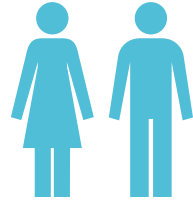# Driving the Digitalization in the Water Industry

Process Industries and Drives, Siemens AG

siemens.com

Water is the most important resource for life

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About **880 million** people do not have access to pure drinking water

3.5 million people die as a consequence of unsecure water sources

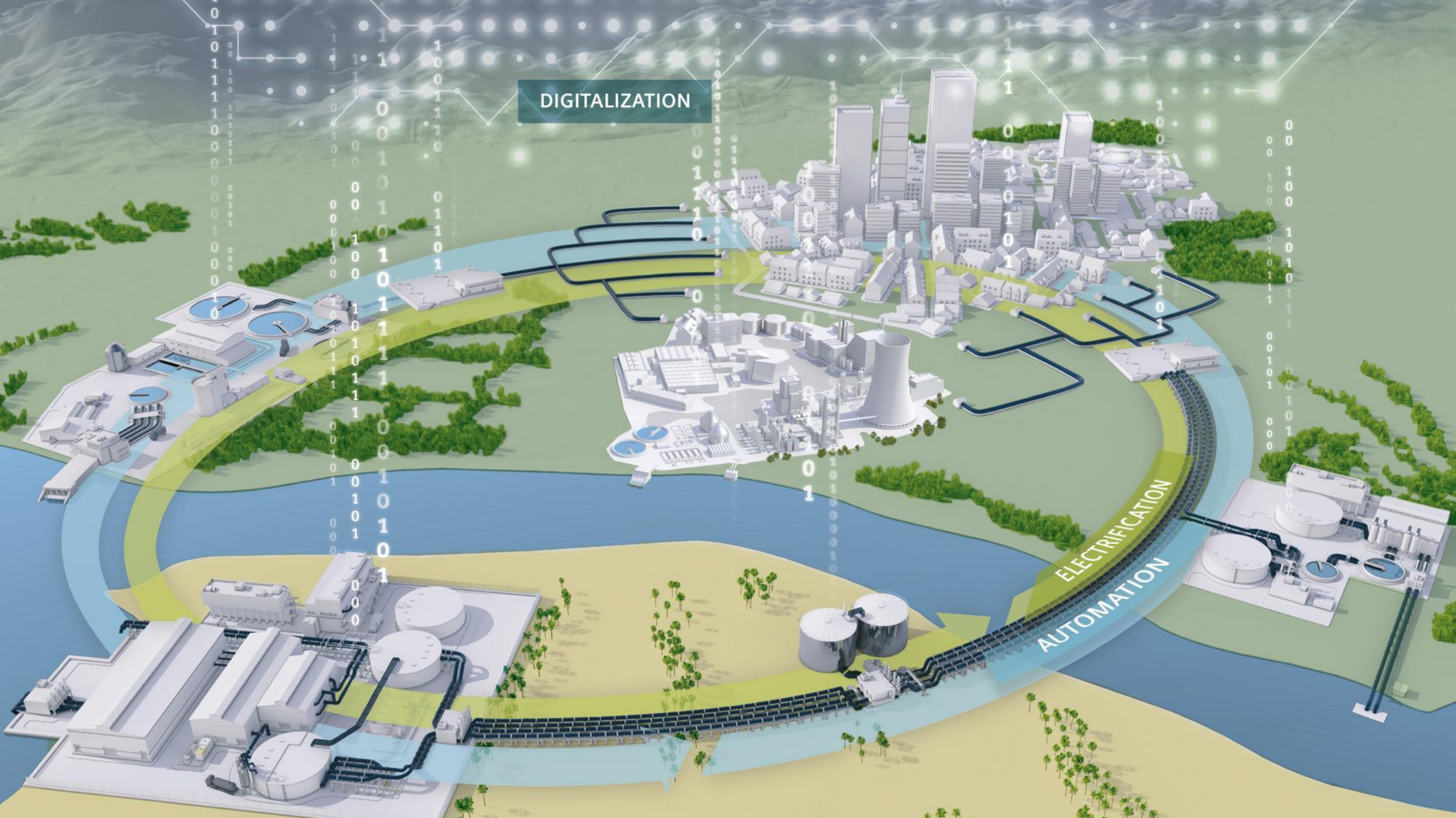In 2050 still **200 million** people do not have access to pure drinking water

