

Yokogawa in the water industry

Clear path to the operational excellence for sustainable future

Water resources are finite, and therefore contributing to a sustainable water cycle is one of the Sustainable Development Goals (SDGs).

Yokogawa has been providing advanced digital control solutions for various water applications in the water supply chain.

With our leading-edge technologies, dependable products and extensive expertise and experience of diverse water projects around the world, we work with you to provide sustainable water solutions that boost your business and add value throughout the plant lifecycle.



Global coverage on the water supply chain

Water treatment

- Integrated monitoring system
- Water quality monitoring
- Chemical injection optimization
- Pump operation management
- Advanced water treatment management
- Demand forecasting
- Operator training simulator



Water distribution

- Water leakage management
- Water distribution management
- Distribution pump management
- Water quality monitoring
- Demand forecasting
- Advanced water leakage detection



Desalination

- Emergency shut-down system
- Power consumption optimization
- Energy management system
- Membrane filtration flux control
- Chemical injection optimization
- Water quality monitoring
- Operator training simulator



System on systems



- Distributed control system
- Blower control optimization
- Sludge control
- Operation efficiency support system
- Water quality monitoring

Wastewater treatment



- Water transmission management
- Pump station monitoring
- Leak detection
- Water quality monitoring
- Reservoir monitoring

Pipeline



- Industrial water distribution management
- Dynamic simulation
- Realtime diagnostics forecasting system
- Water quality monitoring

Industrial water



Your single-source partner for operational excellence

OpreX™ Transformation



Production Management

Plant Information Management



Exaquantum

Data Driven Modeling system for Optimization



Data Driven Modeling system for Optimization (DDMO)

Water Leakage Management System



Water Leakage Management System (WLMS)

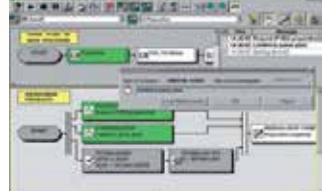
Asset Management and Operation Efficiency

Plant Resource Manager



Plant Resource Manager (PRM)

Operation Guidance



Exapilot

Operator Training Simulator



Operator Training Simulator (OTS)

