Technology to transform the everyday

Digital solutions for the water industry

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Siemens Industry Inc.
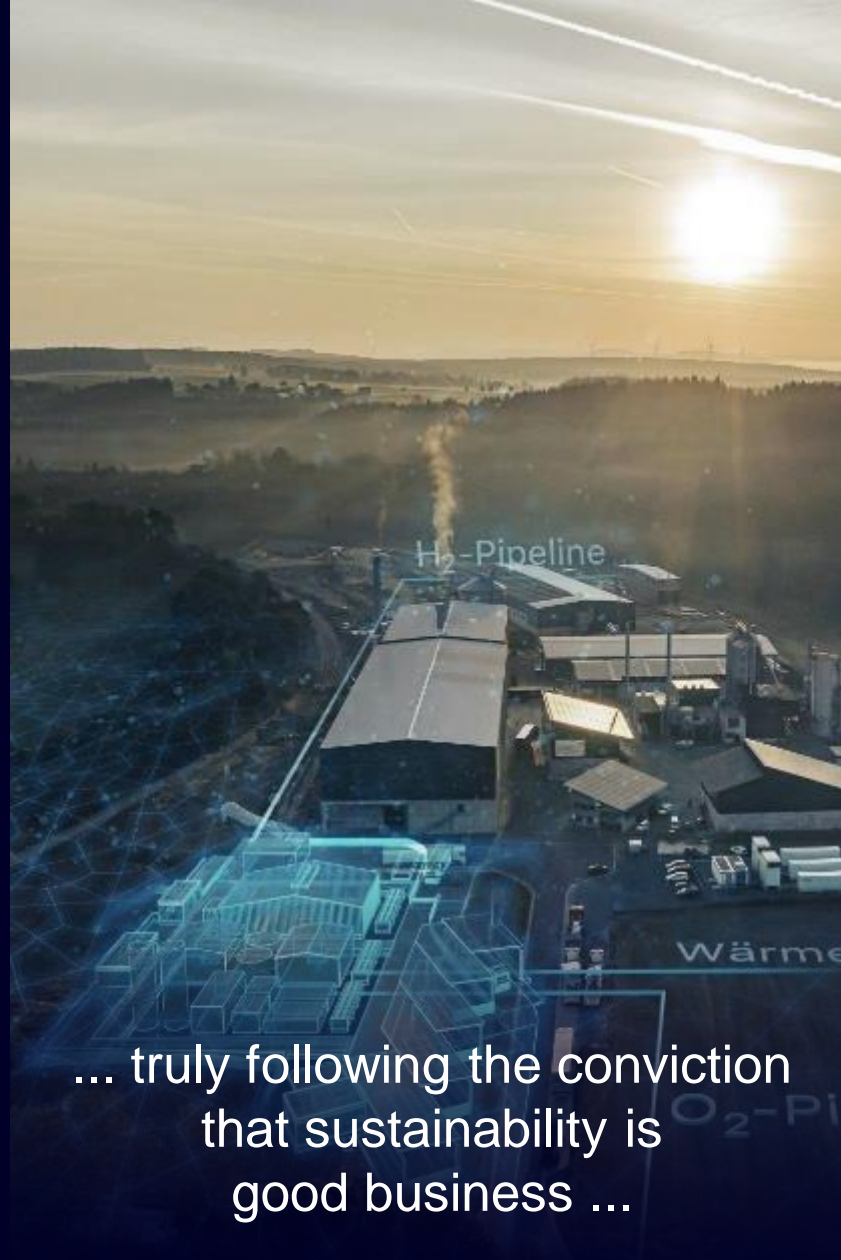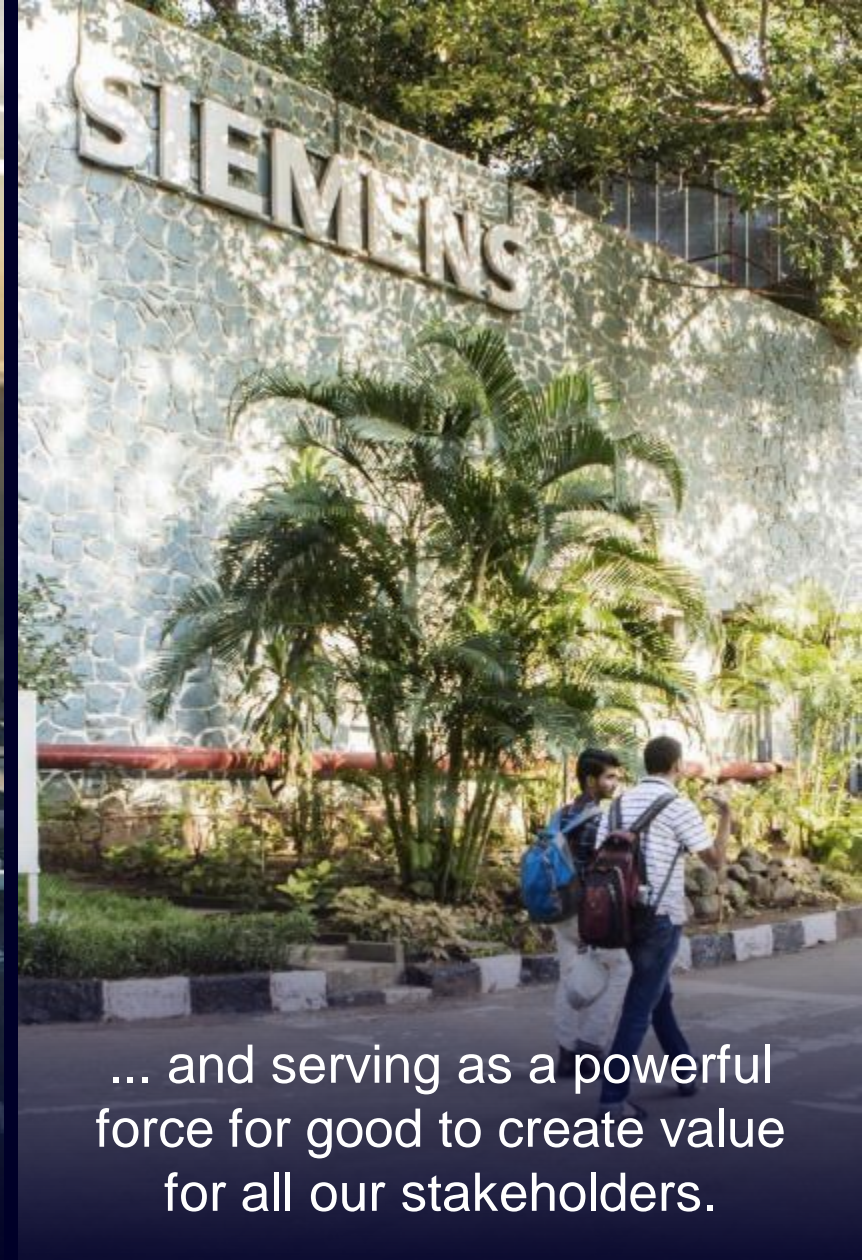
www.siemens.com/water

SIEMENS

We transform the everyday for billions of people by creating technology with purpose, ...

... truly following the conviction that sustainability is good business ...

... and serving as a powerful force for good to create value for all our stakeholders.

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Today's drinking water business is facing many challenges

CLIMATE CHANGE

- Decrease carbon footprint
- Use less energy

URBANIZATION

- Ensure water quality
- Secure water supply
- Aging infrastructure

DIGITAL TRANSFORMATION

- Many new technologies are introduced
- Cyber security
- Where to start and what projects to pursue?

DEMOGRAPHIC CHANGE

- Decreasing number of qualified staff
- Loss of plant specific know-ledge

REGULATIONS

- Increasing regulatory demands
- Higher risk of penalties

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We have broad capabilities to serve the water industry's needs

>20% of water business' SW revenues aaS

>500 digital transformation consultants worldwide

>32,000 industrial SW / automation engineers

#1 in industrial software, factory automation and motion control

7,500+ partners

>60% recurring share in industrial software revenue

>10,000 PLCs shipped per day

30 global water industry focus clusters

180,000+ loyal customers

€ 1 bn Equity of Siemens Financial Services

Unique DNA towards the digital transformation

Since our foundation in 1847 we strive to innovate and drive transformation. We have already mastered transformation from Electrification to Automation. **Our mindset is to 'fully enable' our customers and partners** by leading the digitalization transformation.

Global Leader & One-stop shop

We offer a comprehensive portfolio of **electrification, automation, and digitalization tailored to water industry** applications.

