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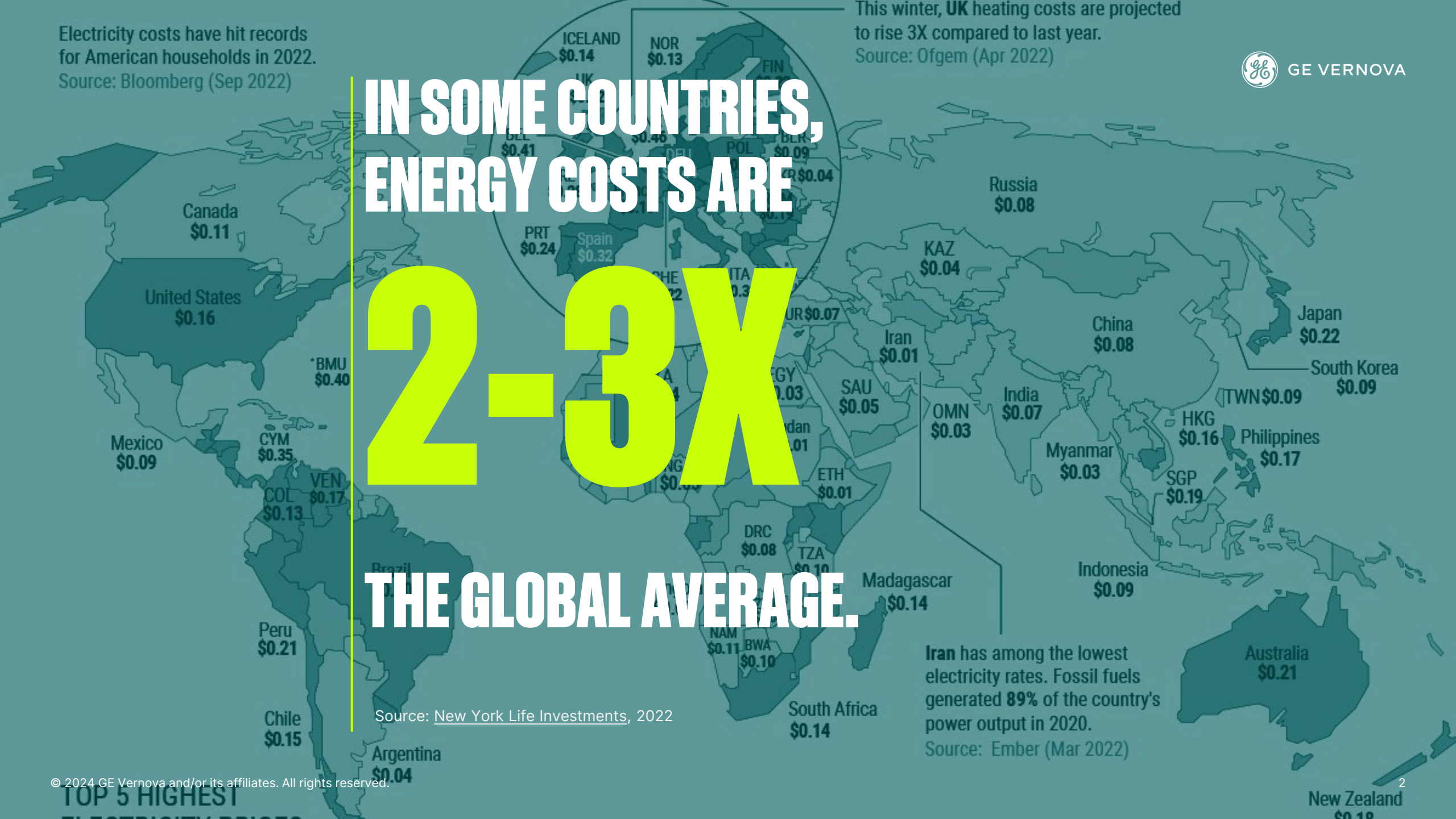

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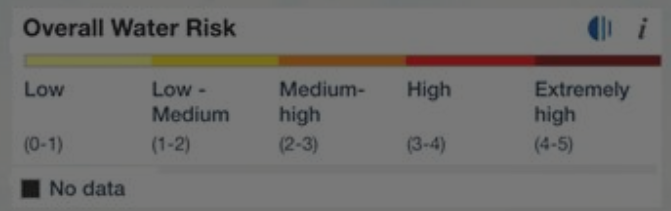
THE FUTURE COST OF WATER RISK TO BUSINESS MAY BE

5X HIGHER

UNLESS WE ACT NOW.



1. Aqueduct Water Risk Atlas, 2023
2. CDP, 2021

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WASTE & CIRCULAR ECONOMY POLICIES ARE

Evolving

RAPIDLY, AND WIDELY VARY.

1. EY, 2022

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“Modeling only the impact of pressure management and active leakage control, we estimate that water losses can be reduced by an additional 38% to 47% globally by 2050. The resulting emissions reduction from pumped distribution could be 0.66–0.94 gigatons of CO_2.”

Project Drawdown

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Challenges and Goals of Water/Wastewater Utilities

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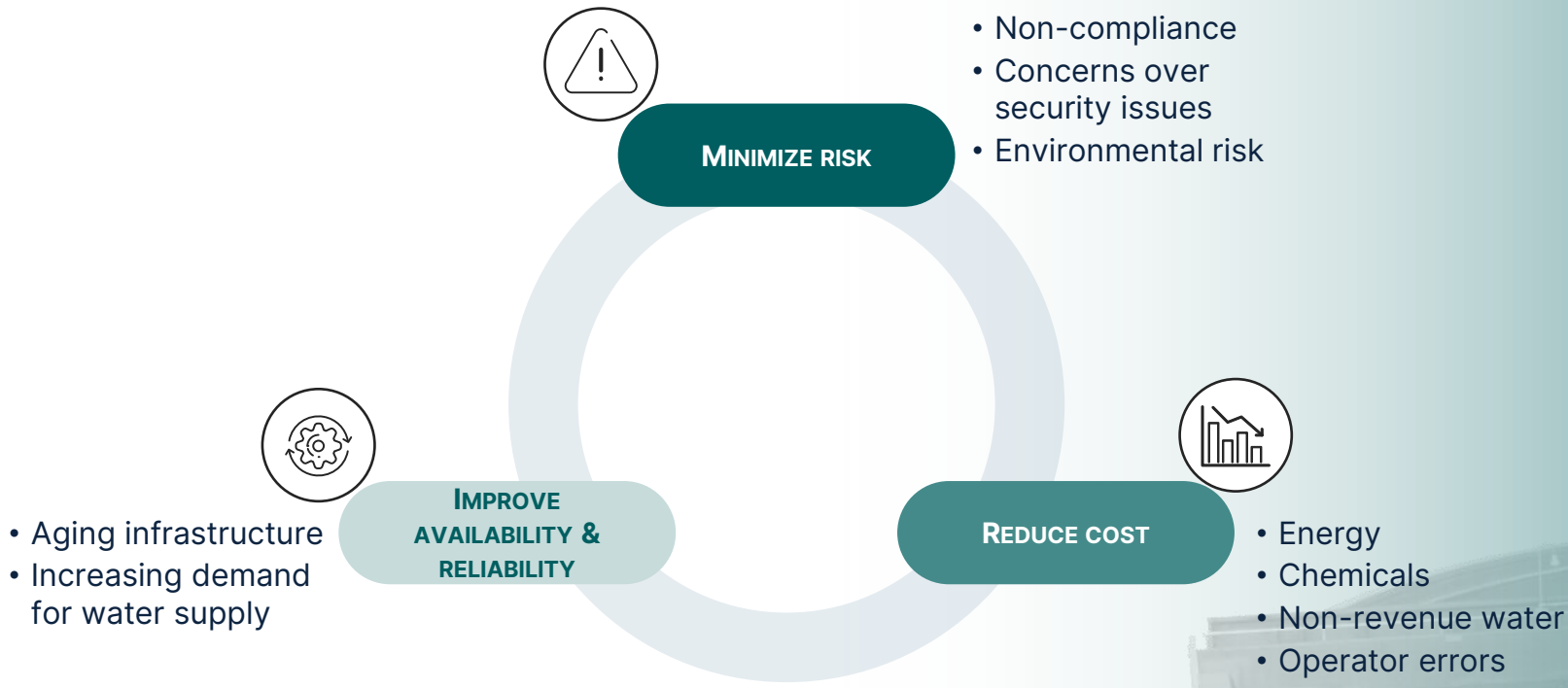