Siemens' innovative and digitalization technology supports the Water Industry to increase productivity and efficiency
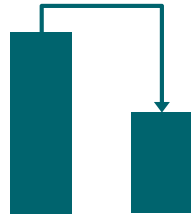
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What is digitalization?

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DIGITALIZATION

ELECTRIFICATION

AUTOMATION

Today's challenges in the Water Industry

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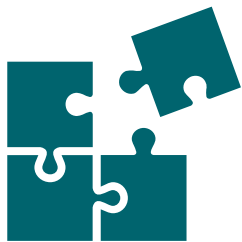*Ingenuity for life*

Security of supply
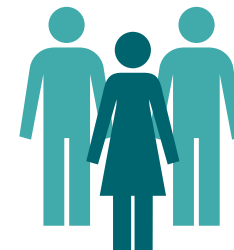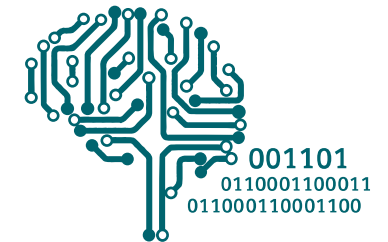
Efficiency and costs

Regulation

Institutionalized Digitalization

Market fragmentation

Cyber Security

Internal barriers

Change in Mindset

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Challenges impacting our customers

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Evolution		Intent	KPI
1	**Security of Supply**	Utilization of new water sources (desalination) and reduction of leakage rates	
2	**Efficiency and Costs**	Smart or digital solutions enable significant energy savings, process optimization, reduction in labor costs etc.	
3	**Regulation**	Utilities and industrial end-users are continually seeking ways to improve control and monitoring in order to ensure that legislation is always met	
4	**Institutionalized Digitalization**	Digital revolution is impacting national technological development plans and agendas, such as Industry 4.0 in Germany and smart industry in the US	
5	**Market Fragmentation**	There are a huge number of players active in the market of digital and smart water solutions. IoT is driving openness – also with the idea of partnerships	
6	**Cyber Security**	With increasingly digital and online solutions, together with the growth of open platforms, comes the issue of cybersecurity; developments are continually happening to ensure system protection	
7	**Internal Barriers**	One such issue is the shortage of skills relating to data management. This is hindering the in-house implementation of data-driven solutions. A second issue is, that the water sector as a whole is conservative in nature. Change of Mindset is necessary	
8	**Change in Mindset**	Change of Mindset is necessary	

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Water's Digital Future –
Direct Benefits and indirect benefits of Digitization

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Direct Benefits

Reduced labour costs

Improved energy efficiency
and optimization

Reduced chemical use

Increased security of supply,
reduced downtime

Leak reduction
(non-revenue water)

Accurate Billing

Indirect Benefits

Improved quality indication towards the public

Clearer picture of the overall state of an entire watercycle
and improved compliance

Continues monitoring provide public health benefits

Real time usage of data improves customer service
and experience

Increased environmental protection
and comply with regulation

Increased reliability and consistency across all plants

Source: Global Water Intelligence: Water's Digital Future

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Digitalization in Water and Waste Water is based on two pillars – Integrated Engineering and SMART Water Management System

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Integrated Engineering and Operation ➕ SMART WATER Management System

The plant's digital twin reduces engineering efforts and operational costs

- Central, object-oriented data repository covering all plant and process aspects like P&IDs, EI&C, etc.
- Technological specification and automated engineering of PLC and DCS hard- and software
- Reduced validation effort and checks via version management, change control and consistent data repository
- Avoidance of time-consuming error corrections and reduced commissioning time with virtual tools
- Reduced cost and risk for project planning, implementation and commissioning
- Increased data transparency and always up-data information via throughout the entire plant lifecycle