End-2-End capabilities

Because we strive for thinking beyond the edge of the plate offering **tailored consulting capabilities** and answers to our **customers' financing** issues.

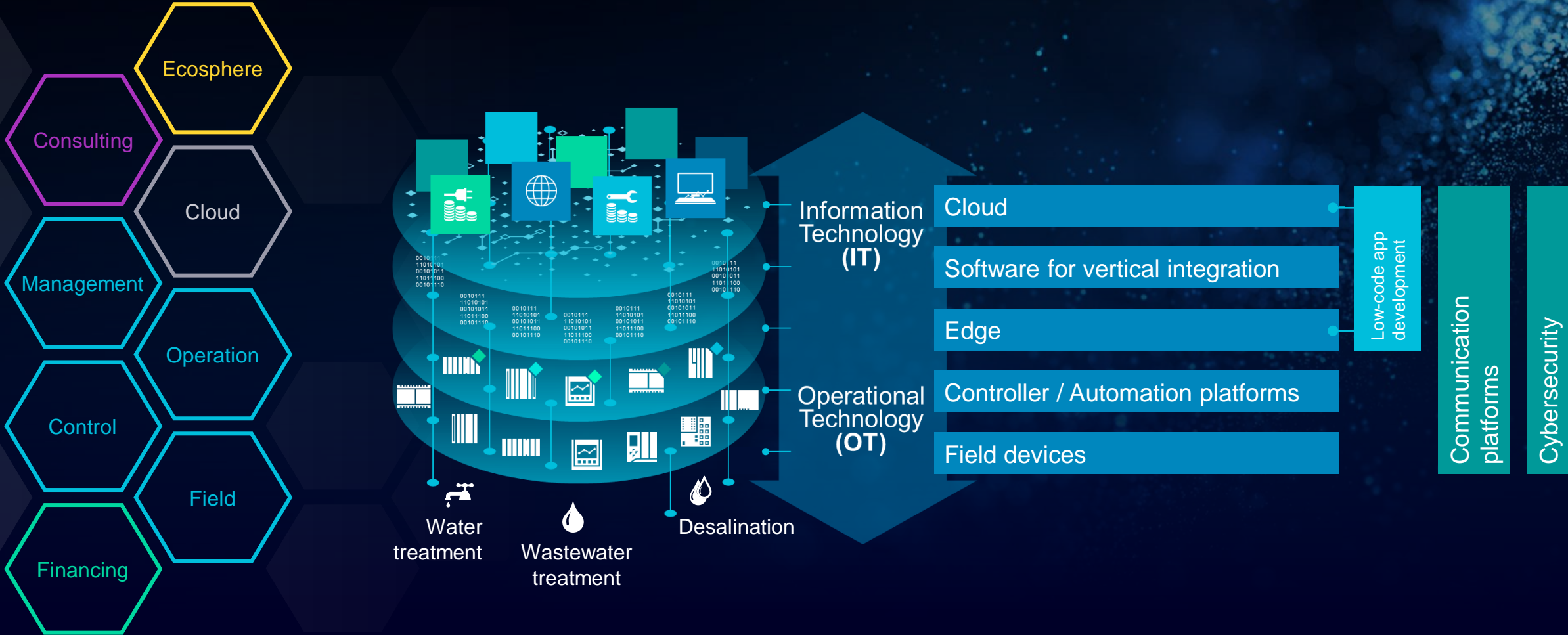## Deep domain know-how & Market experience

Decades of experience in serving the water industry best and our global market appearance with a **wide coverage of water business experts** are foundation for our mission.

Powerful ecosphere

We are proud on being able to rely on a **wide trusted partner network** from research labs, start-ups to global fortune 500 players combining best-in-class approaches without boundaries.

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Water technology gets "smart" with horizontal and vertical integration of portfolio based on a strong ecosphere knowledge

Ecosphere

Consulting

Cloud

Management

Operation

Control

Field

Financing

Water treatment

Wastewater treatment

Desalination

Information Technology (IT)

Operational Technology (OT)

Cloud

Software for vertical integration

Edge

Controller / Automation platforms

Field devices

Low-code app development

Communication platforms

Cybersecurity

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Comprehensive solutions for the water industry
Seamless interoperability – From field to cloud

Cloud, Management., Operation, Control, Field

Cloud

SW Applications   MindSphere   Digital Twin Cloud Services

Management

Process Optimization   Asset Performance Management   Operations Intelligence   Simulation

Operation

Industrial Edge Management System   Network Management System   SCADA   Process Control System   Energy Management   Maintenance Management

Control
◆ Edge-enabled devices

Industrial Edge   Controller   Human Machine Interfaces   Industrial PC   Industrial Communication
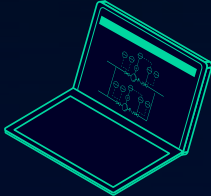
Field

Industrial Controls   MV & LV Drive Systems   Distributed I/O   Process Instrumentation   Analytics   MV & LV Power Supply & Distribution   MV/LV Distribution Transformer
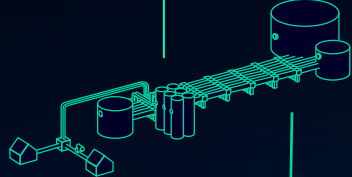
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Our digital twin approach for the water industry

SIMULATION

- Virtual commissioning and operator training
- Integrated modelling suite across the entire process lifecycle

AUTOMATION

- Completely web-based process control system
- Powerful, flexible, and scalable distributed control system
- Common hardware platform and application architecture

- Plant engineering & Commissioning
- One complete digital twin in the cloud
- Operations & Maintenance

ENGINEERING

APPLICATIONS

- Leakage detection in water distribution network and transportation pipelines
- Monitoring and optimization of water supply systems in drinking water networks
- Monitoring and optimization of wastewater systems in wastewater networks and pump stations

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Siemens Water (SIWA)
Applications tailored to the water industry

Monitoring and optimization of wastewater systems

Anomaly and leakage detection

Monitoring and optimization of drinking water supply systems

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MONITORING WASTEWATER SYSTEMS
## Predicting blockages in CSOs

CUSTOMER CHALLENGES

- Pollution incidents in combined sewer overflows (CSO) generally from heavy rainfall, system overloads, or blockages
- Overutilization of maintenance resources caused by false alarms from traditional SCADA systems based on threshold alarm systems

CUSTOMER TARGETS

- Reduce pollution incidents
- Increase response window to issues
- Improve operational efficiency

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Improve Processes
SIWA Blockage Predictor

↑

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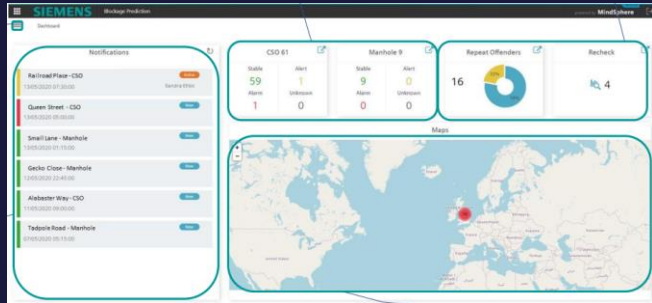
OPERATIONAL
EFFICIENCY

BLOCKAGES
& POLLUTION

HOW DOES SIWA BLOCKAGE PREDICTOR ADDRESS THESE CHALLENGES?

