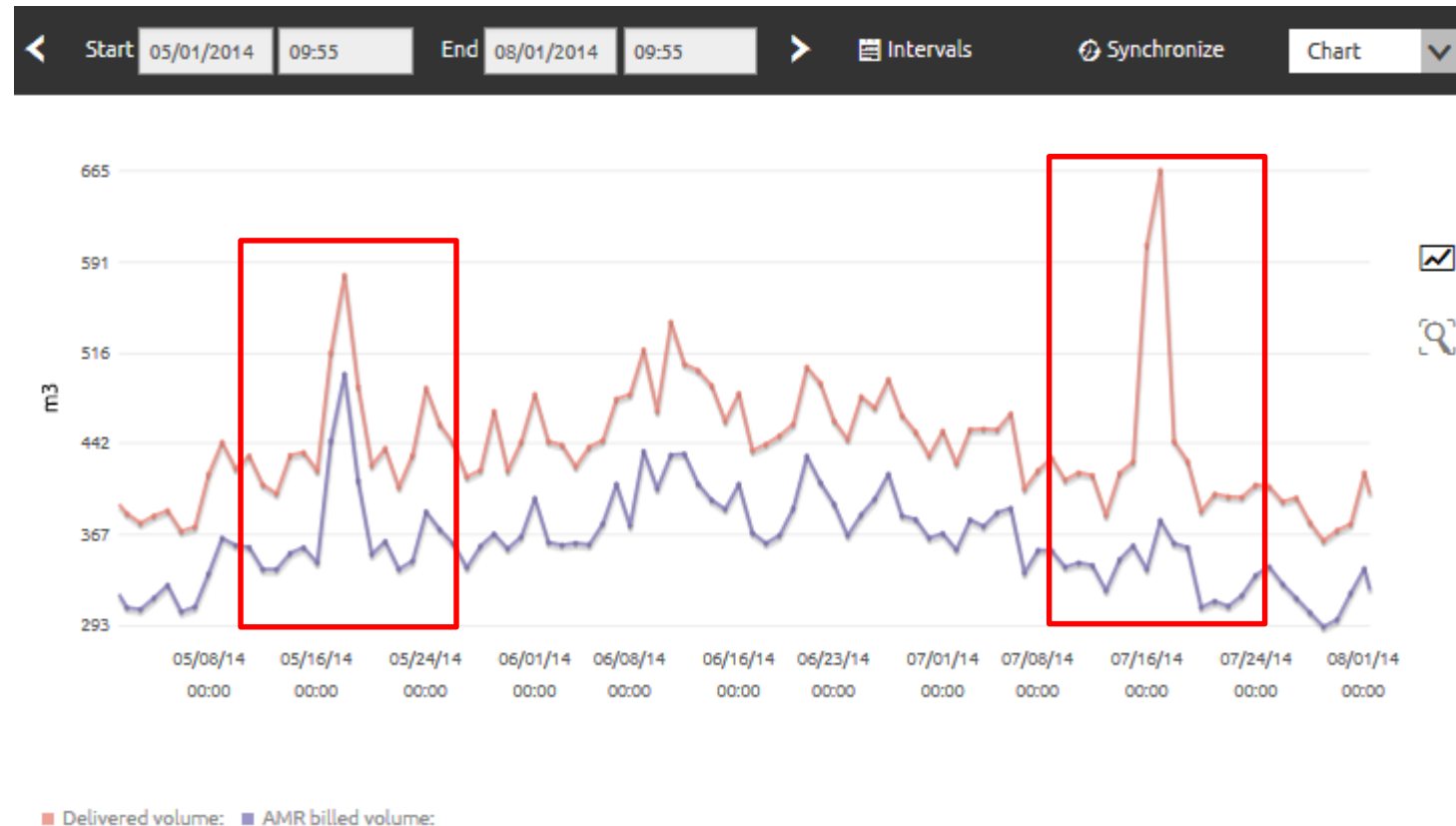
AQUADVANCED® WATER NETWORKS

Increased efficiency of leakage detection

Comparison between delivered flow and AMR data



LET'S PLAY: DO YOU THINK THERE'S A LEAK?