IIoT Wireless Solution



Sushi Sensor*

OpreX™ Control



Control and Safety System

Integrated Production Control



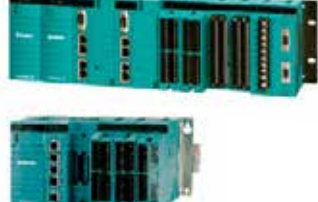
CENTUM VP

Integrated Safety Control



ProSafe-RS series

Hybrid PLC/RTU



STARDOM

SCADA



FAST/TOOLS, CI Server**

Control Devices

PLC



FA-M3V

Industrial AI Platform



e-RT3 Plus

Controllers & Indicators



UTAdvanced / YS1000

OpreX™ Measurement



Field Instruments

Flow



Multi-variable



Pressure



Level



Temperature



Wireless



Distributed Temperature Sensors



Handheld Instruments



Analyzers

Analyzers



Data Acquisition

Data Acquisition Equipment



SMARTDAC+

Life Science

Flow Imaging

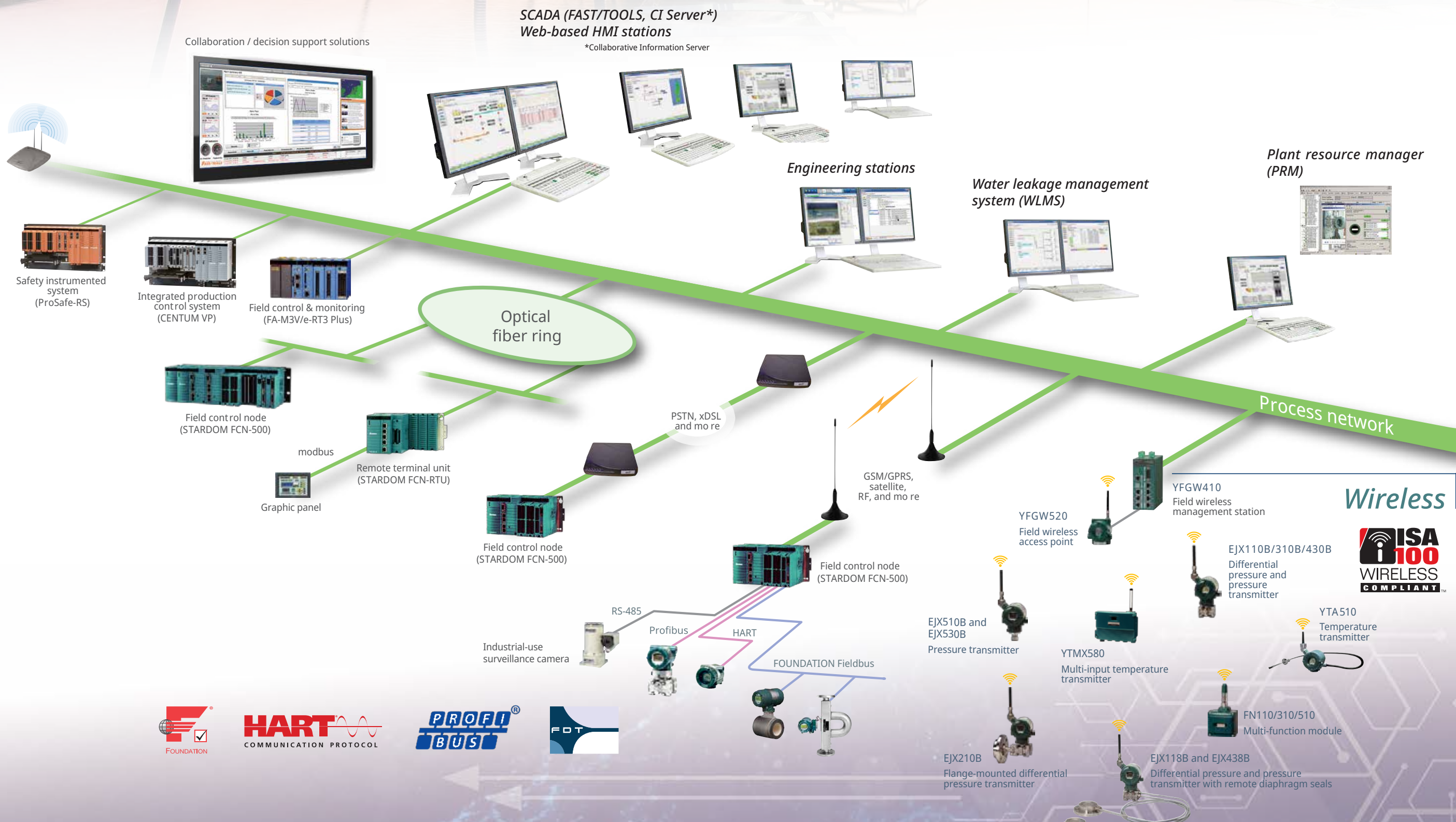


FlowCam

* Please confirm availability in your area with Yokogawa.
** Collaborative Information Server

Dependable & scalable control solution platforms

Yokogawa offers a wide range of control solutions that embody our outstanding technologies, product quality, and application know-how to improve your operation of municipal and industrial water/wastewater plants.



Water intake

- **Raw water quality management**
 - VOC analyzer, trace oil-in water monitoring, UV, conductivity analyzer
 - Turbidity analyzer, pH sensor, alkalinity analyzer
- **Water intake flow control**
- **Activated carbon injection control**

Water treatment

- **Chlorine injection feedforward control**
 - Automatic ammonium nitrogen analyzer