- **Artificial Intelligence** solution that models the expected level in your combined sewer overflow chamber given the current rainfall to detect blockages

- This results in **reduced false alarms** in high rainfall conditions compared to a SCADA system

- Up to 70 hours **advance notice** of a blockage compared to threshold-based alarming

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SIWA Blockage Predictor in more detail
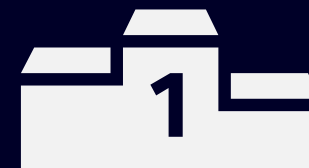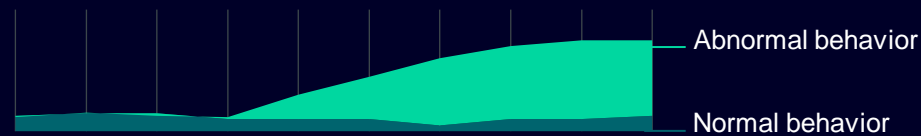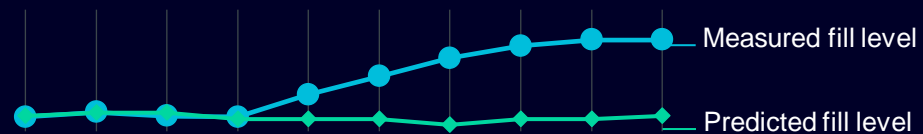Analytics enable insights on risk and blockage

GOAL

- No new hardware or connectivity required

- Require no hydraulic models or network data

- Minimum deployment capability one asset
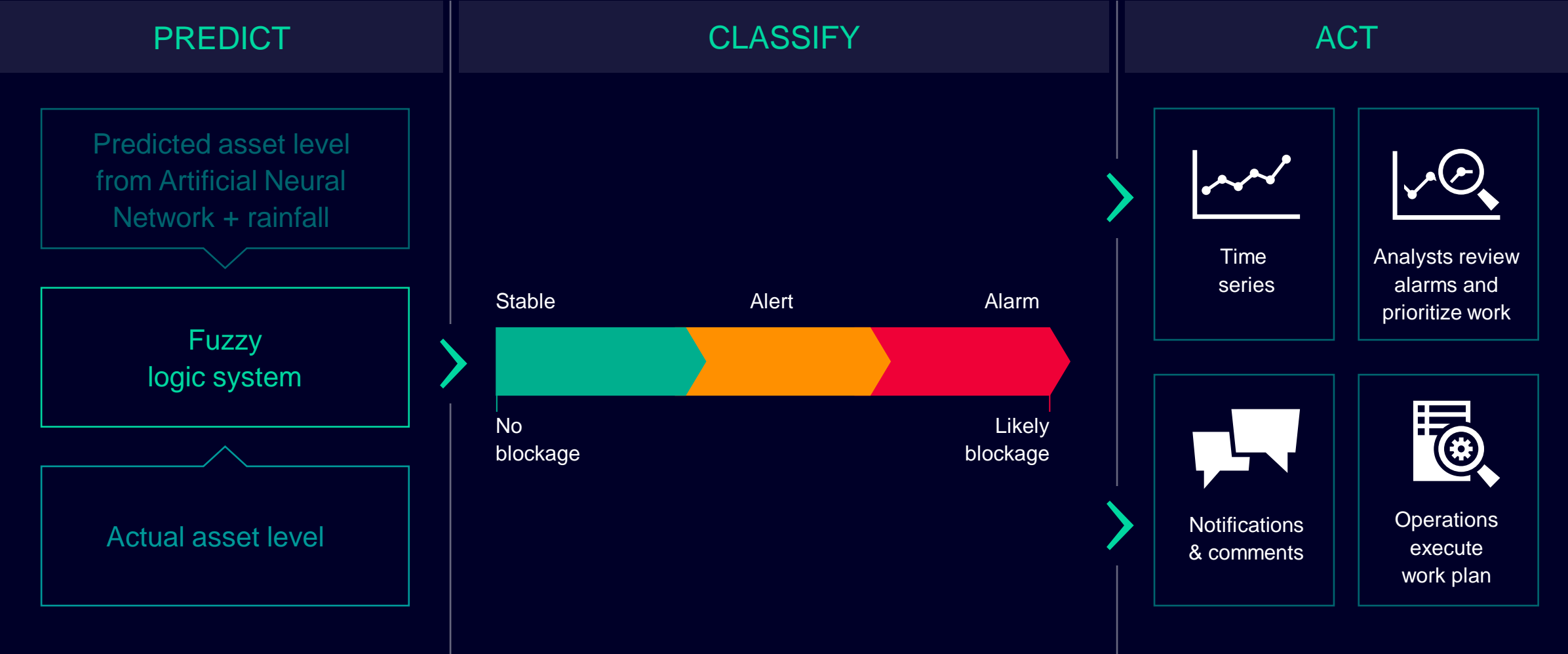
APPROACH

- Predict how the CSO or manhole should be behaving

- Intelligently classify the difference between actual and predicted behavior

Measured fill level

Predicted fill level

Abnormal behavior

Normal behavior

Unrestricted | © Siemens | Alex Pfalzgraf | April 29, 2022

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SIWA Blockage Predictor in more detail
Analytics in the cloud enable action

PREDICT	CLASSIFY	ACT

PREDICT

Predicted asset level from Artificial Neural Network + rainfall

Fuzzy logic system

Actual asset level

CLASSIFY

Stable | Alert | Alarm

No blockage | | Likely blockage

ACT

Time series

Analysts review alarms and prioritize work

Notifications & comments

Operations execute work plan

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Yorkshire Water
Blockage prevention in the sewer network

Ecosphere, Cloud, Portfolio

TOPIC

Reduction of flooding risks, pollution incidents, and sewer collapse

LINK

Industry Reference Story

CHALLENGE

- To remove CSO blockages and thereby minimize the probability of a release of sewage water into rivers of Yorkshire thus preventing flooding in public areas
- To cut pollution incidents by 50 percent within Incident Reduction Plan 2020 – 2050

SOLUTION

- Evaluates combined sewer overflow behavior in real time
- Provides a better understanding of the system's performance of any issues
- Identifies if a sewer is blocked, not operating correctly, or if a CSO is soon to have operational issues

BENEFITS

- Pinpoints problems within the network
- Gives you more time to act and increases your operational efficiency
- Warning of identified issues 2 weeks earlier
- Blockage prediction 3x more effective

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OPTIMIZATION
of drinking water supply

CUSTOMER CHALLENGES

- Security of supply – ensure constant availability of water for all consumers
- Optimized costs for operations, especially for pumps (>70% of energy consumption for water distribution)
- Handle complex system of interconnected boundary conditions and parameters in an optimized way

CUSTOMER TARGETS

- Improve utilization of existing assets
- Optimize energy consumption by smart control of pumps and valves
- Intelligent cross-linking of all input parameters (filling levels, supply models, electricity rates, planned downtimes etc.)
- Identify and estimate optimization opportunities and risks based on actual operating parameters

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## Secure water supply at optimized costs
SIWA OPTIM

↓
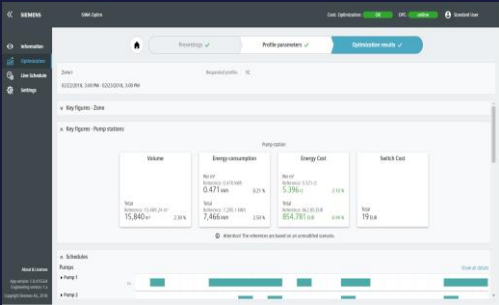
ENERGY COSTS
Savings by optimizing pump operation (15% optimization potential)

HOW DOES SIWA OPTIM ADDRESS THESE CHALLENGES?

- Helps to secure the supply of **drinking water**

- **Optimizes pump schedules**, i.e., pump at times when electricity prices are low and takes water tariffs in consideration

- Fully utilizes **existing automation** and instrumentation

- Assists the water industry in participating actively in the **energy market**

- **Creates insights** into the energy consumption and utilization of your existing pumps and other assets