With the AMR Data

OUR TECHNOLOGIES FOR NRW MANAGEMENT



Leak detection & repair techniques



Pressure management



Renewal and New works



Meter and customer losses management



Idroloc

Helium tracer leak detection

Calm Network



High frequency pressure analytics and control

Epulse & Scanner



Non destructive pipe condition assessment

ON'CONNECT



Smart metering services

IDROLOC

How it works

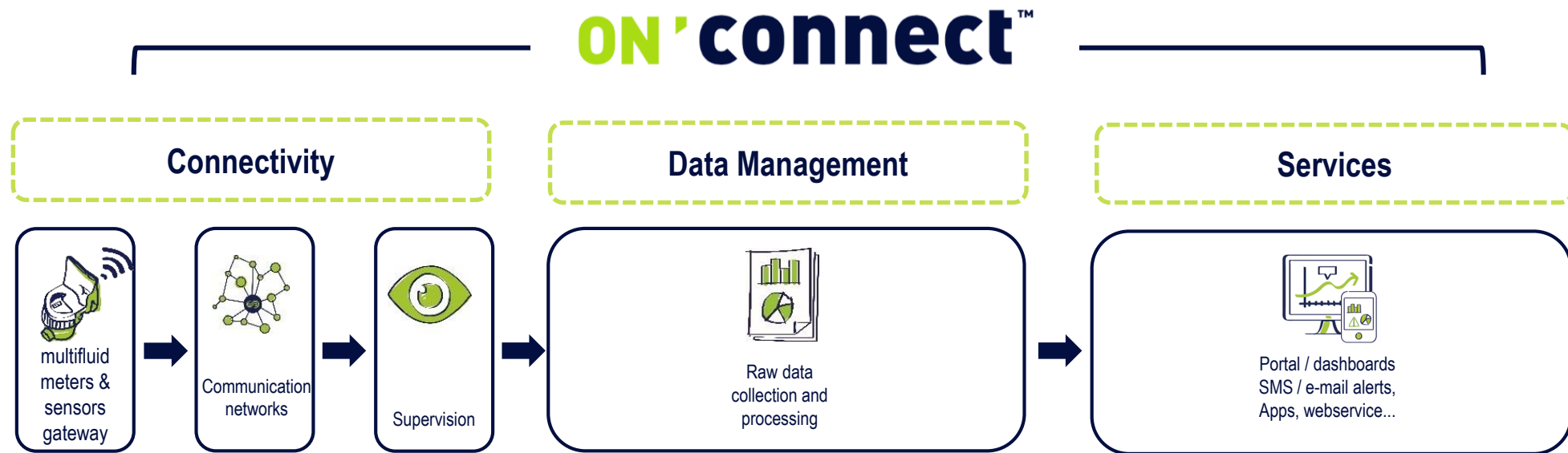
- 1) Helium gas is inserted through the tapping into the flow of water in the pipe
- 2) Engineers ensure the helium gas has travelled the full length of the pipe being surveyed
- 3) Engineers travel the full length of the pipe checking for any signs of helium, indicating that a leak is below.



Features

- Zero customer disruption – all work is carried out on the live network
- Leaks can be located on areas that have a high percentage of plastic or non-metallic pipework – does not rely on sound to locate leaks
- Detection is fast and accurate in large pipes, where standard methods may not always be reliable
- Most effective method for leak detection on non-metallic pipes and/or low network pressures (suitable for intermittent supply systems)

ON'CONNECT



FOR PUBLIC SERVICE MANAGERS & COMMUNITIES

- Reliability of counting
- Easy management of disputed customer situations (fraud, complaints,...)
- Implementation of personalized pricing policies (seasonal, social,...)
- Helps to detect leaks on the distribution network