Chemical injection equipment

- Sodium hypochlorite injection control
- Coagulant
- Alkaline agent

- **Coagulation control**

- Turbidity analyzer, pH sensor, alkalinity analyzer, temperature

- **Sedimentation basin water quality control**

- Alkaline agent, pH sensor, residual chlorine analyzer

- **Ozone and activated carbon filtration management**

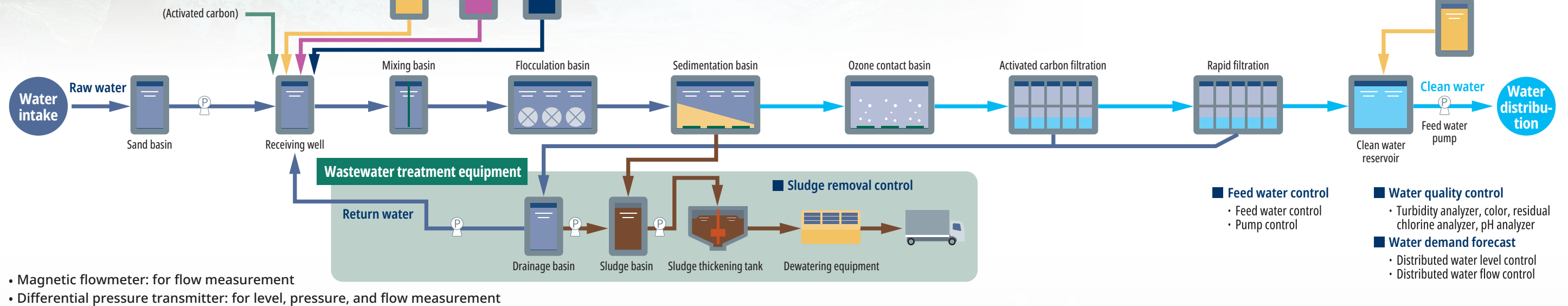
- Dissolved ozone, waste ozone

- **Sand filtration management**

- Turbidity analyzer
- Residual chlorine analyzer

- **Filtrated water flow control**
- **Filtration basin wash control**

- **Chlorine injection control**
 - Residual chlorine analyzer
- **Clean water quality control**
 - Turbidity analyzer, color meter, pH sensor

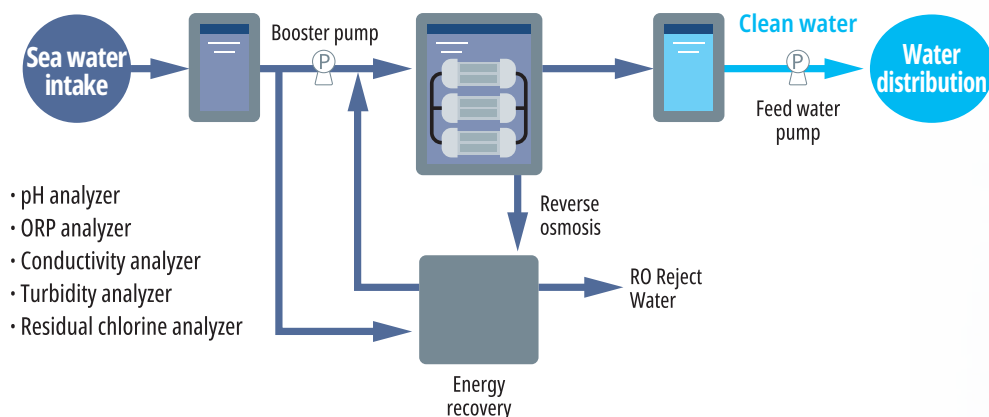


Water treatment plant

Sea Water Reverse Osmosis (SWRO) desalination

- **Sea water intake control**
- **Pretreatment control**

- **SWRO (Sea Water Reverse Osmosis) control**
- **BWRO (Brackish Water Reverse Osmosis) control**
- **Post treatment control**