- **Contextualizes and correlates data** for better decision-making

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How SIWA Optim can assist
to increase resiliency for critical demands on water distribution operations
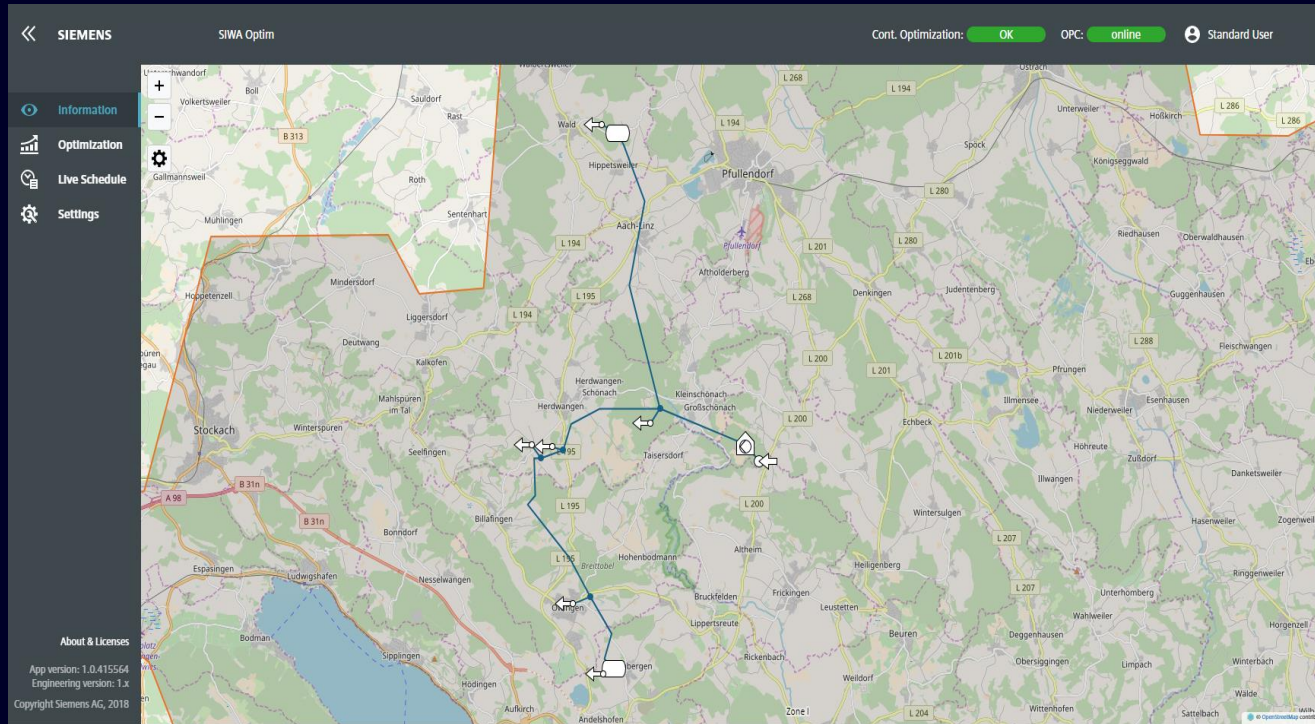
IMPROVED UTILIZATION OF EXISTING ASSETS, CONSUMPTION OPTIMIZED CONTROLS OF PUMPS AND VALVES

- Better utilization of existing assets

- Sustainable application of assets and resources in service

- No investment in new hardware necessary

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How SIWA Optim can assist
to incorporate increasing market volatility
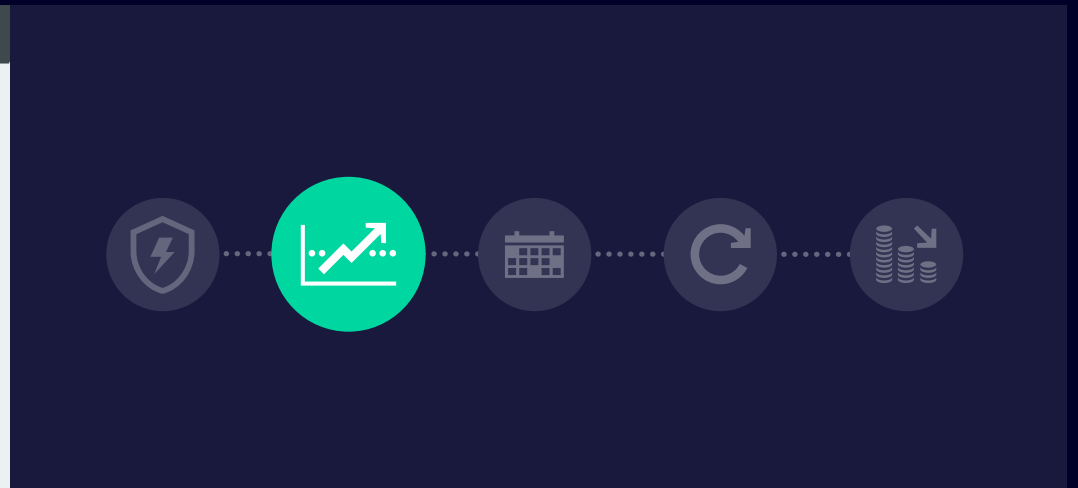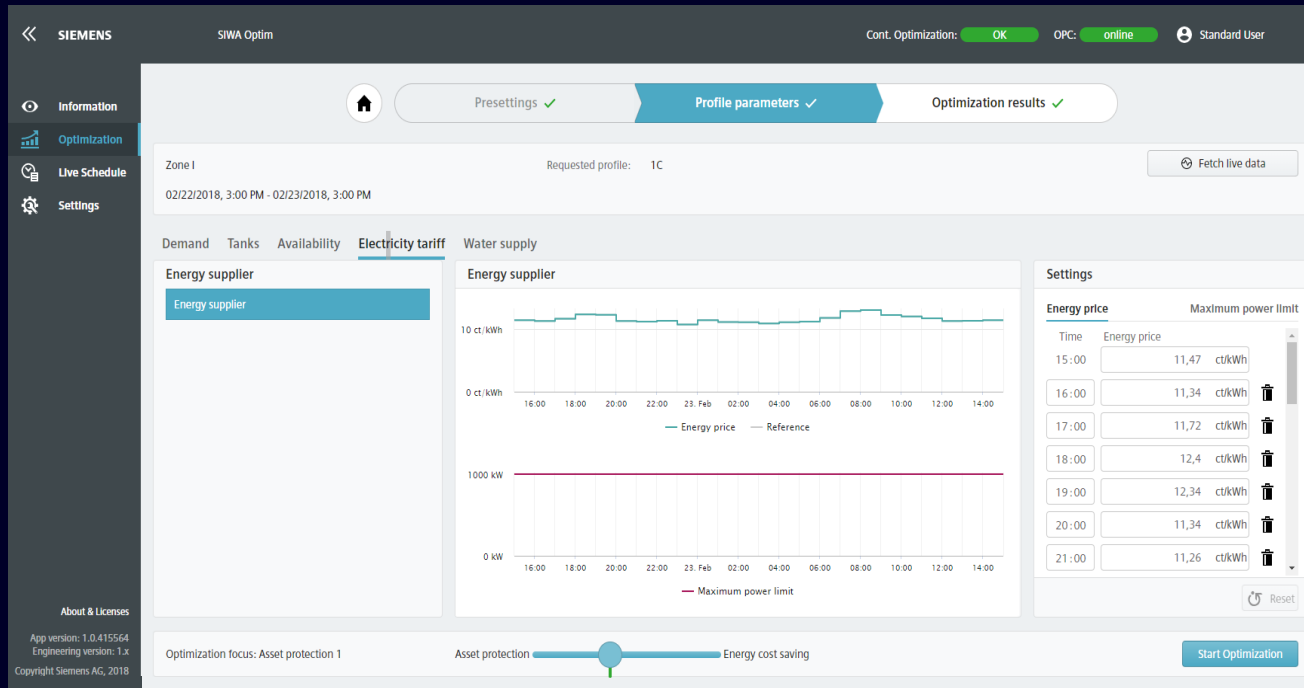
SYSTEMATIC INCLUSION OF INPUT VARIABLES INTO PLANNING AND DECISION-MAKING

- Intelligent cross-linking of all input parameters (filling levels, supply models, electricity rates, planned downtimes etc.)
- Thereby ensuring adaptability