FOR CONSUMERS

- Automatic remote reading (without disturbance at home)
- Invoicing according to actual consumption and no longer estimated
- Monitoring of daily consumption
- Alerts in case of overconsumption or leakage (mail or sms)

EPULSE & SCANNER

GENERAL DESCRIPTION

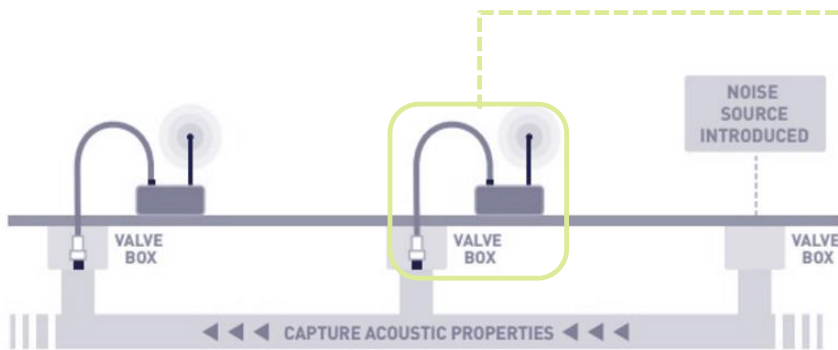


EPULSE®

SUEZ, in partnership with Echologics, provides its subsidiaries with a new technology, ePulse®, for assessing the condition of both distribution and transmission mains, while simultaneously searching for leaks - without the need for large excavations or service disruptions.

HOW IT WORKS

Acoustic sensors are attached to existing contact points or directly in contact with a pipe. A sound wave is induced in the pipeline. The acoustic sensors capture the time it takes the sound wave to travel between two sensor stations. The speed at which the sound wave travels is dictated by the condition of the pipe wall. As the sound wave travels, it pushes water molecules outward on the pipe wall. This places a microscopic flex on the pipe wall — and the greater the flex, the weaker the pipe. Through this method, ePulse® measures the actual strength of the pipe wall which is an ideal measure of actual pipe condition.



LEAK FINDER CORRELATOR



EPULSE & SCANNER

GENERAL DESCRIPTION

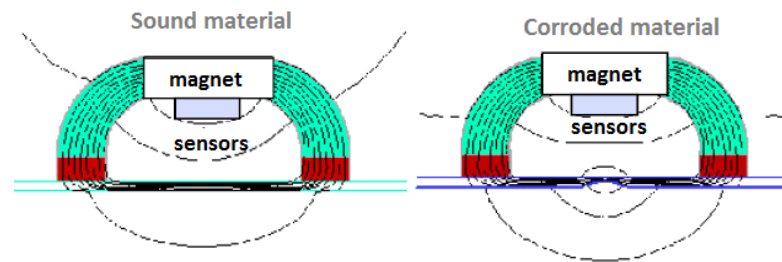


SCANNER

Scanner is a tool for the detection of external and internal corrosion in metal pipes.