Integration of Automation and innovative IT applications provide resource-efficient water management

- Water Network Simulation and Operation Optimization
- Training Simulator for Pumping Station Operation
- Energy Optimization of Water Distribution Pumping Schedules
- Leak and Burst Detection solutions for Pipelines and Networks
- Flooding protection for Rainwater Collection Systems
- Model Predictive Control for Sewage Treatment and Reverse Osmosis

Product design → Process and plant design → Engineering → Operation → Services

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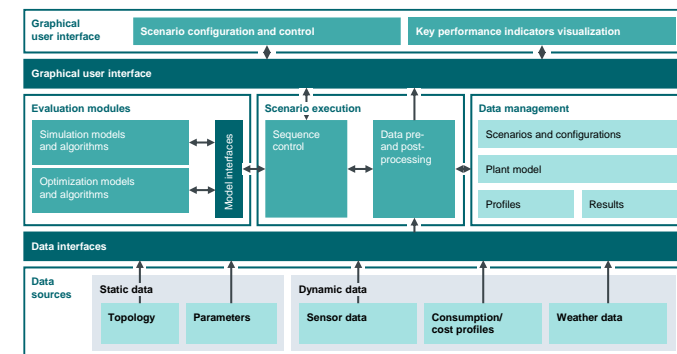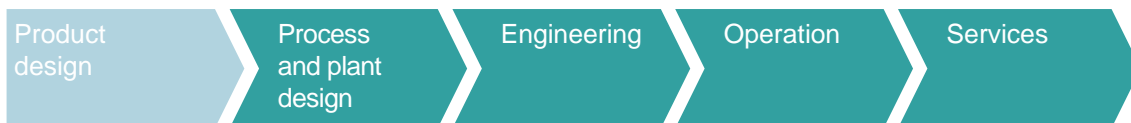
Standardization of Plant Engineering

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Product Highlight

COMOS and Water Unit Templates for a Waste Water Treatment Plant
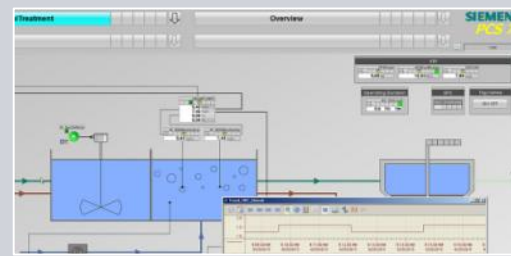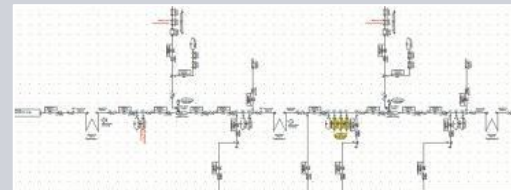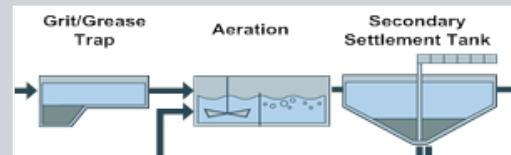
Integrated Engineering and Operation

Savings over the entire plant lifecycle

- Central, consistent and continuously updated data repository through all planning and engineering phases
- "Digital twin" of the real plant provides a bridge across all levels and organizations: Consultants and EPCs as well as OEMs, system integrators and end customers
- Preconfigured templates for piping and instrumentation, electro-planning, automation and drives engineering
- Preconfigured application examples including process screens
- Automated project generation from ready-to-use control and equipment module templates
- High degree of standardization (IEC 61512/ISA-88 and NAMUR NE3) and reusability
- Significantly increased productivity with time and cost savings as well as risk reduction in project planning and execution
- Consistent plant documentation "as is" during all phases

A Holistic Cyber Security Approach –
More than the Sum of its Features

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Everything deliver has to be cyber secured