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How SIWA Optim can assist
to lower downtimes
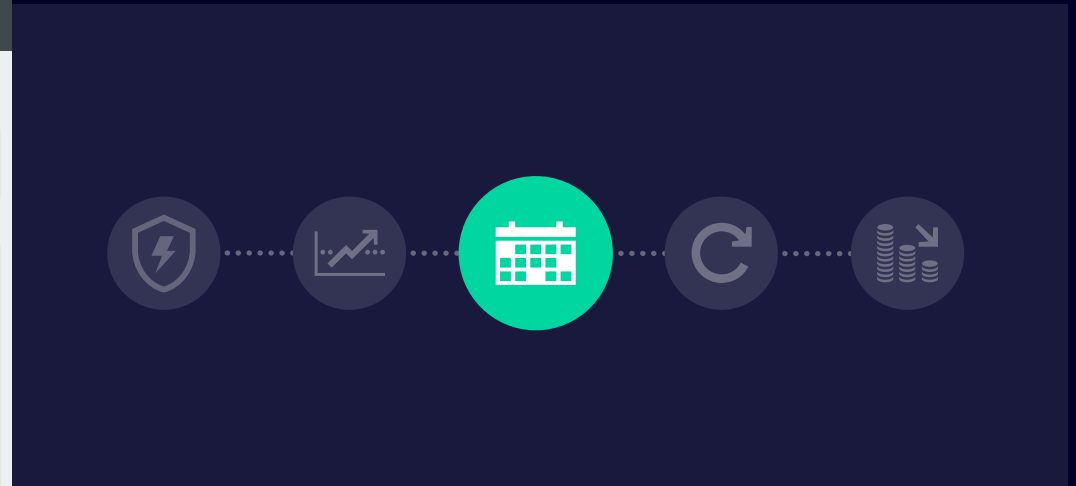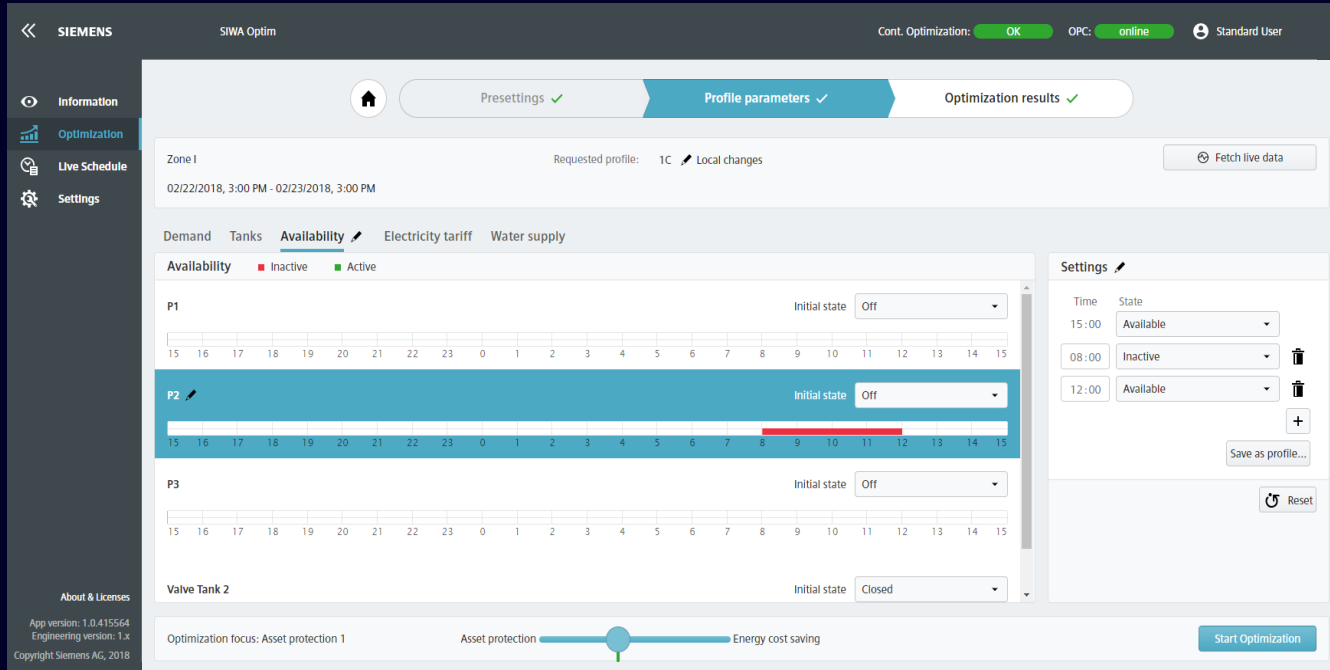
VIRTUAL OPTIMIZATION OF MAINTENANCE AND REPAIR SCENARIOS
AND IMPLEMENTING RESULTS INTO REALITY: "FIRST TIME RIGHT"

- Identifying and estimating optimization opportunities and risks based on actual operating parameters (think digital)

- Implementation of optimized, secured procedures into the real world (act real)

- Thereby reducing complexity

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How SIWA Optim can assist
to secure sustainable supply
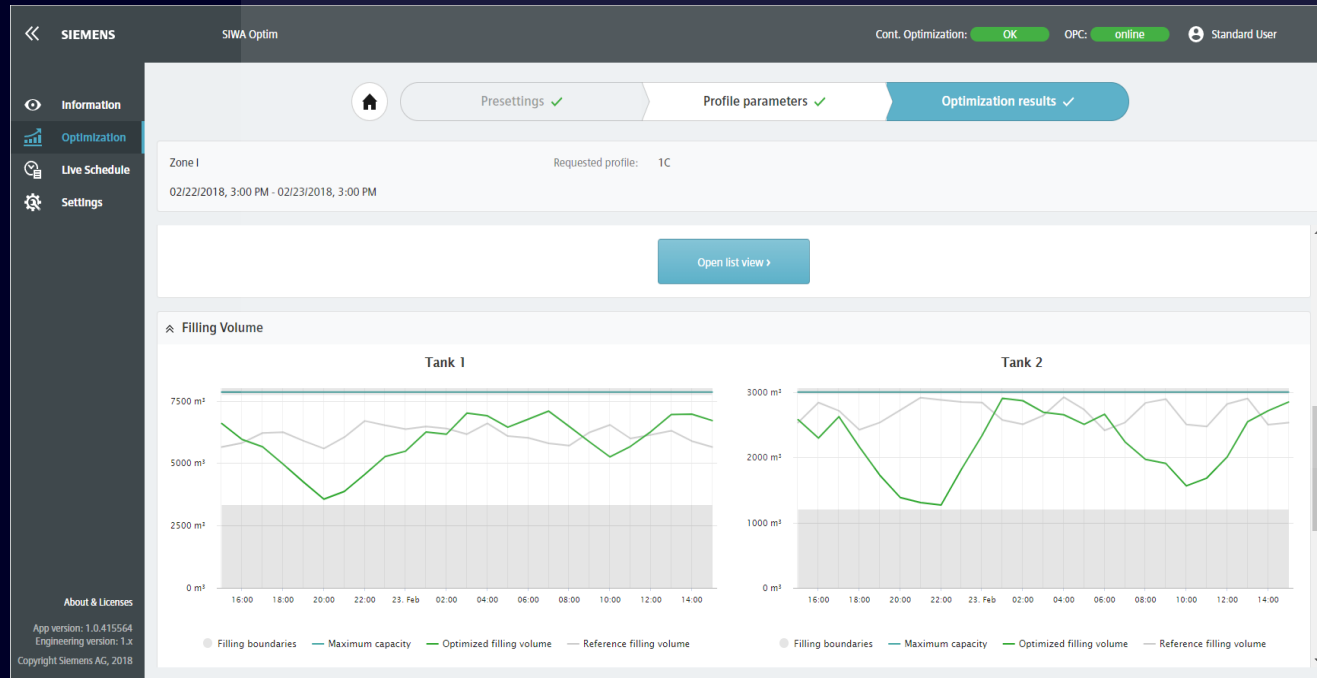
EARLY SIMULATION OF INFLUENCE ONTO THE SECURITY OF SUPPLY

- Valid data for decisions by information processing 24/7

- Analytic identification of leakages or other outages with real-time data of filling levels and deviations of water consumption

- Overall securing of supply e.g., by simulating states of operation or cross-linking supply clusters

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How SIWA Optim can assist
to create a transparent overview
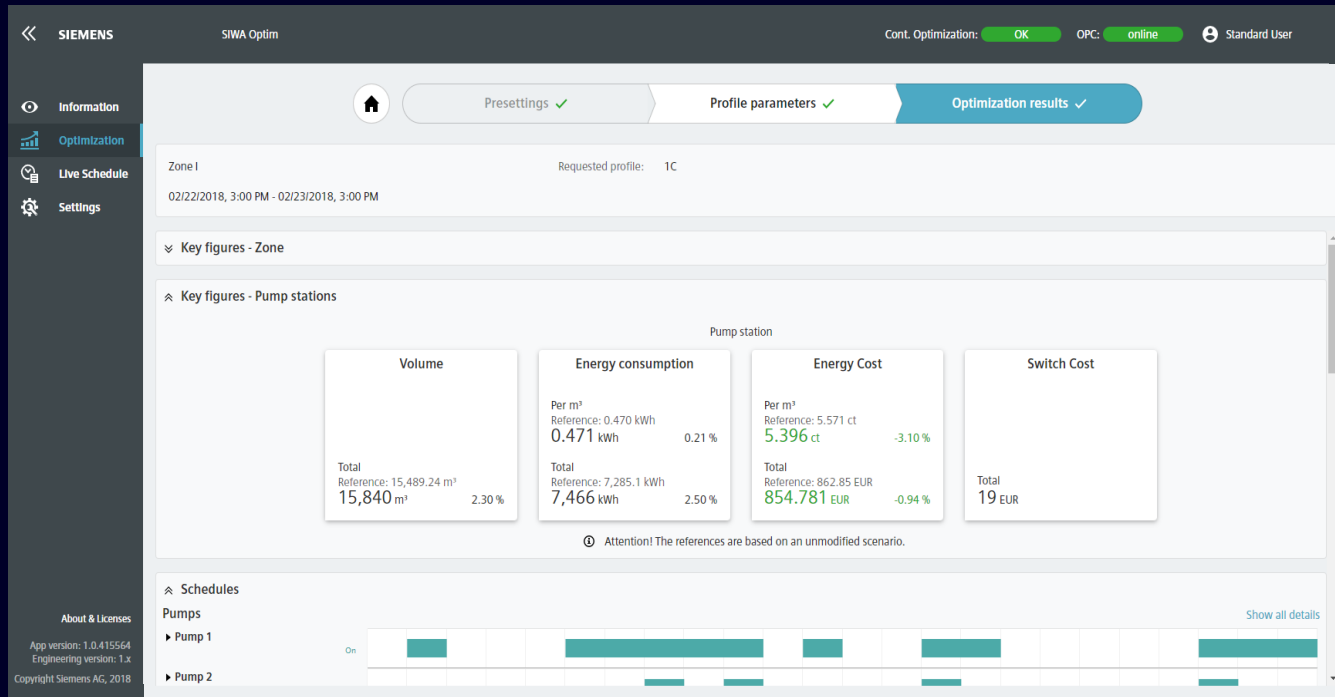
SUMMARY OF KPIs ON AN EASY-TO-HANDLE USER INTERFACE