✓ **Deliver clean water** to customers 24/7

✓ **Release safe water** back to the environment

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State of the Industry

ONLY 12%

of water utilities see themselves as early adopters benefiting from smart technologies.

Consequently, water utilities rated **operations, SCADA, and maintenance** as the top 3 most needed data categories (Water Online). With **analytics**, water utilities can model & optimize sites for circularity and stronger P&Ls.

25-40%

of energy used by municipalities treats water

This equates to **8% of total global energy use** and can be mitigated by “controlling water pressure… variable speed drives, process control…” among other energy transition and on-site production opportunities.
(World Economic Forum, EPA)

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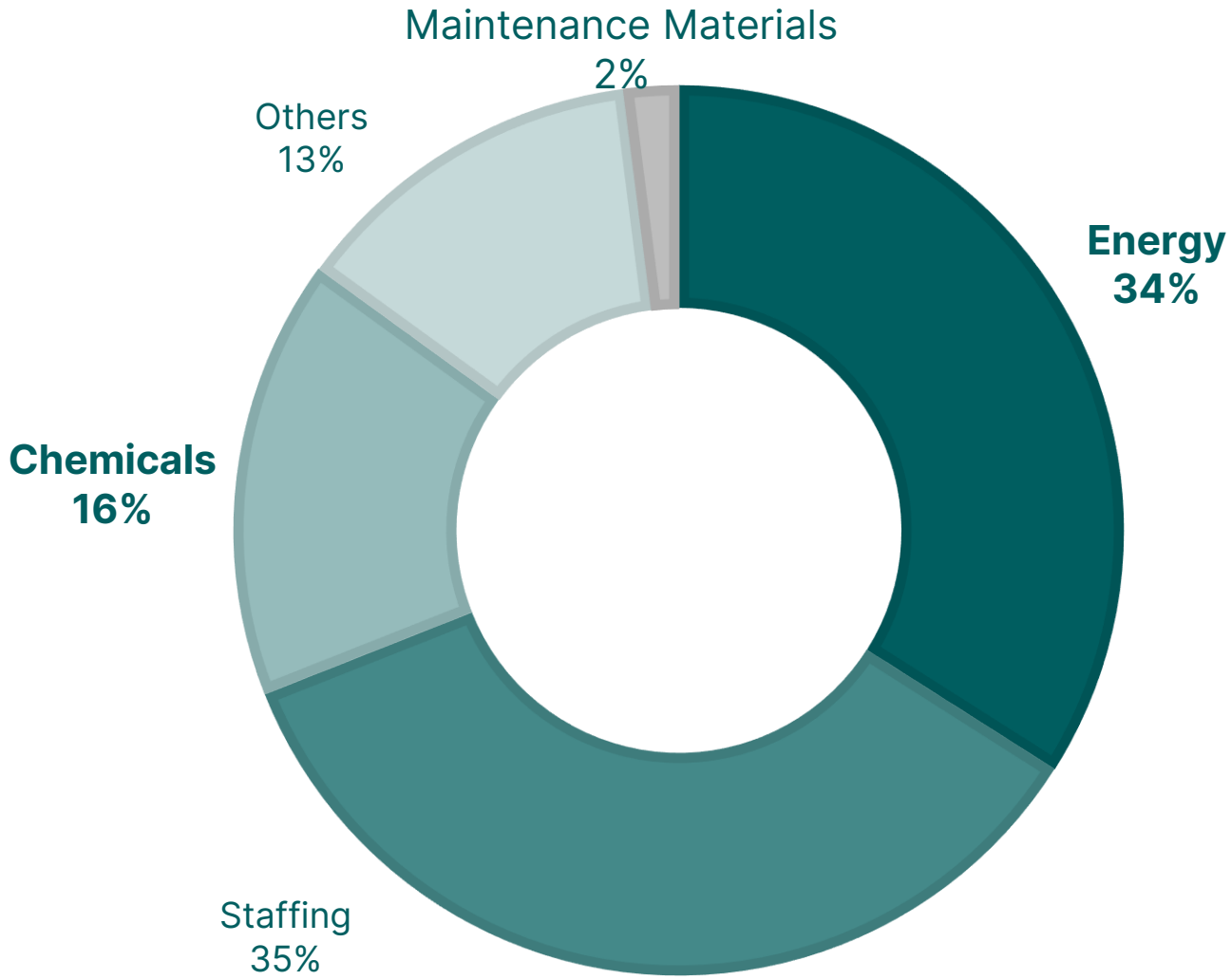
Typical Potable Water Treatment Plant Costs



Source: US EPA

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OPPORTUNITY WITH
SMART RESOURCE MANAGEMENT

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It all starts with Data

COLLECTION

- Time-series process data and alarms & events data from equipment and processes
- IoT
- Quality
- Safety

CONTEXTUALIZATION

Scalable from small to large:

- Scale
- Assets
- Persona
- Relationships

ACCESSIBILITY

- Control
- Analysis
- Business
- Optimization

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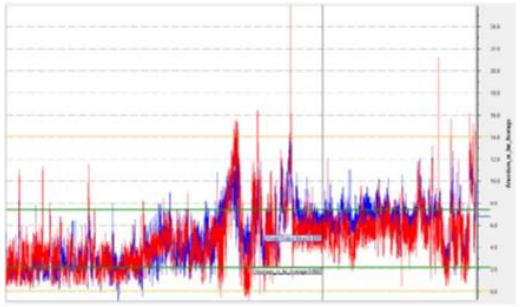
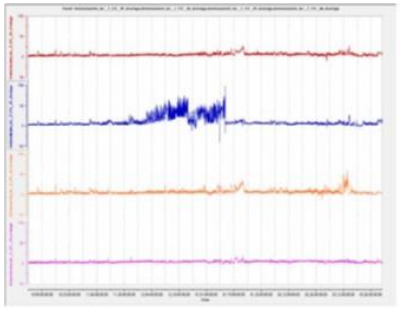
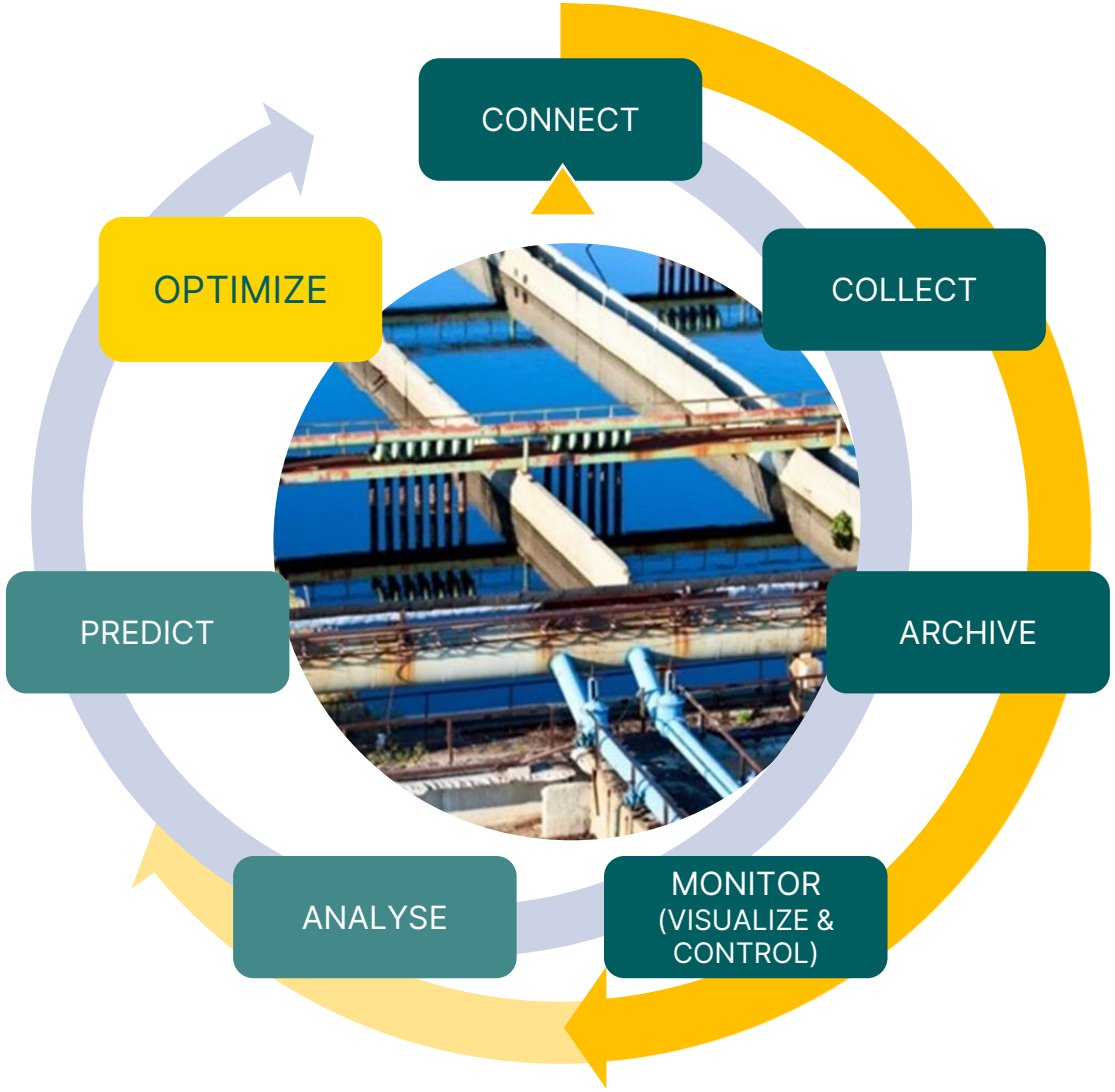
Smart Resource Management Journey
From Control to Information to Analysis & Optimization







Today's most common technology stack (Automated plant, incl. HMI/SCADA software)

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CASE STUDY

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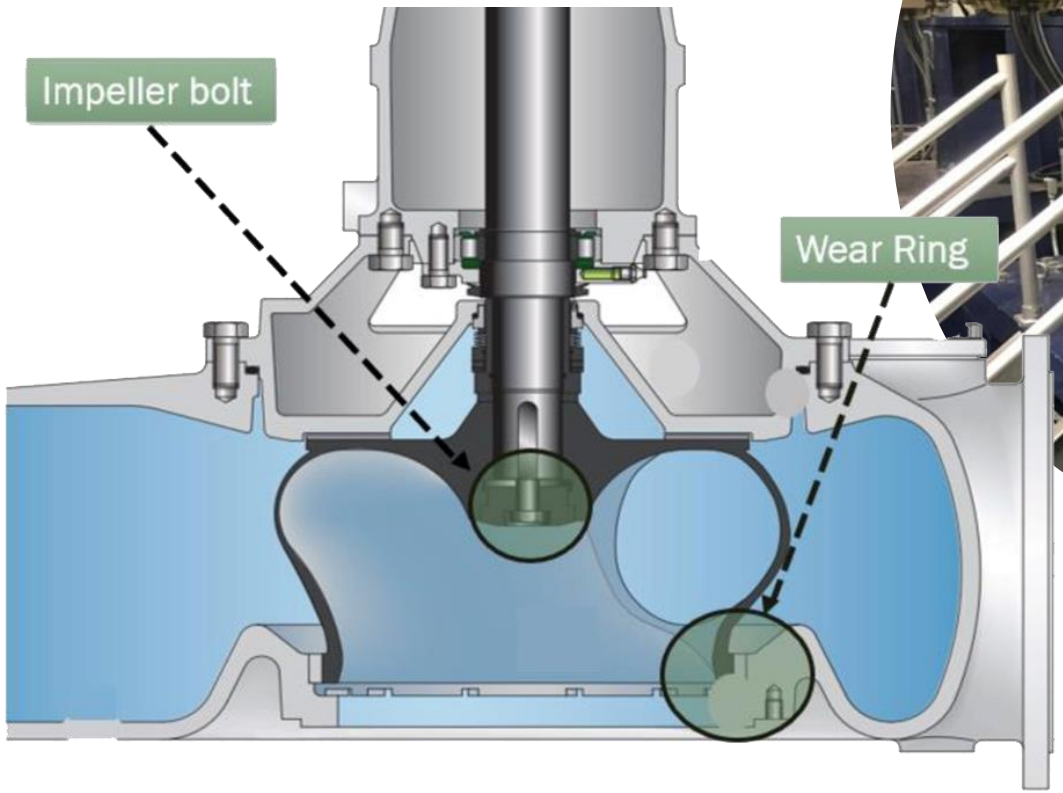
Overview