5 Levels   of Cyber Security

| Plant security features | Improved security processes | Handling of incidents | Security consciousness | IT infrastructure |

Siemens Industrial Cyber Portfolio

Consulting
- Risk assessment
- Security program development
- Security awareness training

Professional Services
- Remote incident handling
- Onsite incident handling
- Quarterly firewall rule review

Managed Services
- Network security monitoring
- Periodic firewall audits
- Managed anti-virus (AV)

Products
- Secure remote access
- Device health monitoring
- Hardened endpoints/PLCs

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Mindsphere in the Water Industry
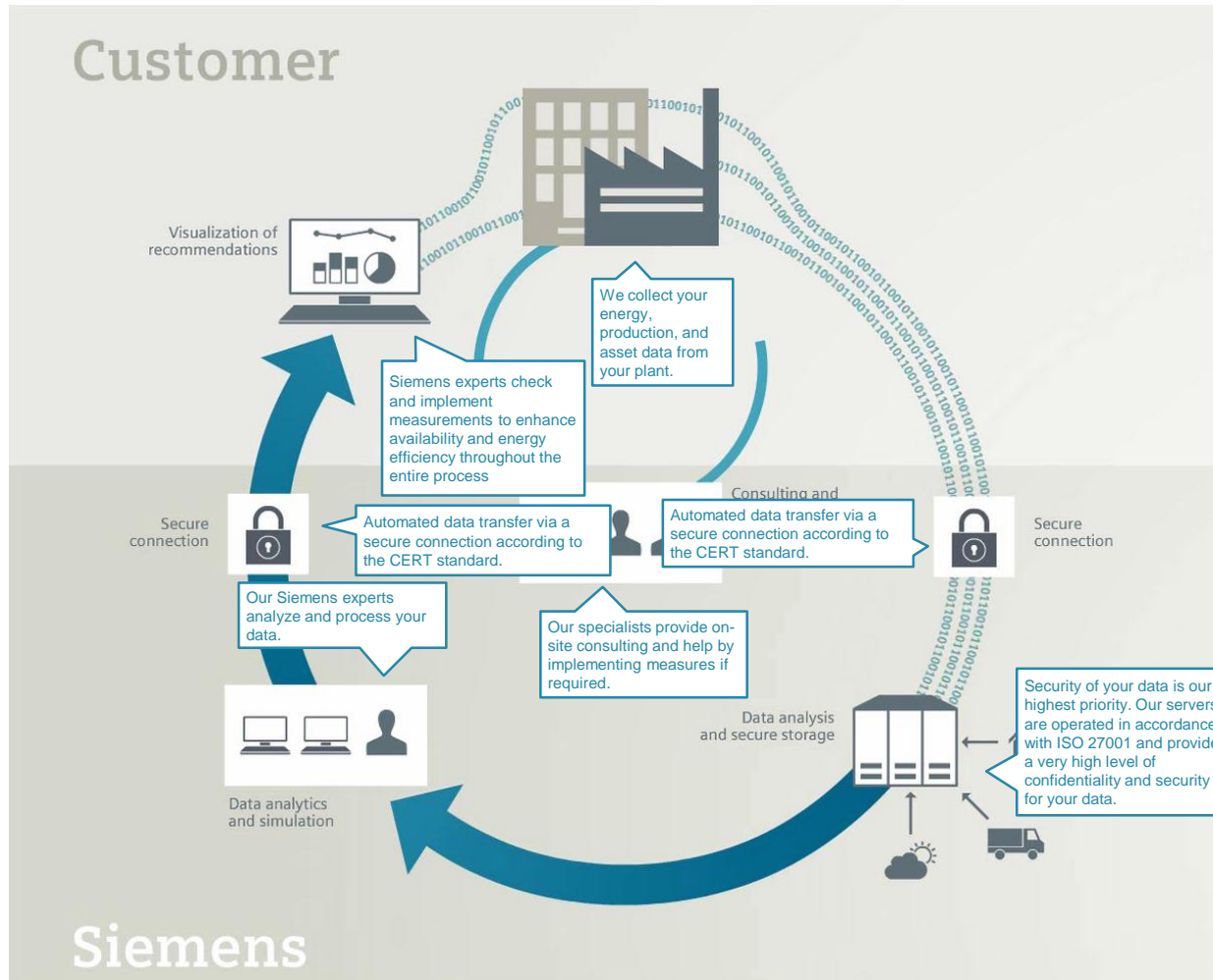
Digital solutions

Intelligently monitoring and managing water networks:

- Smart Sensors for quickly detection of potential leaks with secure data transmission directly to the cloud by FTPS.