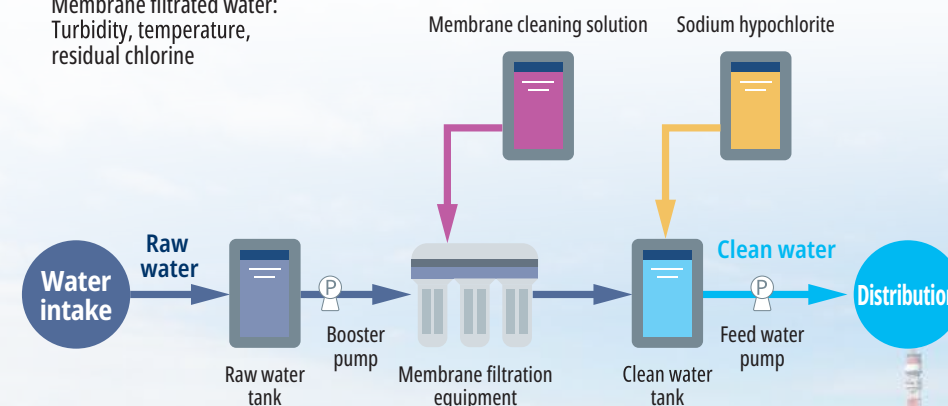
Membrane filtration

- **Water quality control**

- Raw water: Turbidity, temperature, pH
- Membrane filtrated water: Turbidity, temperature, residual chlorine

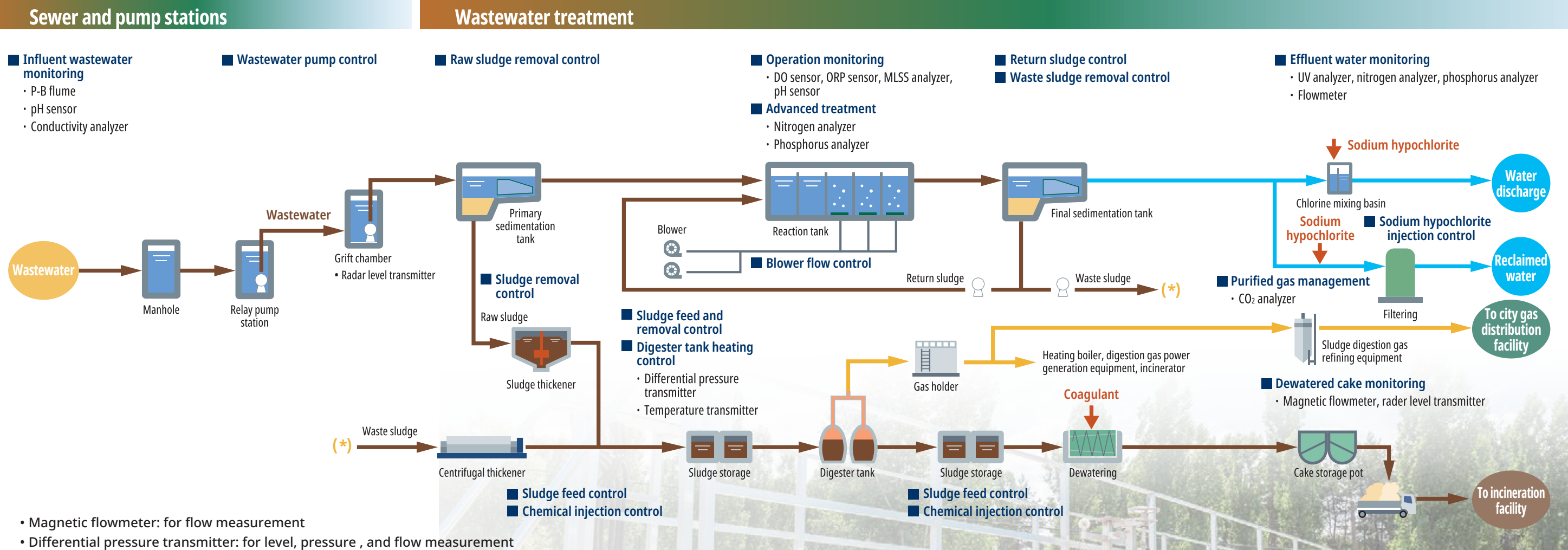
- **Membrane cleaning, chemical injection control**

- Membrane cleaning solution
- Sodium hypochlorite injection control



- **Membrane filtration flux management**
- **Membrane differential pressure management, membrane disruption detection**
 - Primary side membrane pressure, secondary side membrane pressure