Class III Ruhrpumpen STV Pump
- ISO 9908 (JIS B 8309)

Frequent Impeller Failure
- Corroded / Failed Bolt
- Impeller Dropouts
- Damage to Coupling

Efficiency issues
- Lower than OEM spec

Access Challenges
- Maintenance
- Inspection
- Clearing debris



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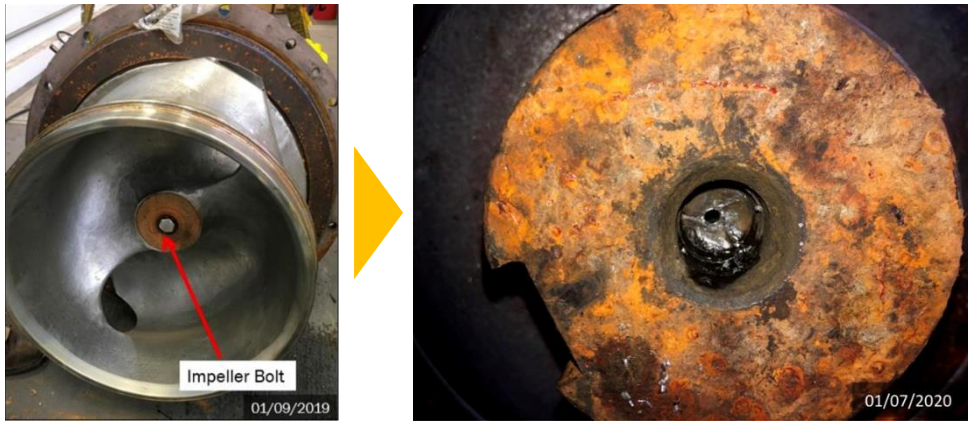
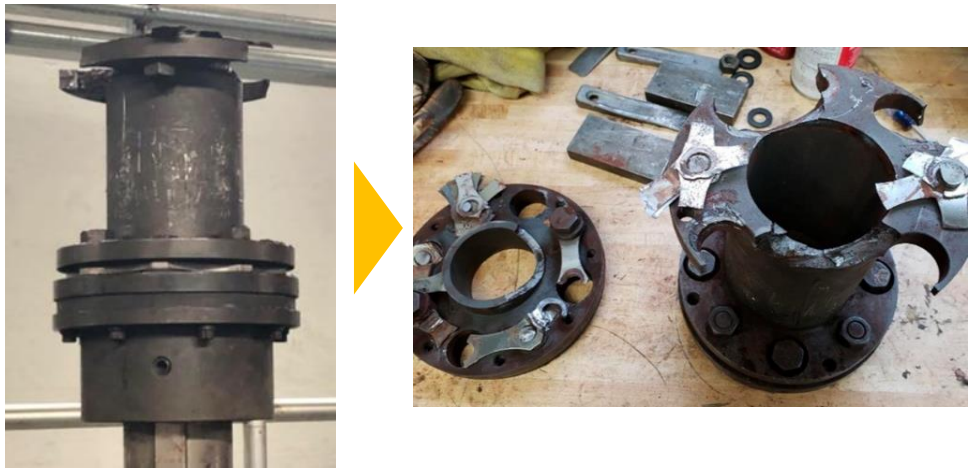
Pump Failure was the Catalyst for Analytics

- Bolt corrodes, causing loss of thread contact
- Loss of thread contact allows for impeller movement (wobbling)





- Movement causes damage to motor and motor coupling
- When bolt head sheers off, impeller can drop out

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Deliverable #1
Pump Impeller Bolt Failure Prediction

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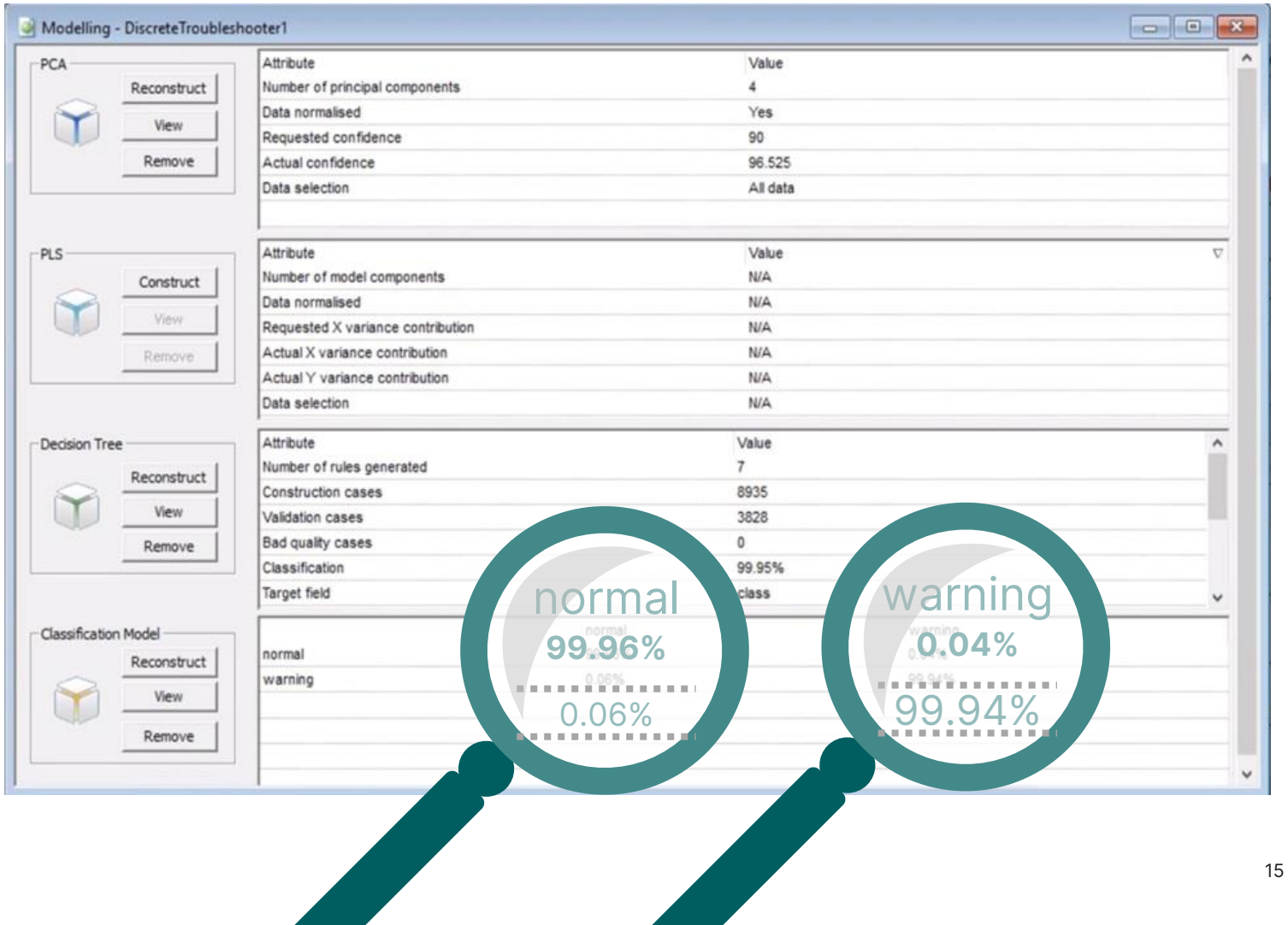
Learning Algorithms
lead to > 99% Accuracy