- Lower energy costs enabled by power rate volatility integration
- Resource consumption / utilization made transparent for optimization
- Data contextualized and correlated for better decision-making

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ANOMALY DETECTION:
Leaks in transmission pipelines

CUSTOMER CHALLENGES

- The performance and profitability of water transport systems largely depend upon water being transported with as little loss as possible
- Leaks in pipelines not only mean a loss of drinking water that has been purified at high cost, but also a potential economic loss caused by possible consequential damage, especially due to the undermining of buildings

CUSTOMER TARGETS

- Real-time analysis in order to early detect anomalies in the water transmission pipeline and trigger alarms
- Detect, locate, and repair leaks at an early stage

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Detection of Leakages in Transmission Pipelines
SIWA Leak
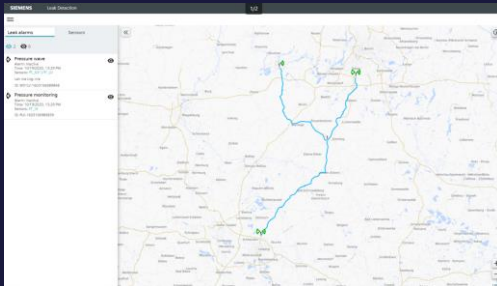
Non-Revenue Water
by leakage identification

HOW DOES SIWA LEAK ADDRESS THESE CHALLENGES?

- **Real-time** analysis in order to early detect leakages in the **water transmission network** and **trigger alarms**

- Increasing the **security of supply** of drinking water

- **Identifying** leakages instantaneously

- Fully integrated in automation system

- **Using intuitive interface** with real-time data analysis and visualization

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Detection and localization of leaks in pipelines

Leak Detection System SIWA Leak

Windows 10 based PC with LDS Central Unit and UI

Mobile Device with LDS User Interface via Web Browser (Option)

Communication via Fiber Optic, UMTS, LTE, Telecontrol, etc.

S7-1200

S7-1200

Pressure　　Flow

Pressure　　Flow

Pipeline
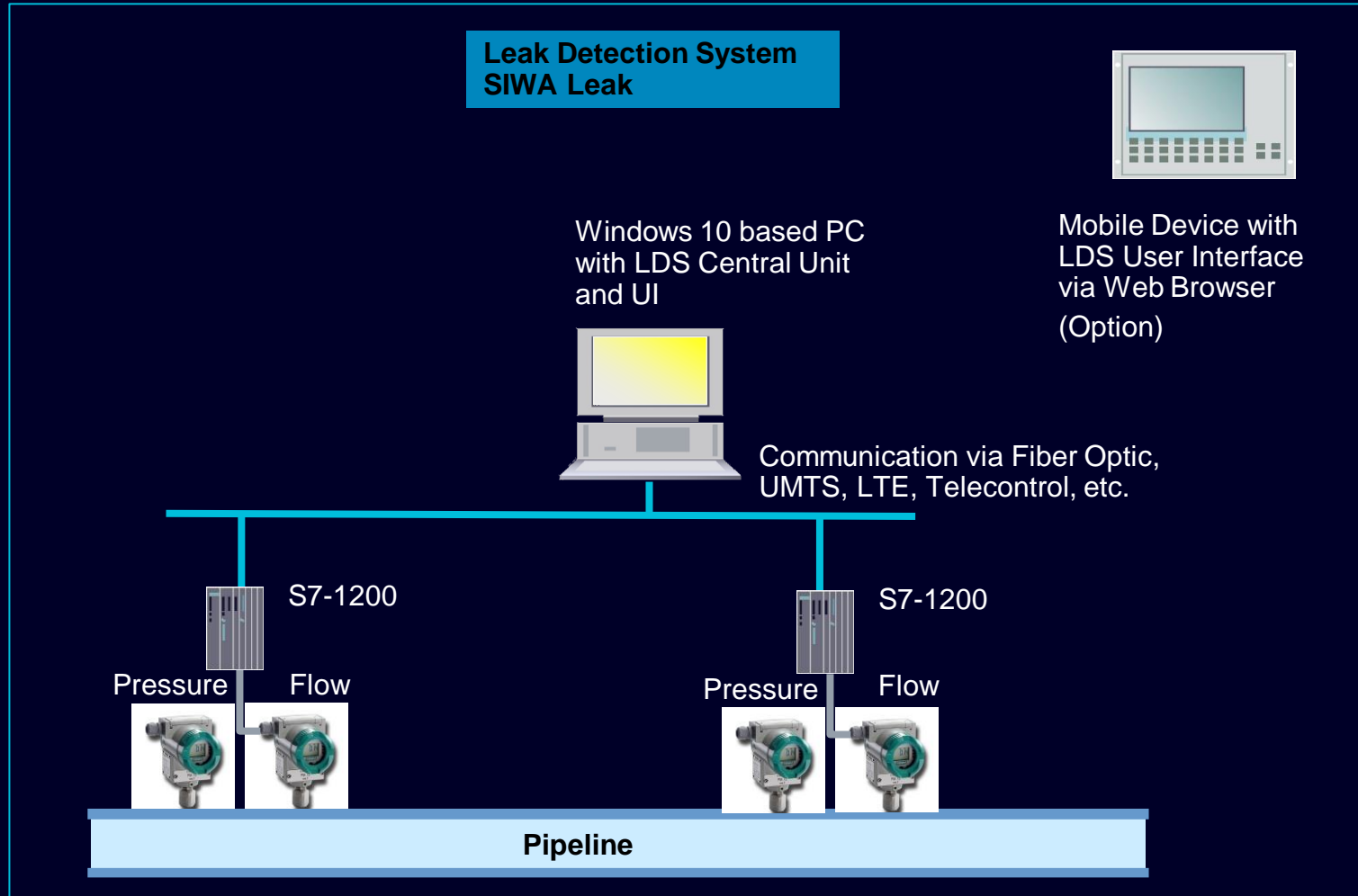
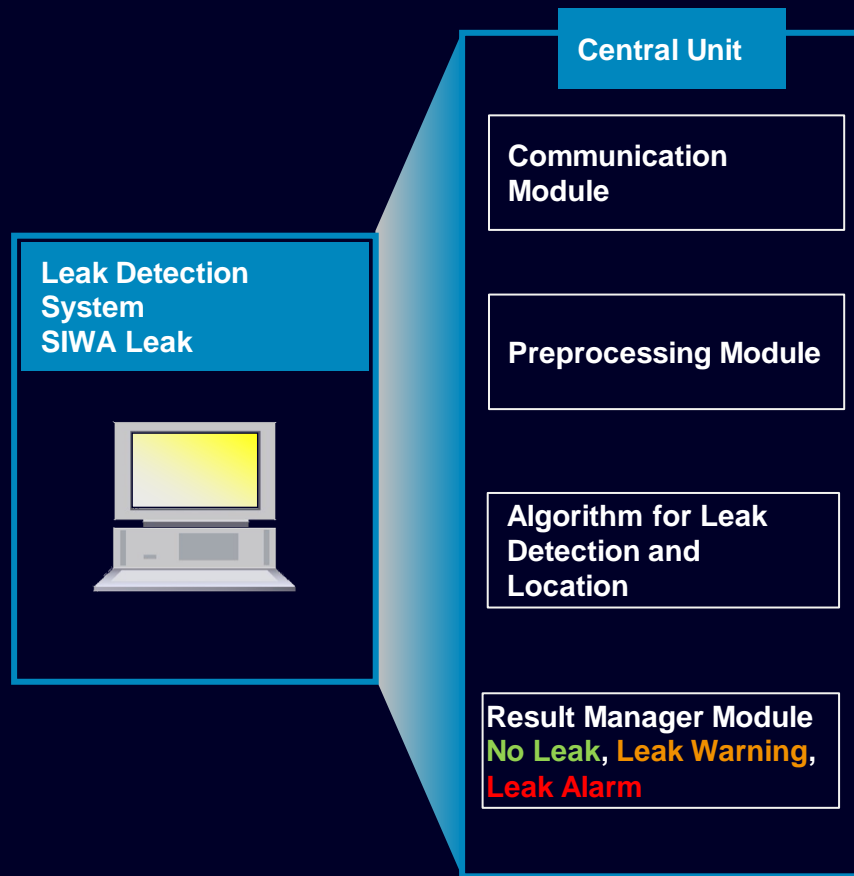**The leak monitoring system uses (the existing) flow and pressure instrumentation to detect and localize leaks.**