Wastewater treatment plant



Sludge treatment



Operation

- Operator training simulator
- Digital twin for predictive suitable operation
- Billing system for SWRO desalination plants
- Remote monitoring
- Water leakage management for water distribution
- Demand forecasting for water treatment plant
- Water quality monitoring
- Leak detection system for pipelines
- Energy saving modeling system for aeration tank at wastewater treatment plants

Disaster prevention

- Tsunami detection
- Water-gate control
- Storm water control
- Flood level monitoring
- Dam level monitoring
- Detection of illicit connections in sewer and stormwater systems



Digital & IIoT solutions and plant security



- Plant asset management
- Vibration analysis of rotating machines
 - Wireless vibration sensor
 - Pump cavitation detection
- Augmented reality (AR) for safe & efficient sitework
- Computerized maintenance management system (CMMS)

Maintenance

- Security assessment
- Security audit
- Security information service
- Antivirus & OS patch improvement
- Malware inactivation service
- Operating system hardening
- Secure network design
- Network health check
- Virus check service
- Backup & recovery

Cyber security



North America

DO Measurement

Project Outline

- Customer: North American Waste Water Plant
- Location: North America
- Application: Dissolved Oxygen Measurement
- Completion: 2022
- Products: Transmitter - FLXA402 4-wire Analyzer or A Modbus host with the use of SENCOM tool Sensor - DO71 or DO72-W

Key Solutions

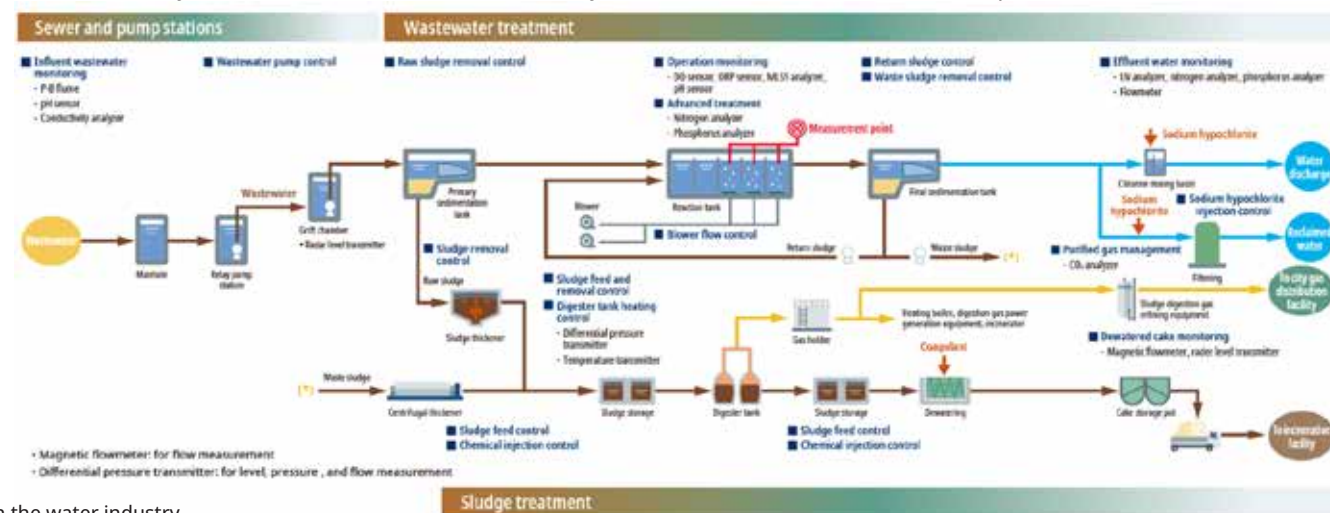
- Continuously measure oxygen dissolved in water with optical measurement method
- Fast response time & good long term stability
- Simple integration, No polarization time
- Available for different oxygen ranges, wide and ultra-trace range oxygen measurements

Executive Summary

Controlling the world's water resources is arguably one of the most critical issues. Water demand from industry and domestic users is set to rise throughout the industrialized world, while water supplies are finite. Legislation constantly demands improvements in potable water quality and reduces the contaminants that may be discharged. Wastewater treatment is one way to get water back. Wastewater is subjected to various treatments in wastewater treatment plants, each intended to remove contaminants and other hazardous substances from the water. The objective is to create water from sewage that is safe to discharge into waterways and won't endanger the environment or human health. Over the last few years, Yokogawa has been applying minimized maintenance measurement systems to an industry that, more than ever, is concerned with condition-based maintenance and the integrity of the measured variable.