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Deliverable #2
Real time Efficiency Calculations

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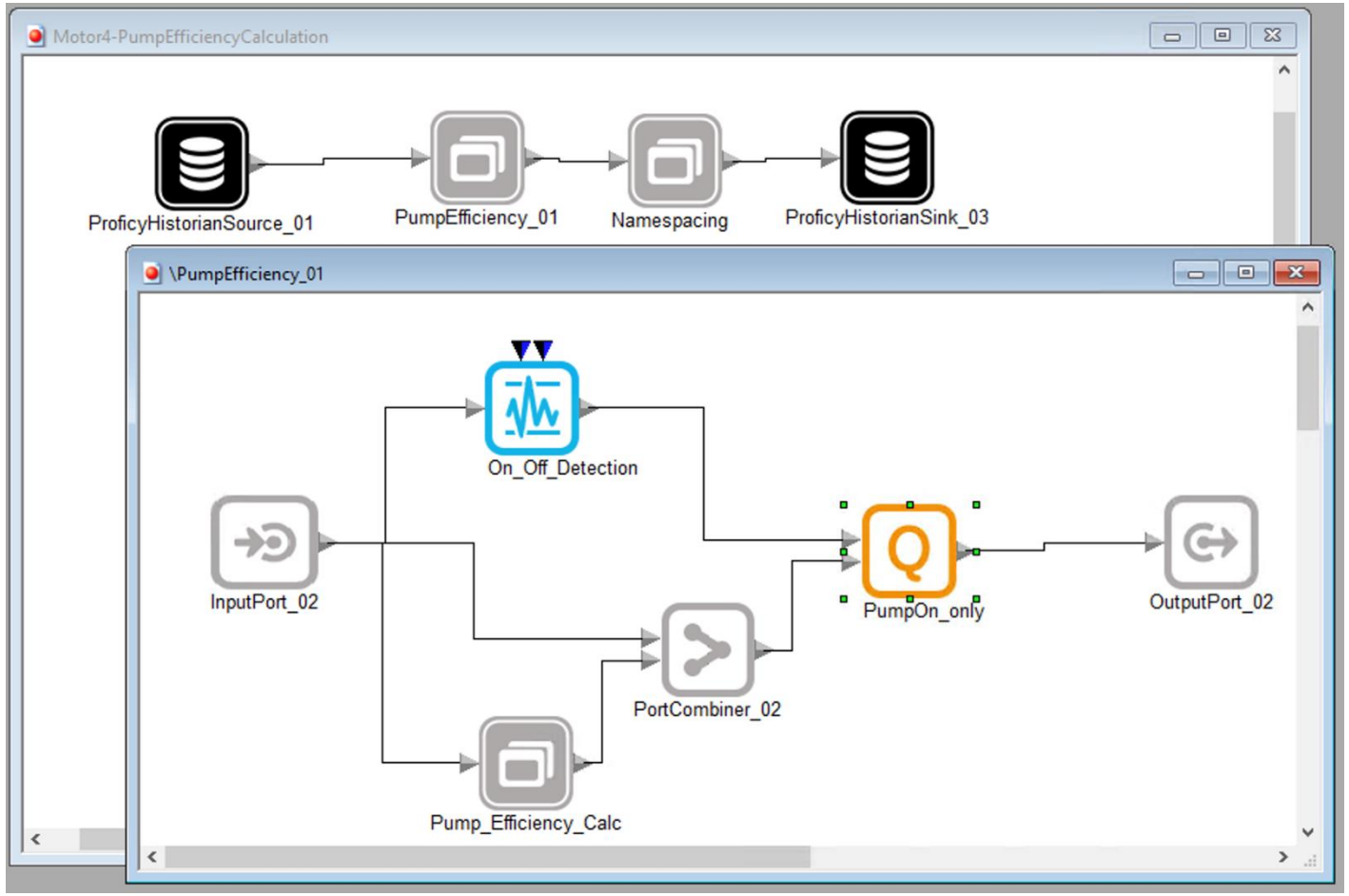
Efficiency calculation
- Power (hp)
- Flow Rate (gpm)
- Total Head
- Gauge Pressure

Moving statistics
- Shift Detection
- Moving Average
- Standard Deviation
- Variance