A combination of different methods ensures that both large and small leaks are detected quickly and reliably.

- Communicates with existing SCADA or PLCs

- Used in static state
  (stable pressure and flow rate)

- Parameters set alarm sensitivity
  (to allow for measuring inaccuracies and pipeline noise)

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SIWA Leak:
Modular structure gives flexibility

Central Unit

Leak Detection System SIWA Leak

Communication Module

Preprocessing Module

Algorithm for Leak Detection and Location

Result Manager Module
No Leak, Leak Warning, Leak Alarm

Central Unit of SIWA Leak

Communication Module
- Communicates with existing SCADA or PLCs

Preprocessing Module
- Plausibility check and preprocessing of PLC data
- Checking for the loss of measured values
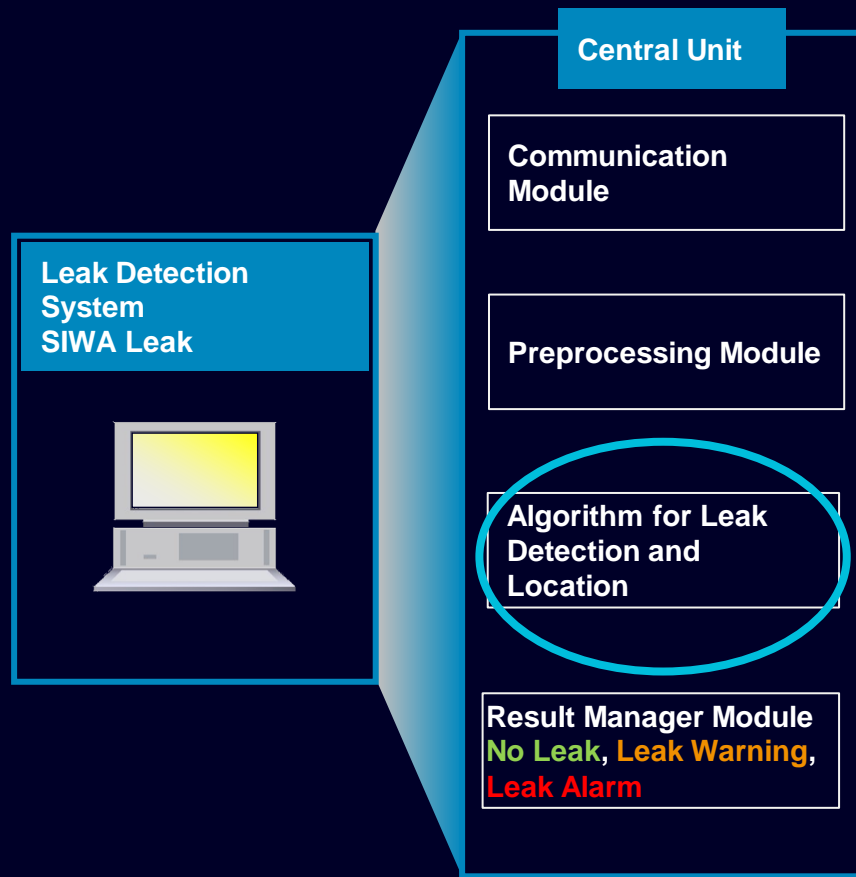- Checking for incorrect and noisy measured values

Algorithm Module
- Leak detection and localization process

Result Manager Module
- Classification of results
- Link to alarm handling

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SIWA Leak:
Implemented and applied processes

Central Unit

Leak Detection System SIWA Leak

Communication Module

Preprocessing Module

Algorithm for Leak Detection and Location

Result Manager Module
No Leak, Leak Warning, Leak Alarm

Various methods and algorithms are combined to ensure reliability
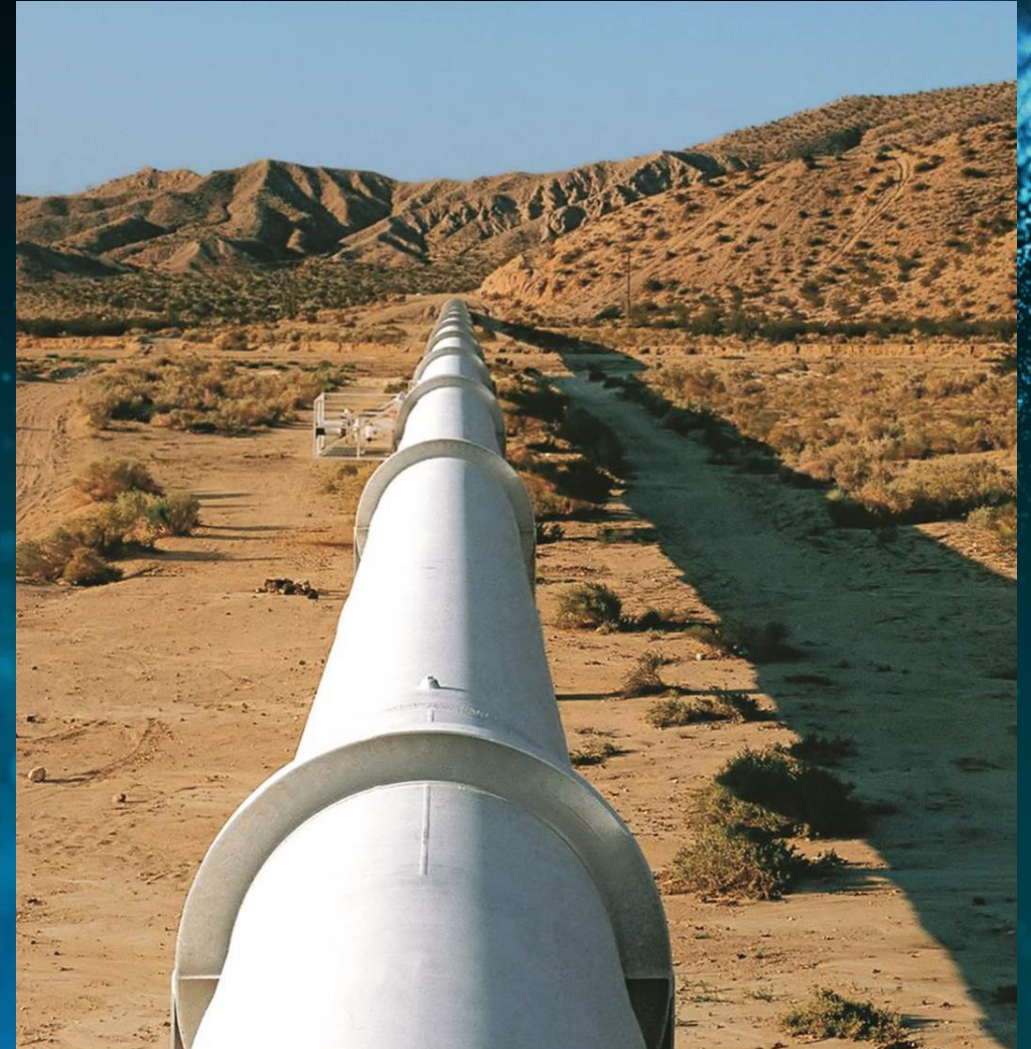
Leak detection
- Mass balance method
- Flow change method
- Pressure drop method
- Pressure wave method

Leak location
- Pressure wave method
- Pressure flow method

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SIWA Leak:
The advantages in operational use