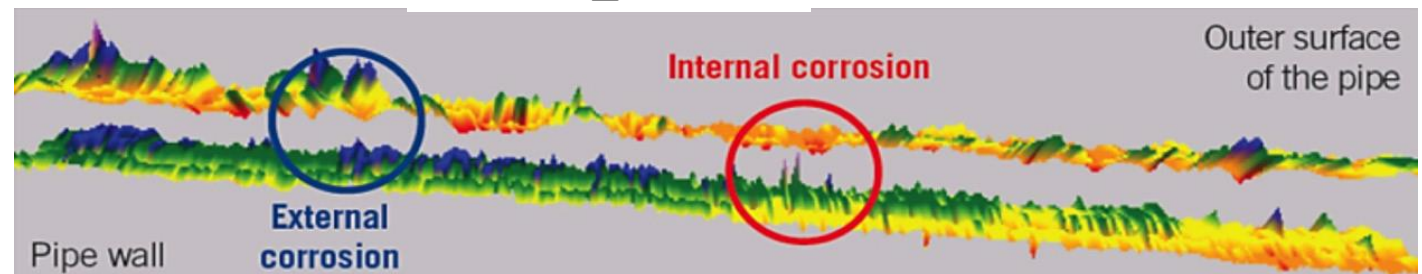
HOW IT WORKS

The Scanner tool detects a problem due to a magnetic flux leakage. The magnetic flux created by a magnet on a metal pipe is changed when a defect is detected. The flux on the thin section is lower than a full section. A sensor placed in the middle of the magnet receives a larger flux density, this indicates a defect. This technique allows pipelines where deterioration is imminent to be indicated, allowing repairs to be effected and more serious damage avoided.



A 4 STEPS METHOD

- Preliminary analysis
- Preparatory work (excavation ...)
- Measurement campaign
- Data Analysis



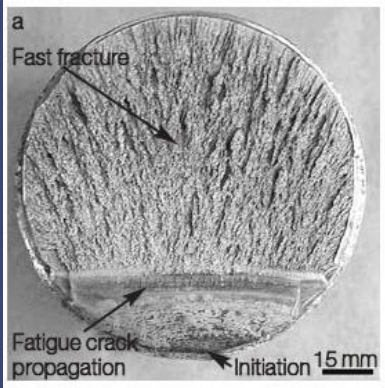
EPULSE & SCANNER

DIFFERENTIATION

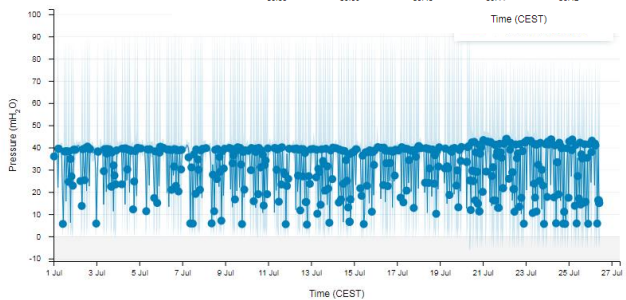
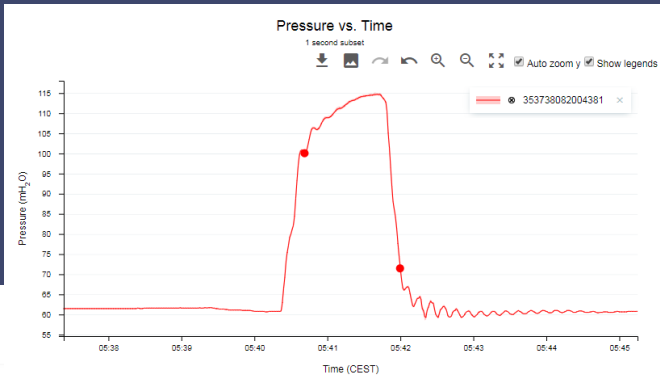
Characteristics	EPULSE	SCANNER
Physical principle	Sound wave analysis	Magnetic flux analysis.
Materials	Cast iron, ductile iron, steel and mortar lined, asbestos cement (also pre-stressed concrete cylinder → specific request handled on a case by case basis)	Cast iron, ductile iron, steel
Allowed Pipe diameter	Between 100 mm 600 mm	Either 100 mm, 150 mm or from 200 to 1200 mm
No excavations	✓	✗
Non intrusive/ destructive + no water service disruptions	✓	✓
Precision	Provides an average thickness over a segment between the two sensors	Provides the residual thickness at a localized point ($\pm 2/10$ th of mm)
Speed of inspection	1km of pipe inspected per day on average	6 measurement points per day on average
Distance surveyed in a single shot	50 m to 200 m	1 m