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INDUSTRY USE CASES

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Accessibility of Data

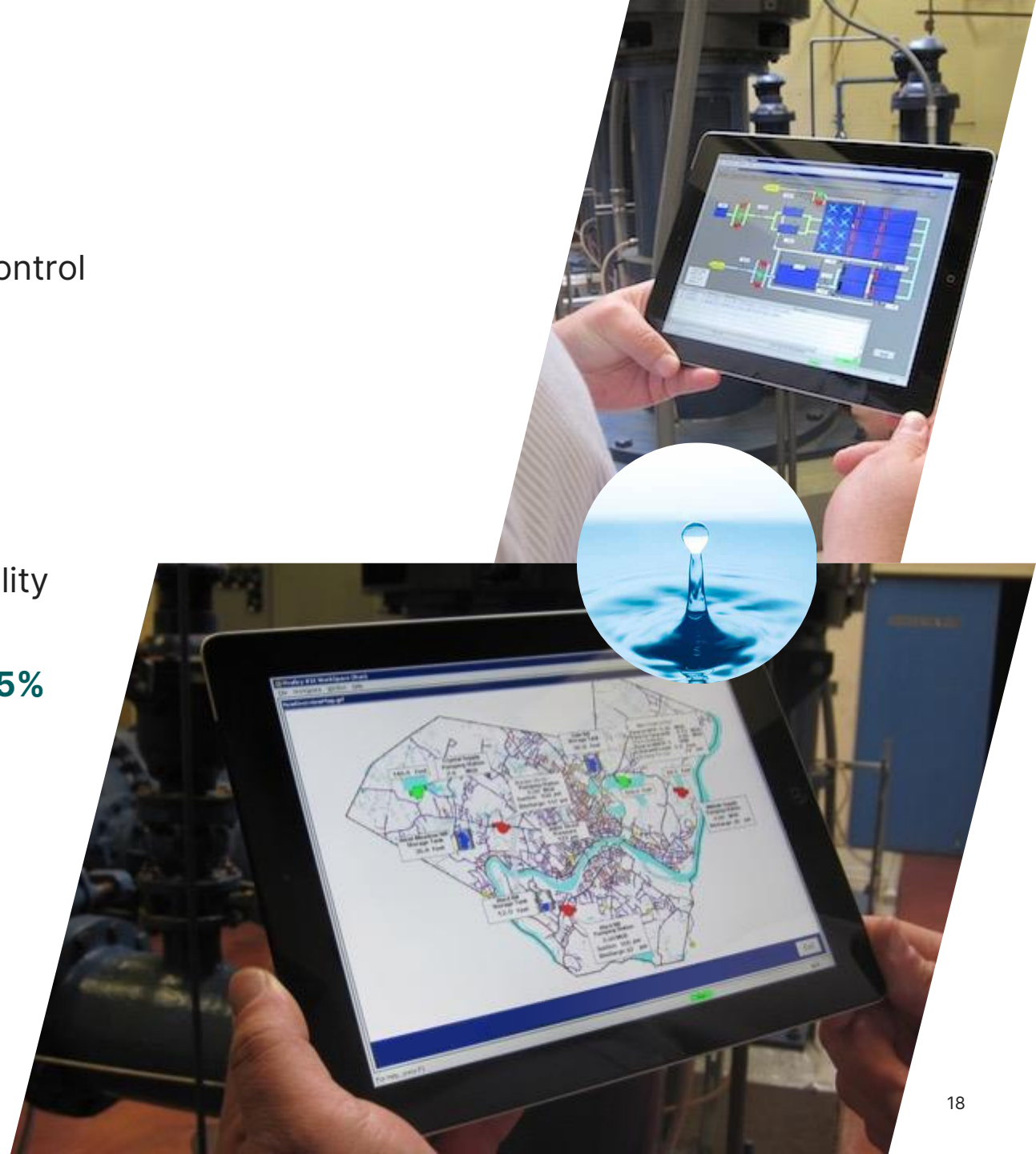
CHALLENGES

- Access to information beyond the control room
- State-mandated digitization of work procedures
- Fill knowledge gap

RESULTS

- Met **state requirements** for auditability
- Increase **consistency** in operation
- Reduced **troubleshooting time by 15%**

Operator empowerment saves
time & money



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Case Study: One City's "Smart Sewer" Reduced Overflows and Cut Costs From $0.23/gallon to $0.01/gallon

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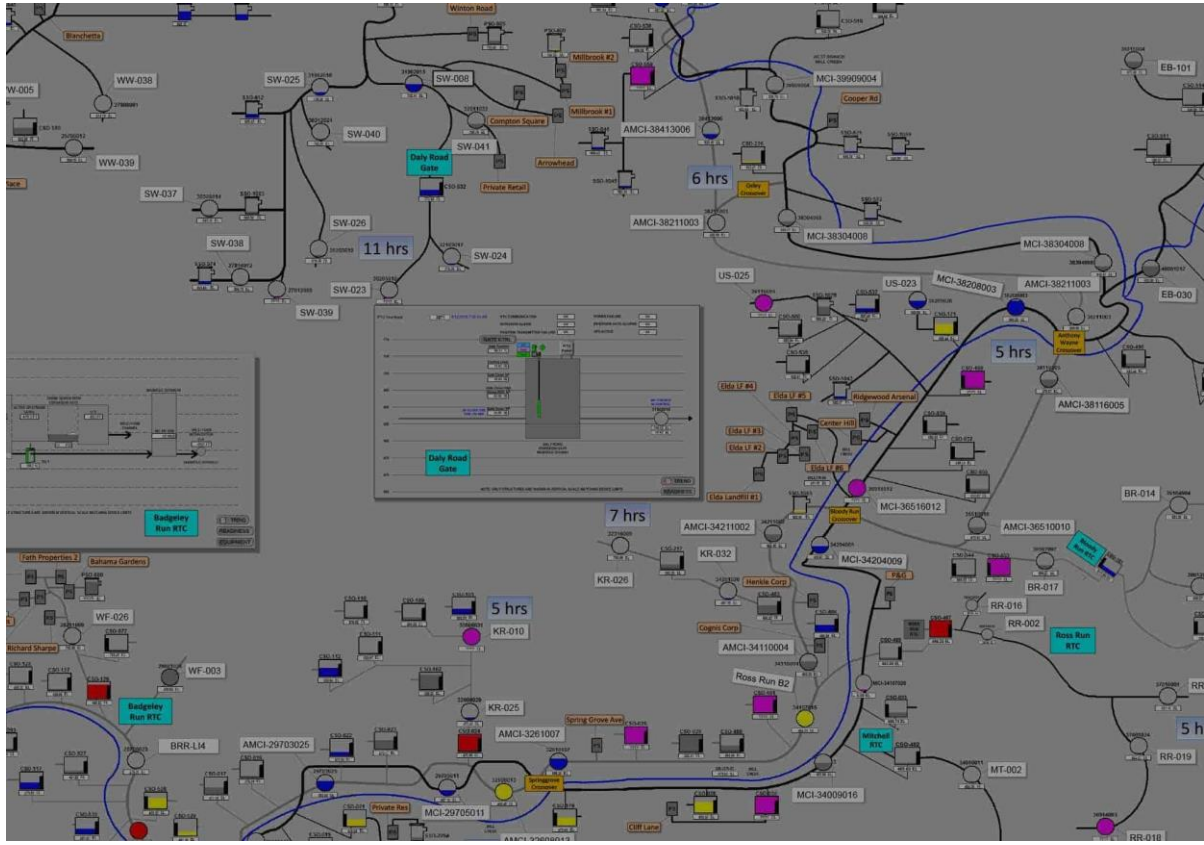
SCADA & HISTORIAN SOLUTIONS

- **Flow monitors and controls** with the creation of a West Weather Operational Optimization System
- **Operator visibility** for informed real-time decisions
- **400 million gallons/year overflow reduction** to local waterways
- **Decrease in new capital projects** and anticipated savings of tens of millions of dollars of infrastructure investments and additional resource use



EVOLVE WITH ANALYTICS & OPTIMIZATION

- **Analytics** enable modeling and simulation to identify non-revenue water and water re-use opportunities
- **Water *and* Energy Optimization Solutions** for reduced consumption, greater resilience, and stronger P&Ls.

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Wastewater Treatment Plant (1,000 m^3/hour)

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Intelligent & Predictive Approach

Water Treatment Challenges

Extreme variation of intake water chemistry & quantity negatively impacted plant operation by **increasing operational costs and reducing quality of discharge** water into crucial river habitat.