- Smart Pump stations with remote Tele control for improve efficiency to keep electricity cost as low as possible and complete data reporting for high end analysis.

- Smart water Management
  - SIWA control and optimize for water supply networks.
  - Leakage detection and location.
  - Optimized the operation of pumps.
  - Control of rainy water flow for proper sewer treatment – for greater energy and cost efficiency.

Application examples for digitalization in Water and Waste Water Industry over the entire lifecycle

	Design and engineering	Automation and Operation		Maintenance and service
Integrated Engineering and operation	COMOS plat lifecycle design and engineer-ing	Virtual commissioning and process simulation based on SIMIT	Engineering and production efficiency optimization based on Water Templates[1]	COMOS MRO application for the Water Industry
SMART WATER Management system	Bentley design and simulation tools	Training Simulator based on Water templates and SIMIT	Energy optimization for pump schedules (SMART WATER Suite)	Leak and burst detection solution (SMART WATER Suite)

1 For PCS 7 and WinCC/S7   ☐ Application in development   ☐ Current portfolio

Vertical Integration
Components & systems

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Process Automation

Engineering Management Level				
COMOS Plant engineering	SIMIT Simulation	XHQ Operations Intelligence	MES Solutions Pharmaceuticals	

Operation and Control Level

SIMATIC PCS 7
Process Control System

Power Supplies

SIMATIC S7-400

Field Level

Analytical Products and Solutions

Process Instrumentation

Industrial Identification

Industrial Communication

Chemical Industry

Pharmaceutical Industry

Food & Beverages

Water & Wastewater

Glass & Solar

Fiber Industry

Mining & Cement

Oil & Gas

Marine

Energy

Utilities

Automotive

Wind

Other

SITRANS Library – Reduced engineering effort while reliability, availability and performance of the plant are increased

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Customer Challenges and Potential

- **Generic faceplates** support only standard device functions

- **High integration effort** for specific device functions

- Risk of data inconsistencies

- Efficient engineering

- Access to additional device functions

- Avoid inconsistency for device parameters

Siemens Solution

SITRANS Library – Device specific Faceplates

- Improved plant operation due to one single view with all necessary parameters and same look & feel

- Simplified checks due to easy access to special functions in the device e.g. partial stroke tests

- Analysis of device behavior via integrated diagnostics

- →**Significant reduction in engineering, commissioning, and test cost with increased performance**

Nominated for ☆ Global Water Award ☆
"Smart Water Project of the Year 2018"

Acciona Agua

Digitalization Project in Morocco "OUM AZZA"

Customer benefits ✓
Optimization of the engineering process and automation through digitalization

- **Surface Water Treatment Project in Morocco**

- **Drinking water supply** in an area with 5 million inhabitants

- The new **water treatment plant** will help meet the region's drinking water demand up to the year 2030; Capacity: 432,000 m^3/d

- **The Siemens solution:** Engineering and Automation based on COMOS, SIMIT and PCS 7

- **Optimizes** the **engineering process**

- Eliminates critical issues thanks to **simulation of the complete automation** of the plant

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Siemens Water Management System – SIWA Optim

Secure water supply at optimized costs

Customer benefits
Saves energy and costs by optimizing pump operation
(15 % optimization potential)

✓

- Helps ensure the supply of **drinking water**
- **Optimizes pumping schedules**, i.e. pumps use electricity at times when prices are low and supply is high
- Fully utilizes **existing automation** and instrumentation
- Assists the water industry in participating actively in the **energy market**
- **MindSphere ready** cloud-based application