CALM NETWORK

Leakage flowrate is directly linked with pressure level



Applied **pressure exceeds** pipe residual strength



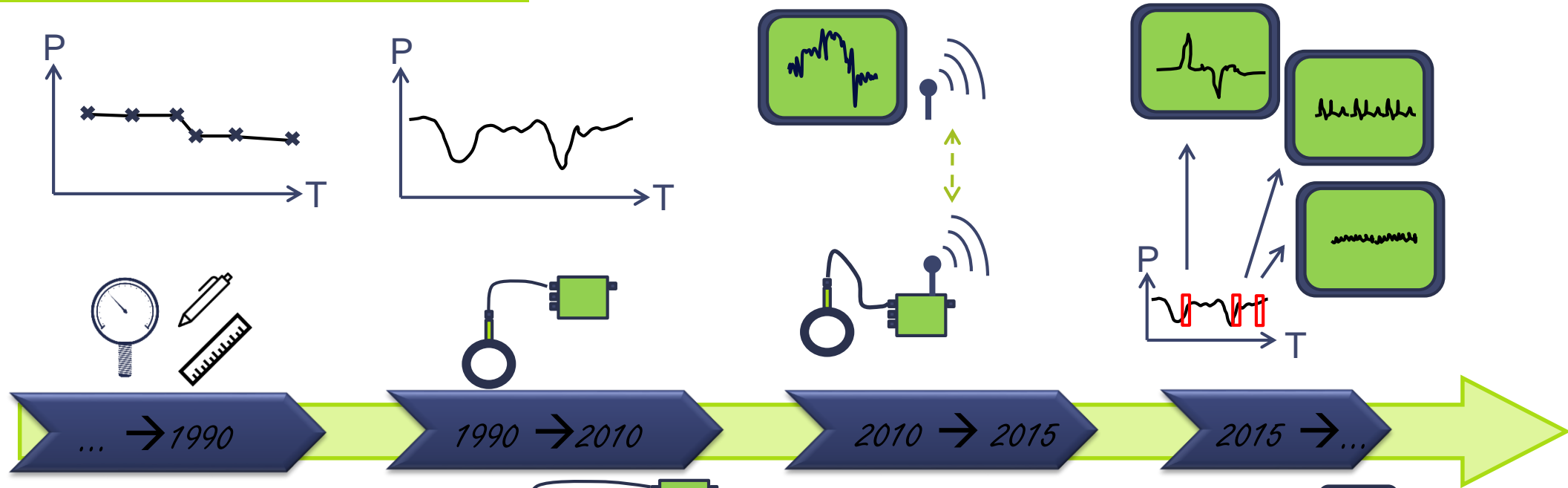
Repeated **pressure variations** induce mechanical strain and fatigue which reduces pipe mechanical strength



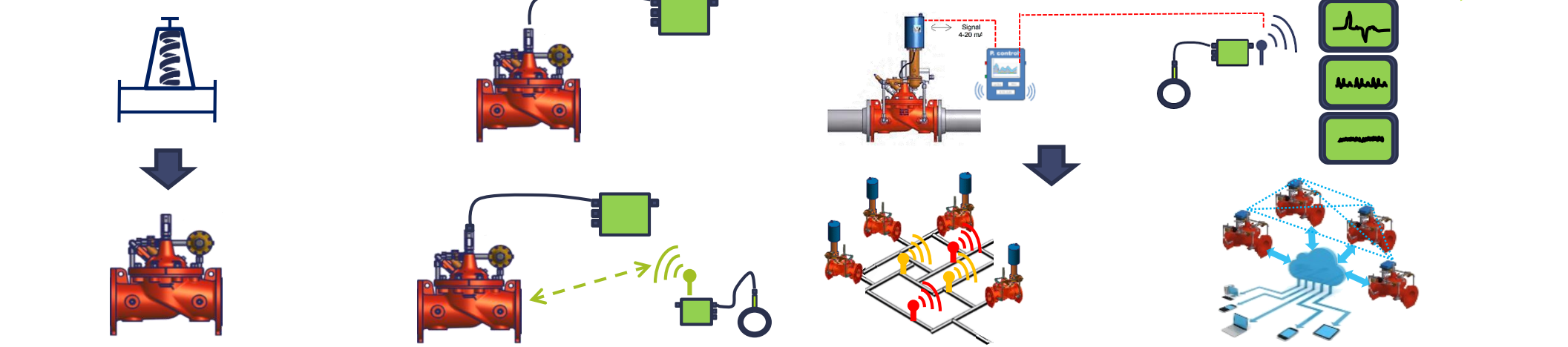
Pipe breakages is a consequence of pressure excess