Solution

- Industrial data management with industry grade Historian
- HMI/SCADA for centralized monitoring & control
- Predictive control based on the influent quality and other critical parameters

Outcomes

- Improved water purification process & quality and better control of river parameters
- 30% energy reduction after 50 days of operations
- 24/7 uptime – centralized operations at night
- Intuitive operator interface

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LOOKING FORWARD:
CIRCULAR WATER SYSTEMS

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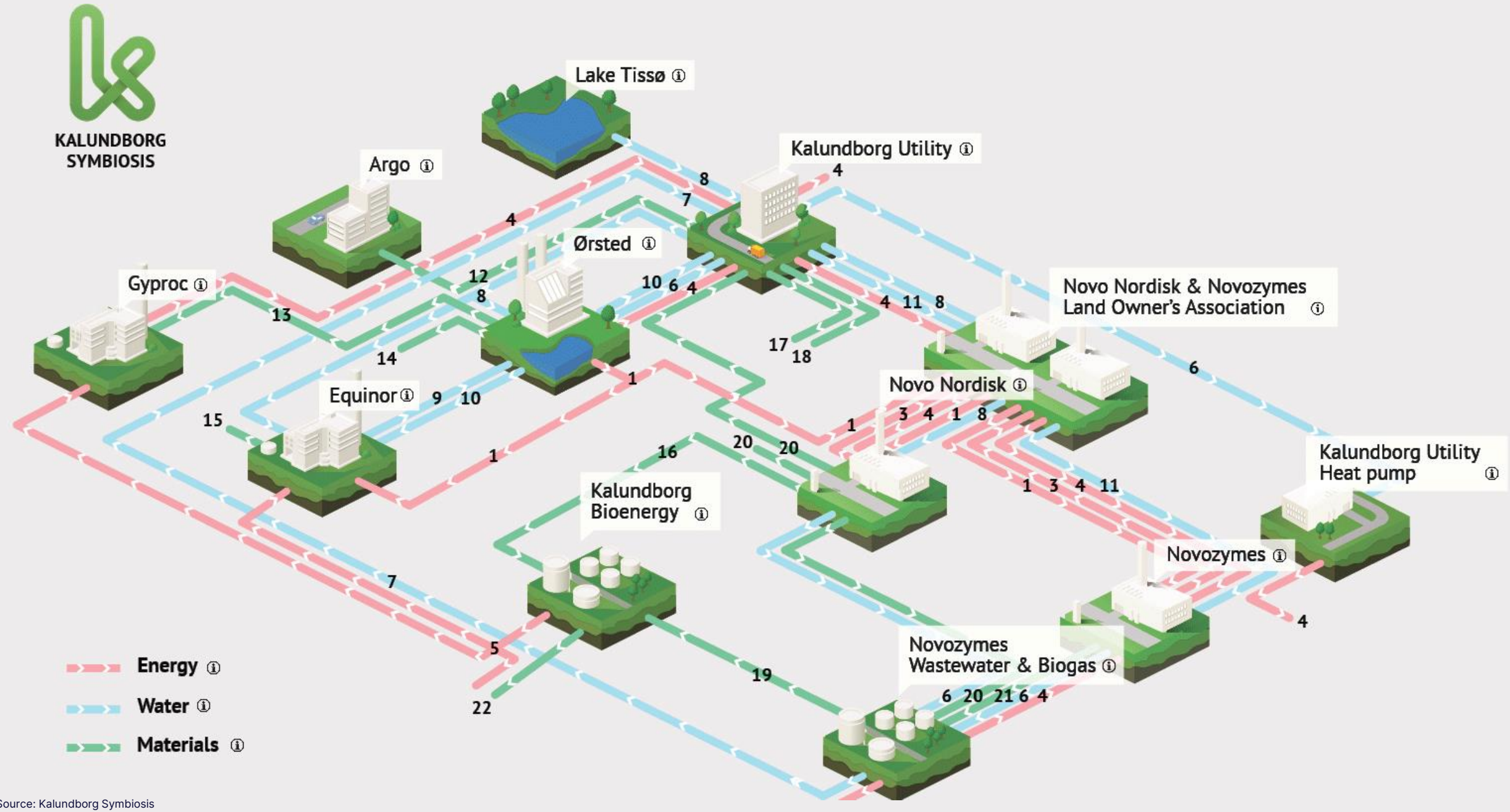

Source: Kalundborg Symbiosis

Opportunities to Capture & Create Bottom Line Circular Value

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Accelerate digital transformation

Reduce (virgin) Resources

Refurbish, remanufacture, & resell (disassembly and reuse of parts, e.g., screws or whole products)

Second-use on-site and remarket for spent organics, effluent, parts

Redesign and re-engineer for circular lifecycles

Infrastructure, data, & resource partnerships

Cascaded (multi-)use of greywater

Recycle & BioCycle

Reuse

Sell to secondary markets

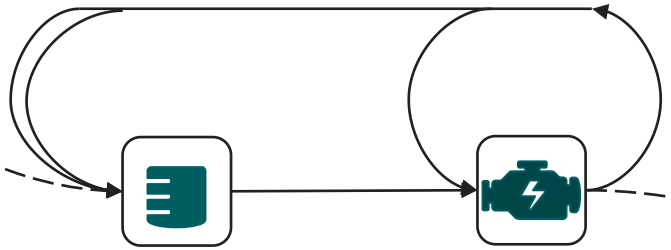
VALUE CAPTURE

VALUE CREATION

Eliminate toxic chemicals

use shared tools and equipment

Energy generation from biosolids



Automate & optimize systems, equipment for energy efficiency

Local watershed resilience

Model for aftermarket / maintenance, **repair**, or overhaul (MRO)

Recover Materials

Address human impact factors & UN SDGs

Composting of digested organics

Transition to renewable energy

Recovery & re-sale of wastewater fertilizers

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How to begin implementing circular water practices

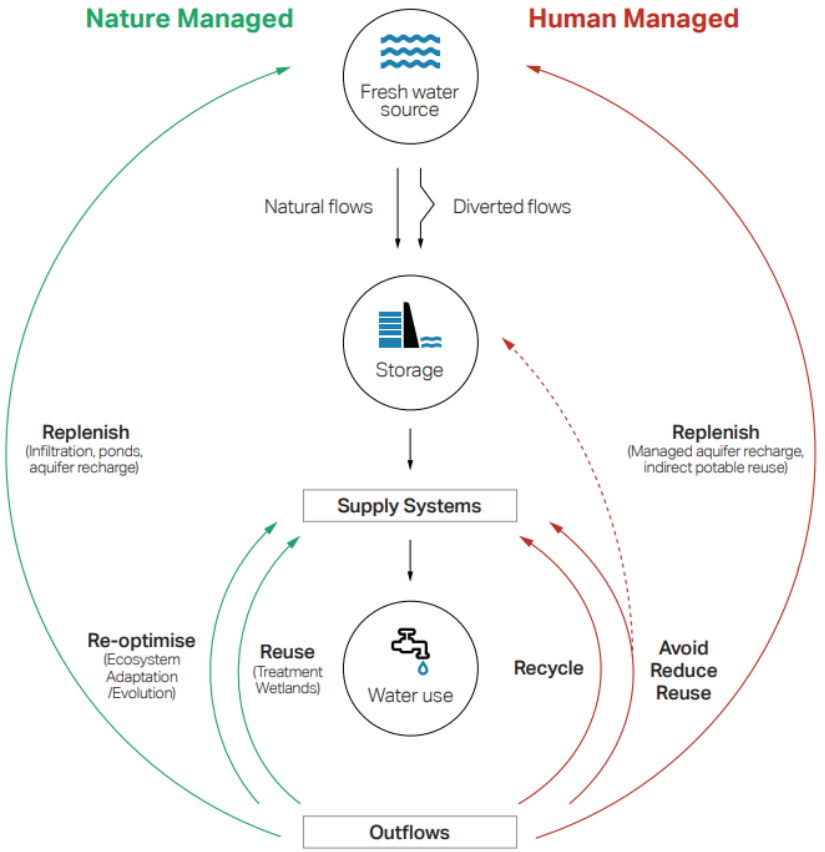
GETTING STARTED TOWARD CIRCULAR WATER SYSTEMS