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Siemens Water Management System
Real Time Burst Detection

Customer benefits ✓
Reduction of Non-Revenue Water
by instant burst identification
(20 % water loss reduction potential)

- Increasing the **security of supply** of drinking water
- **Identifying** bursts instantaneously
- Localizing bursts with **up to 10 – 20 m accuracy**
- **Using intuitive interface** with real time data analysis and visualization
- **MindSphere ready** cloud-based application

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Wastewater Treatment – Huber SE in Berching, Germany
New Service models through Data transparency

Customer benefits
New Service Business Models
for Global Fleet Management ✓

- Rake connected to **MindSphere** for pre-cleaning the wastewater
- Development of **Apps** and new service business models on **cloud-infrastructure**
- **Data transparency** in secure data transmissions and storages
- **Reduction** of company-ownded IT- and hosting-efforts

Gain energy savings of 10 – 15% by improved process control through embedded APC (Advanced Process Control)

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B | **Use Case → Process and Operations Optimization:** Embedded APC
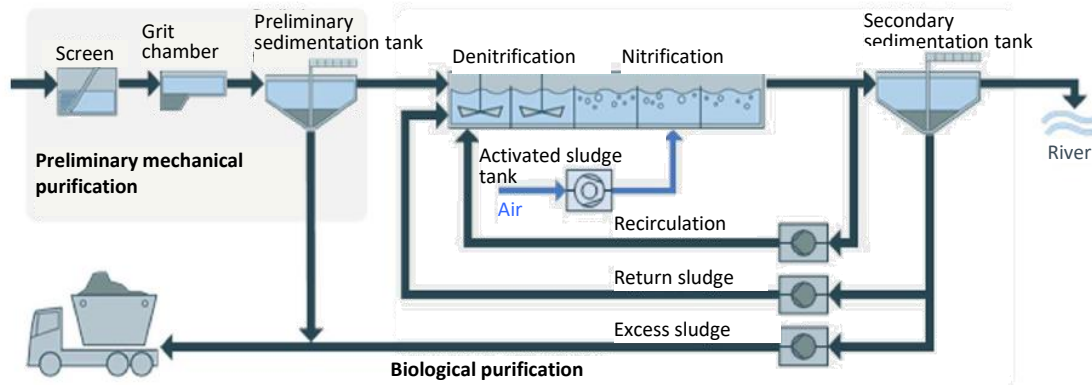
Initial situation

Activated sludge tank in a sewage treatment plant

Challenges
- **High energy costs** through **high concentrations of dissolved oxygen**
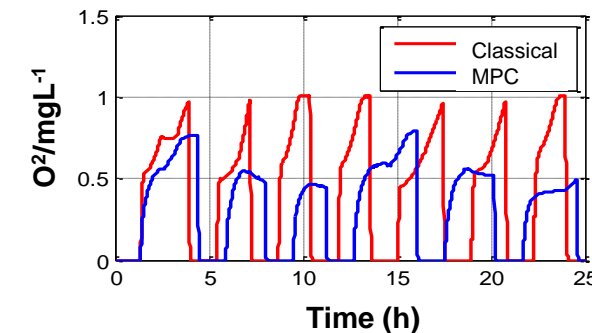- **Volatile effluent quality** due to fluctuations in influent load

Value Proposition
- **Optimized** dissolved oxygen **set points reduce energy consumption**
- Consideration of **predicted process states** to **increase process stability**
- **Pre-defined application templates** to reduce technical risk

Screen | Grit chamber | Preliminary sedimentation tank | Denitrification | Nitrification | Secondary sedimentation tank

Preliminary mechanical purification

Activated sludge tank
Air
Recirculation
Return sludge
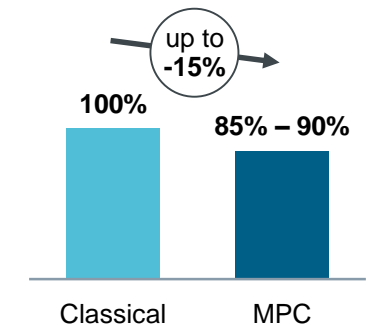Excess sludge
River