CALM NETWORK

MONITORING



CONTROL



REDUCTION

MODULATION

ADVANCED

CALM NETWORK™

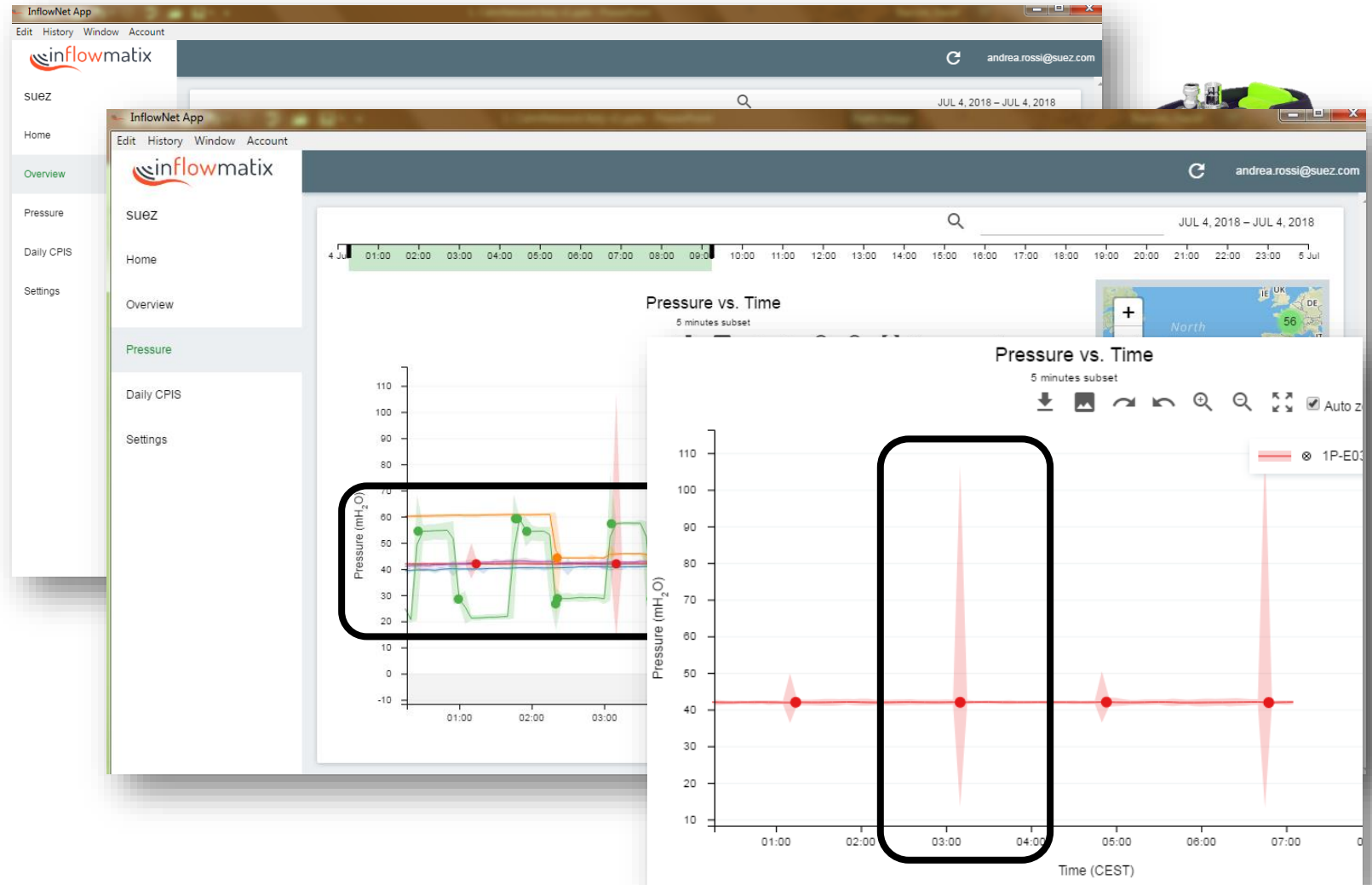
CALM NETWORK

NEW TECHNOLOGY: HIGH FREQUENCY NETWORK PRESSURE ANALYTICS

Calm Network for optimized pressure management



Calm Network avoids pressure transients and reduces average and maximum pressure while still meeting **customer demand**, thanks to smart monitoring technologies and advanced control systems



CALM NETWORK: THE METHOD

1 MEASUREMENT

Field diagnosis of network functioning

Study and planning of sensors deployment

Data collection and transmission



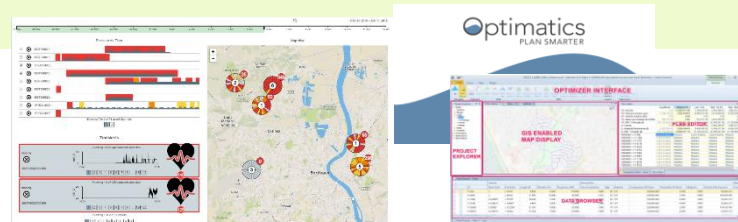
2 CONCEPTION

Optimization of existing hydraulic design

Anomaly identification and diagnosis