Measurement and data are key first steps to optimizing the circularity of water inbound to, within, and outbound from facilities.

KNOWING THE SYSTEM REQUIREMENTS

Identifying opportunities for water reuse and water recycling onsite and offsite (third-party) requires defining the quality and quantity needed for the application, from the source water, resulting from the application, and for discharge – then pairing current and alternative sources to the most appropriate application

The water “butterfly”



Source: Water & Circular Economy: White Paper by ARUP, Antea Group, and Ellen MacArthur Foundation

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SUMMARY

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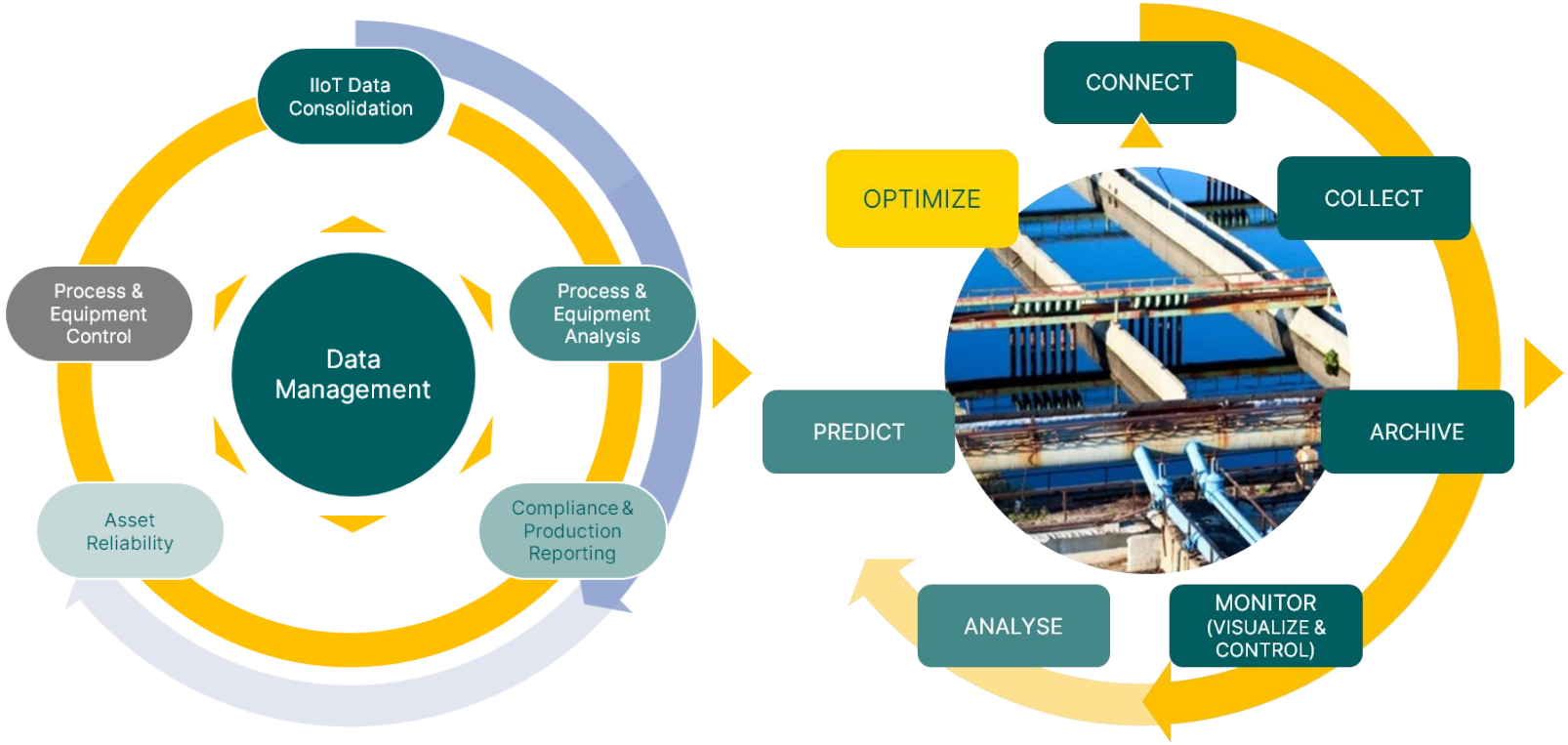
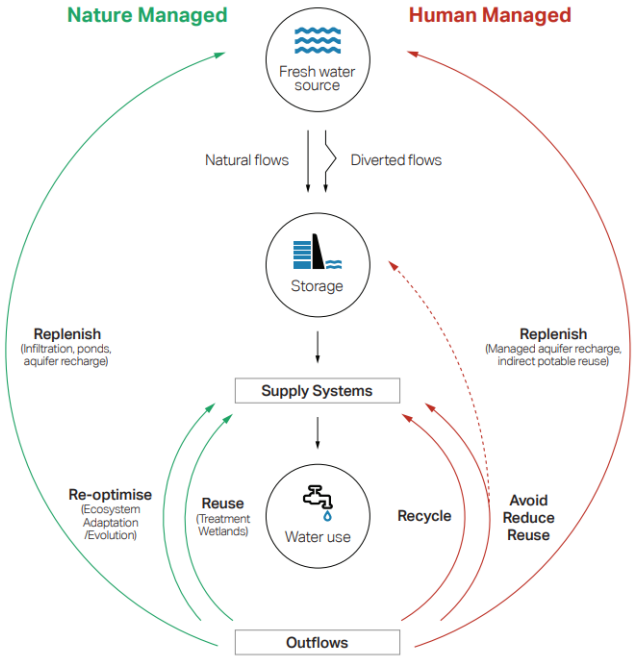
Smart Resource Management Journey
Data leads to Intelligence to Circular Water Practices





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THE ENERGY TO CHANGE THE WORLD

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