Biological purification

CFC – Continuous Function Chart; **APC –** Advanced Process Control; **MPC –** Model Predictive Control

Offering full flexibility

Energy consumption

up to **-15%**

100% — 85% – 90%

Classical — MPC

O^2/mgL^{-1} vs **Time (h)** — Classical (red), MPC (blue)

Solution
- **SIMATIC PCS 7:** Scalable DCS system, incl.
  - **APC (Advanced Process Control)** function blocks with **MPC (Model Predictive Control)**
- → **Pre-defined application templates** (CFC Charts), free-of-charge
- → On demand: Simulation based performance proof

Efficient reduction of environmental impact of storm water rain through optimized operation of sewage channel system

C | **Use Case → Smart Water Management:** Pilotproject SIWA Sewer, Erftverband, Germany
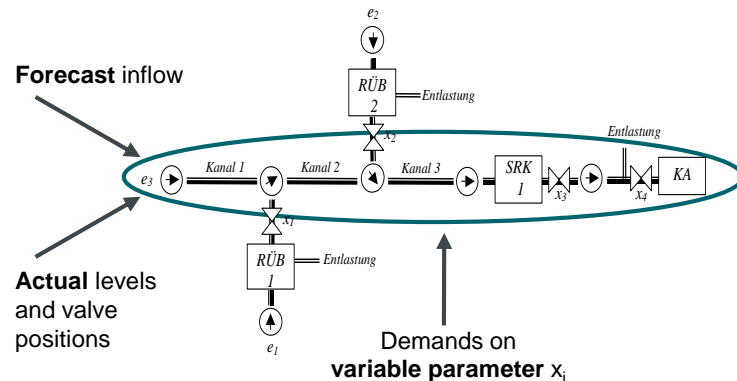
Initial situation

Challenges
- **Decision support system**
  (hydraulic model and mathematical optimization algorithms)
  - **Reduce frequency and volumes of spillover**
  - **Homogenize flowrate**

Value Proposition
- **Online analysis** of network situation
- **Real time semantic information**
- **Optimization** of flow schedules
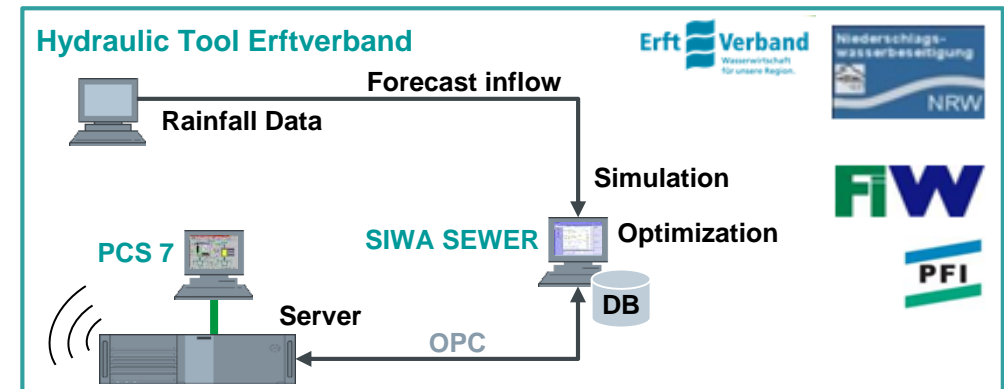- Network planning and **energy-efficient operation**

- Minimized storm water overflow frequency and volumes
- Reduced investment and operational costs