- The automatic detection and localization of leaks ensures high levels of operational reliability and security of supply

- The timely detection and localization of leaks prevents consequential damages, such as undermined foundations

- The solution is economically viable because there is no need for additional instrumentation and cabling

- Graphic operator guidance based on SIMATIC PCS 7 / WinCC reduces operator training costs

- Reduced leakage losses reduce operating costs

- Suitable for almost all conventional control systems in the field inventory

VA Syd
Leakage detection with AI at Water Utility in Sweden

TOPIC

Sustainable water supply, leakage reduction, energy and resource efficiency

LINK

Industry Reference Story

CHALLENGE

- Continuous water loss of 10 %, impacting economic performance and increasing pressure on natural water resources

SOLUTION

- AI-based application SIWA Leak Plus detects and reduces leaks in water pipes
- "On-premise" solution using a locally delivered hardware with the installed software, ensuring all data and calculations are not saved in the cloud
- State-of-the-art solution making optimum use of the available flowmeters and smart meters

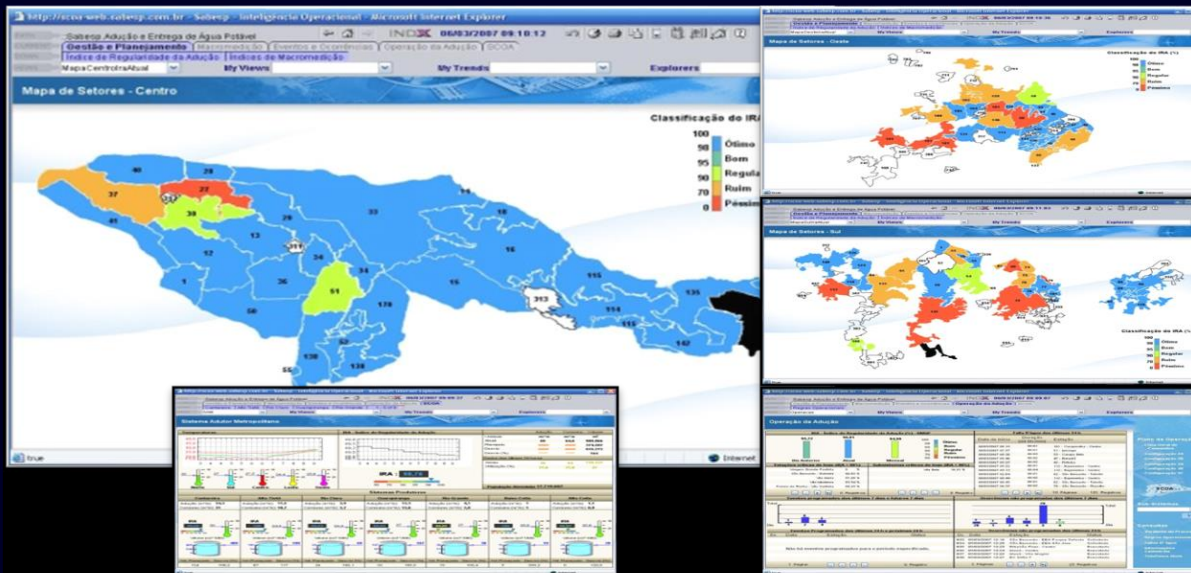**BENEFITS**

- Pinpoint leaks through smart metering zones up to 0.2 – 0.5 l/sec
- Detecting and fixing small critical leaks efficiently
- Economic benefits by streamlining physical leak detection
- Saving energy and resources
- Contribution to the goal of zero unplanned interruptions of service

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Sabesp
Centralized real-time monitoring of the Metropolitan Integrated Water Supply System

Customer

Overview:
- Industry segment: Water treatment and supply
- Location: Sao Paulo, Brazil
- Scope: 180+ plants
- Solution benefits 19 million people in Greater Sao Paulo area

Project

Vision:

The **Supply Operational Control System (SCOA)** manages the processes of adduction and storage of treated water from the water treatment plants to the reservoirs.
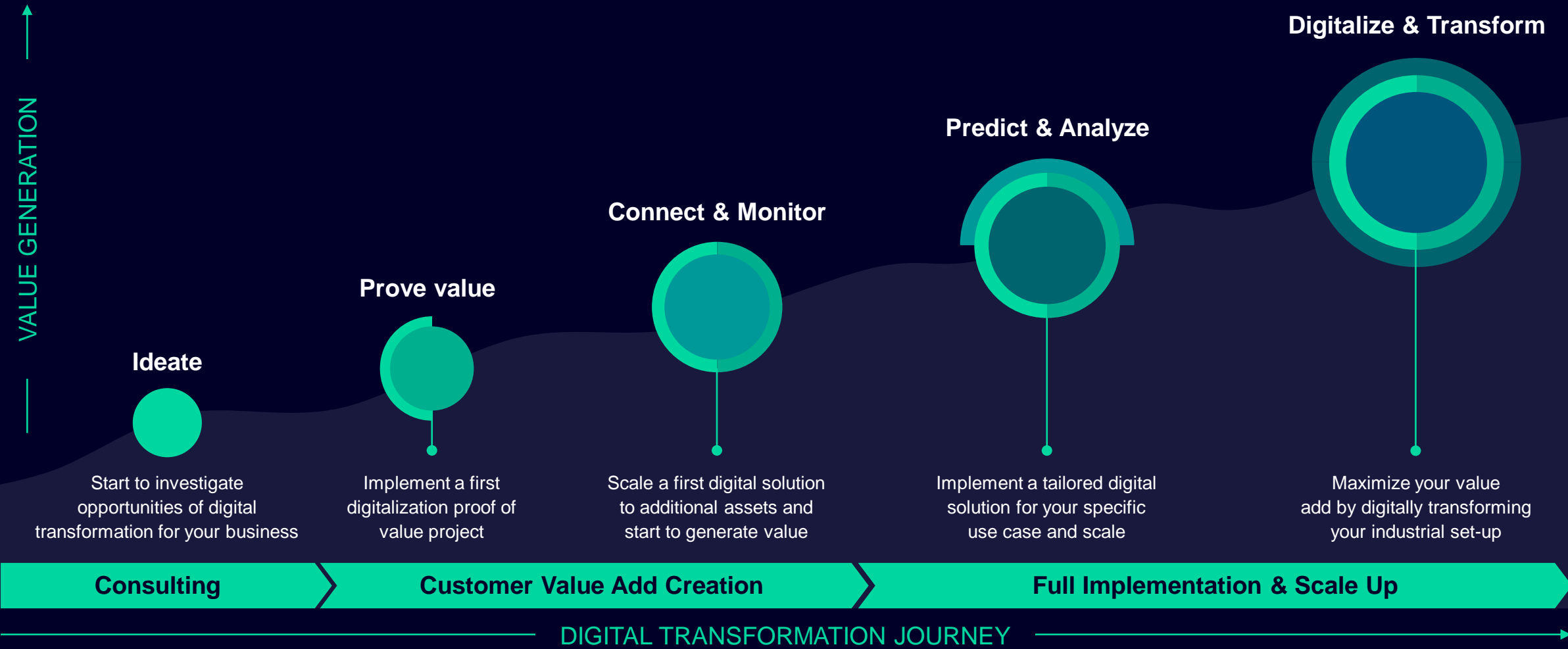
Highlights:

- Runs inside SABESP's Operational Control Center (OCC) and monitors infrastructure in near real-time
- Provides continuous visibility and analysis
- Real-time dashboards are provided for plant operators based on supervisory control and data-acquisition systems

Scope

Real-time data integration and information presentation features needed by SCOA to enhance daily operation tasks, including:
- Animated maps to speed up identification of areas
- Historical and live data analysis
- Operational planning
- KPIs (20+) monitoring energy consumption, water productivity and other operational aspects

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A roadmap to success – Our digital transformation journey drives customer value and scalability

VALUE GENERATION

Digitalize & Transform

Predict & Analyze

Connect & Monitor

Prove value

Ideate

Start to investigate opportunities of digital transformation for your business

Implement a first digitalization proof of value project

Scale a first digital solution to additional assets and start to generate value

Implement a tailored digital solution for your specific use case and scale

Maximize your value add by digitally transforming your industrial set-up

Consulting | **Customer Value Add Creation** | **Full Implementation & Scale Up**

DIGITAL TRANSFORMATION JOURNEY

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> " We create **sustainable** industrial innovation for a world we want to live in, **today** and **tomorrow**.

– Our purpose @ Siemens Digital Industries

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