Recommendations

Design and building of solution



3 EXECUTION AND CONTROL

Entry into service

Operate and maintain network

Adapt network control





Bordeaux

NRW < 16%



Versailles

NRW < 10%



Casablanca

NRW from 56% TO 22%



Algiers

NRW from 60% TO 50%
24/7 in 3.5 years for 5 M



Macao

NRW < 8 %



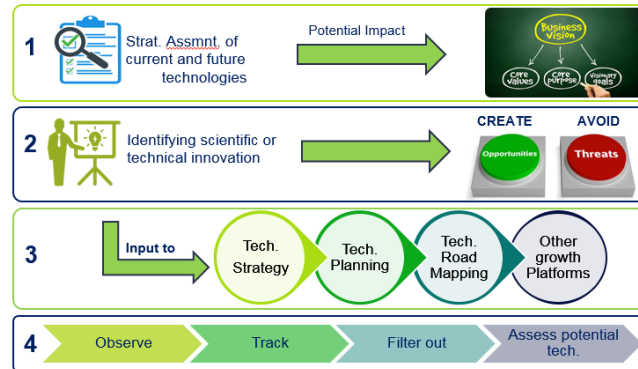
Chongqing

NRW from 22% TO 15%

CONCLUSIONS

INNOVATION AT SUEZ: TO BUY OR TO MAKE

Scout, test & evaluate process

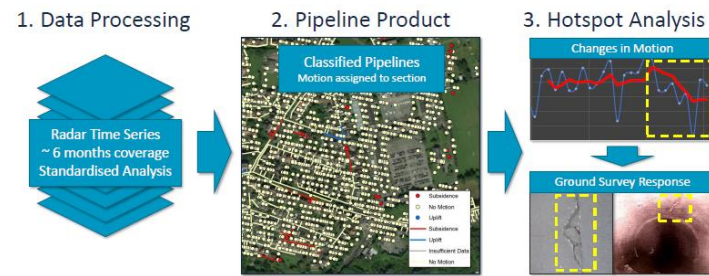


Internal Development

9	Commercialized
8	Pre-production
7	Field Test
6	Prototype
5	Bench / Lab Testing
4	Detailed Design
3	Preliminary Design
2	Conceptual Design
1	Basic Concept



Ex: Satellite leak detection



Ex: Aquadvanced