Actual status at Erftverband
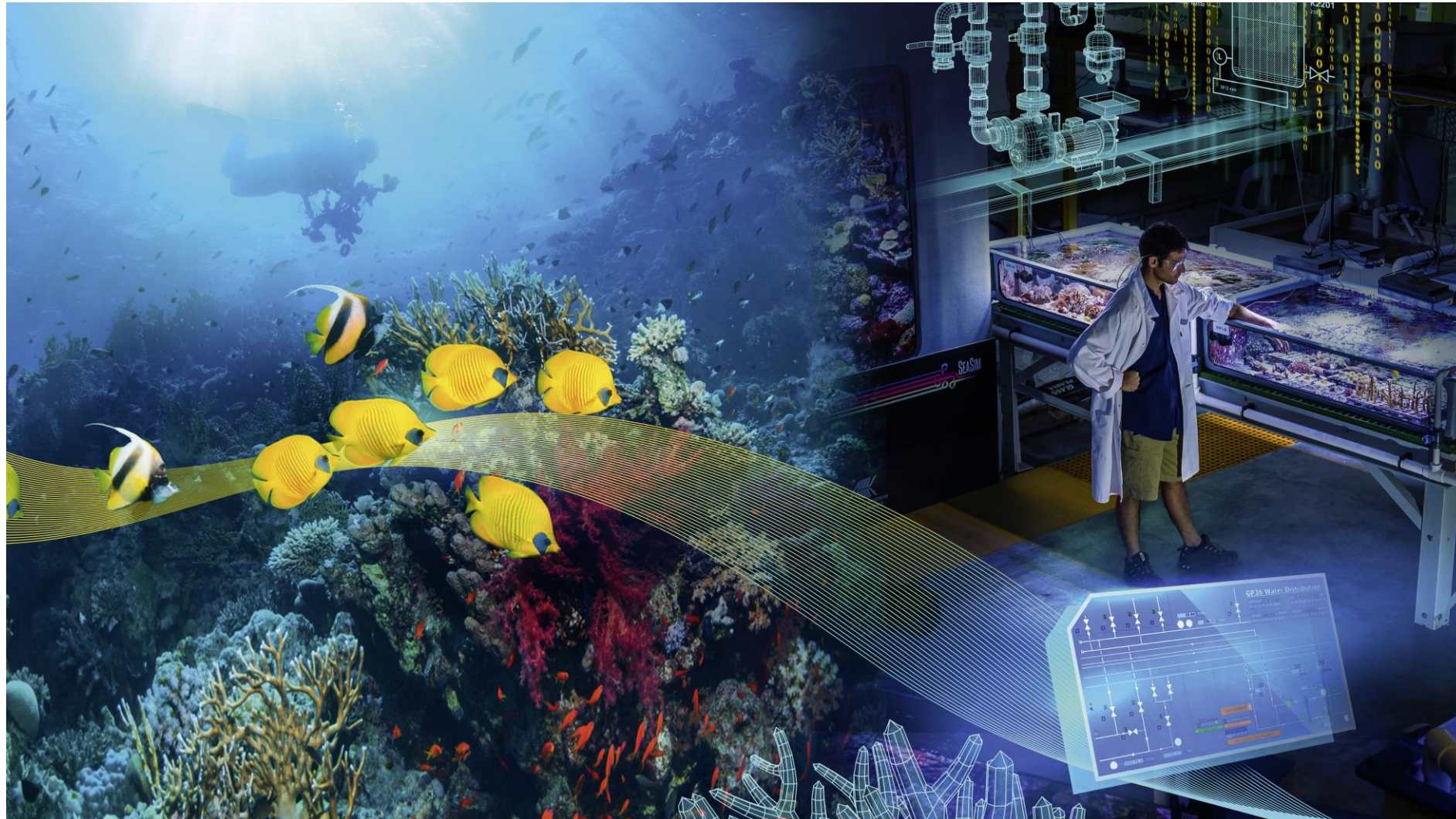
Solution – Optimized flow schedules
- Siemens **SIWA Sewer** and **SIMATIC PCS 7**
- Online computation of optimization modules, taking also rainwater forecast into consideration

→ Significant reduction of spillover of sewage water (frequency/volumes)

→ High environmental impact by reduction of spillover sewage water in running waters like rivers etc.

What is digitalization?