Sewage that flows into a treatment plant is sent to a primary sedimentation tank to remove the garbage and sludge. Afterward, it is routed to an aeration tank where activated sludge (sludge containing bacteria, protozoa, and other microorganisms) is added. The air is blown into the mixture to agitate it. The microorganisms in the activated sludge thrive on oxygen, which encourages the growth of the sludge's organic compounds and the precipitation of produced solids. A shortage of dissolved oxygen (DO) will kill the microorganisms, so the aeration tank's DO content needs to be carefully managed. The DO concentration is regularly measured using a DO analyzer.

Yokogawa's DO71 and DO72 optical dissolved oxygen sensors use the optical measurement method to measure oxygen dissolved in water continuously, with a fast response time & long-term stability. These sensors are prone to less maintenance, and the overall cost of ownership is lower. Sensors are available for different oxygen ranges, wide and ultra-trace range oxygen measurements, ideally suited for oxygen monitoring in industrial applications or for W&WW where they must stand harsh measurement conditions. The optical sensor is integrated into an exchangeable stainless-steel cap that is screwed to the probe housing. As a digital interface, they use RS485 and can be connected directly to the FLXA402 4-Wire converter or any other host like a PLC, DCS, or data acquisition unit.



North America

Water Treatment

Project Outline

- Customer: North American Water Treatment Plants
- Location: North America
- Application: Water Quality Monitoring
- Completion: 2022
- Products: Turbidity, Free Chlorine, pH and Conductivity Analyzers (FLXA402T, TB820D, FC800D)

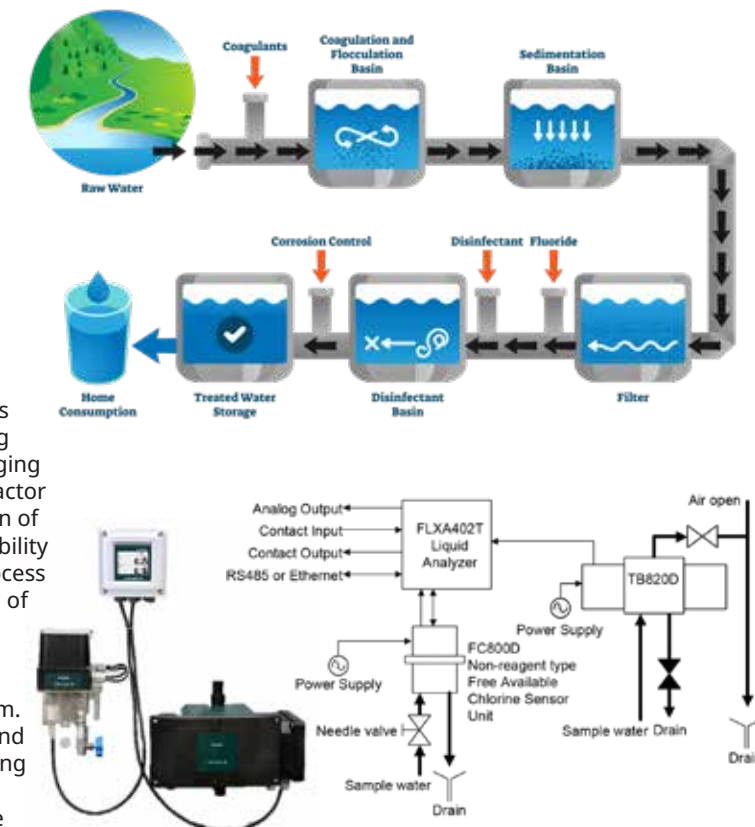
Key Solutions

- Removal of suspended matter and production of clean and colorless water with no disagreeable taste and odor
- Water bacteria content reduced through disinfection
- Reduction of harmful chemicals and corrosive properties and protection of the pipe supply system

Executive Summary

The measurement of turbidity is an important indicator of water quality that will supply valuable information quickly, accurately and continuously. Turbidity can be affected by the presence of microscopic particles such as clay, silt and other fine undissolved matter. These microscopic particles can promote microorganism growth. This growth can harbor pathogens and also inhibit the chlorination process that helps disinfect and maintain purified drinking water in an area – thereby creating potential health hazards. The presence of free chlorine in drinking water indicates whether sufficient amounts of chlorine were added initially to the water to deactivate the bacteria and some of the viruses, thus ensuring that the water is protected from recontamination during storage. Therefore, it is important to measure both for compliance with international regulations and for producing safe and clean drinking water.

One of the main concerns when measuring the turbidity at water treatment plants is the drift of the measurement value caused by dirt build-up. Additionally, the required maintenance costs combined with the number of units within a plant can be high. Hypochlorous acid (HClO), Hypochlorite (ClO-) and Chlorine (Cl₂) are known as "Free Chlorine." The concentration of each of these two forms is determined by the pH of the water it is added to. The hypochlorous acid has the most disinfectant power whereas hypochlorite is much less powerful. As pH determines how much of each of these forms will be present, pH is an important factor in making sure the "free chlorine" is an effective disinfectant.



Yokogawa's Turbidity TB820D and Chlorine FC800D Solution is a low maintenance with advanced diagnostics. The measuring cell structure has been optimized for easy cleaning and changing of parts and total maintenance time has been reduced by a factor of two-thirds. This will not only result in a significant reduction of the maintenance and operating costs, but the increased reliability of the measurement will enable more stable and efficient process control. That, in turn, reduces additional costs such as dosing of chemicals and reduction of unexpected shutdowns.

The FLXA402T is a Multi-Input/Multi-Parameter Analyzer and is part of Yokogawa's SENCOM 4.0 SMART sensor platform. This innovative analyzer platform provides full visualization and enhanced process uptime by optimizing maintenance, reducing configuration time, and simplifying in-field maintenance and calibration, real-time diagnostics as well as efficiency to move data and workloads seamlessly on an ongoing basis.

Indonesia

Water treatment

Project Outline

- Customer: Perusahaan Daerah Air Minum (PDAM)
- Location: Bali, Indonesia
- Application: Water treatment
- Completion: 2013
- Products: SCADA, RTUs, flowmeters, transmitters and analyzers

Key Solutions

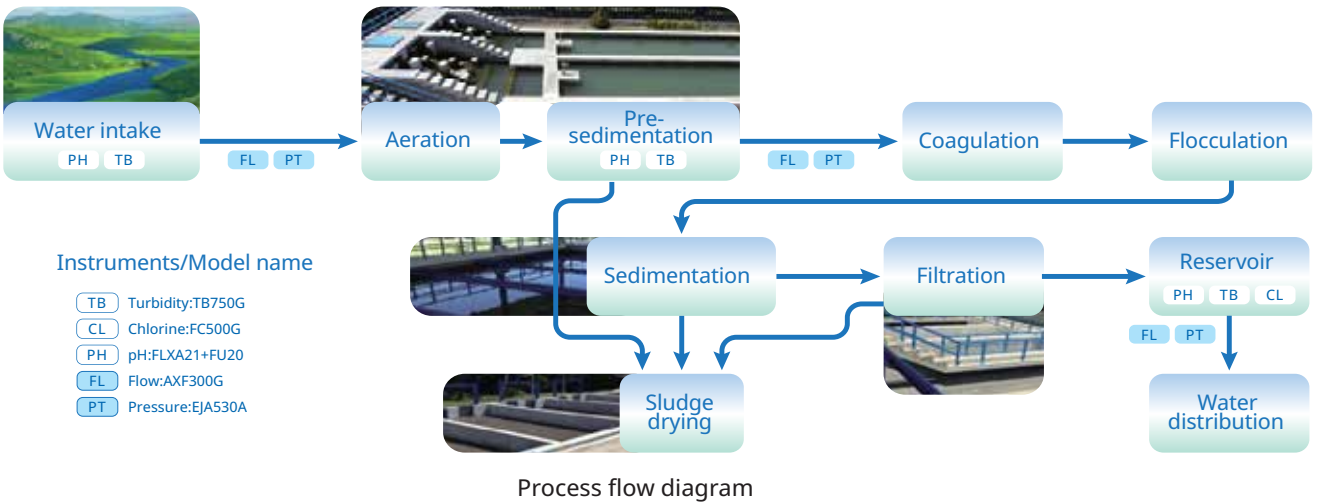
- Centralized operation by SCADA system
- Local engineering support
- Sophisticated operator training

Executive Summary

The new Petanu water treatment plant is designed to produce 300 L/s (25,920 m³/day) of clean water. The plant started operation in September 2013 and its production capacity is being steadily increased.

PDAM and PT. Waskita Karya (Persero) Tbk selected Yokogawa's process automation system as a one-stop solution which includes the FAST/TOOLS SCADA (supervisory control and data acquisition) system, STARDOM™ network-based control system, and various field instruments. To meet urgent demand, Yokogawa Indonesia was asked to deliver the instruments and systems within just three months, and executed the entire project from product supply to engineering, installation, and commissioning as a one-stop solution.

PDAM is familiar with conventional panel operation in their existing water treatment facilities in Bali. However, for the new plant at Petanu, they decided to employ the latest reliable control system to increase the availability and quality of operation and facilitate maintenance and future expansion. Learning the new technologies was a major challenge, but the plant has been supplying safe and clean water to the southwest of Bali since successful start-up in 2013 thanks to the great efforts of both customers and Yokogawa Indonesia.



Singapore

SWRO Desalination

Project Outline

- Customer: YTL PowerSeraya Pte. Limited
- Location: Pulau Seraya Power Station, Singapore
- Application: Seawater Reverse Osmosis Desalination
- Completion: 2007
- Products: SCADA, RTUs, transmitters, flowmeters and analyzers

Key Solutions

- One-stop provider for successful installation on a tight schedule
- Reliable SCADA system for steady power generation and water supply
- Accurate field instruments and analyzers for reducing total cost of ownership

Executive Summary

YTL PowerSeraya's desalination plant converts seawater into potable drinking water and service water for its existing boiler plants and utilities operations, producing up to 10,000 m³ of water per day. All operations are monitored and controlled by an integrated STARDOM and FAST/TOOLS SCADA system.

The first challenge in the YTL PowerSeraya desalination project was a very tight schedule. Yokogawa Engineering Asia was able to meet this challenge from start to finish as a one-stop provider of not only STARDOM controllers and the FAST/TOOLS human machine interface (HMI), but also various field instruments.

Yokogawa also provided comprehensive engineering services, from formulation of the control strategy to installation and commissioning of the integrated system. Approximately 1,400 I/O points were wired in/out at the STARDOM controller panels in the desalination plant's main control room. With this integrated system, all real-time process data can now be monitored from the administration and turbine buildings via a dual redundant fiber optic cable network.

YTL PowerSeraya needs a constant supply of water for its boiler plants in order to generate power steadily 24/7. The quality of this service water is carefully monitored and controlled by Yokogawa conductivity and pH meters. Accurate measurements of the conductivity and pH readings in the sea water reverse osmosis (SWRO) membranes are important for quickly detecting any seawater leakage. This prolongs SWRO membrane life and reduces total cost of ownership. Meanwhile, Yokogawa's magnetic flowmeters help keep costs down by accurately measuring the consumption of many different types of chemicals.

Installed on a very tight schedule, this system has been in operation since September 2007 with no major problems. This highly reliable SCADA system is managed by the O&M staff of YTL PowerSeraya.



Conductivity/pH meters



Magnetic flowmeters



Main control room for field operations

Philippines

Water distribution

Project Outline

- Customer: Metro Cebu Water District
- Location: Cebu, Philippines
- Application: Water distribution
- Completion: 2016
- Products: SCADA, water leakage management software, RTUs, flowmeters and transmitters

Key Solutions

- Real-time monitoring of water networks
- Water leakage management to reduce NRW

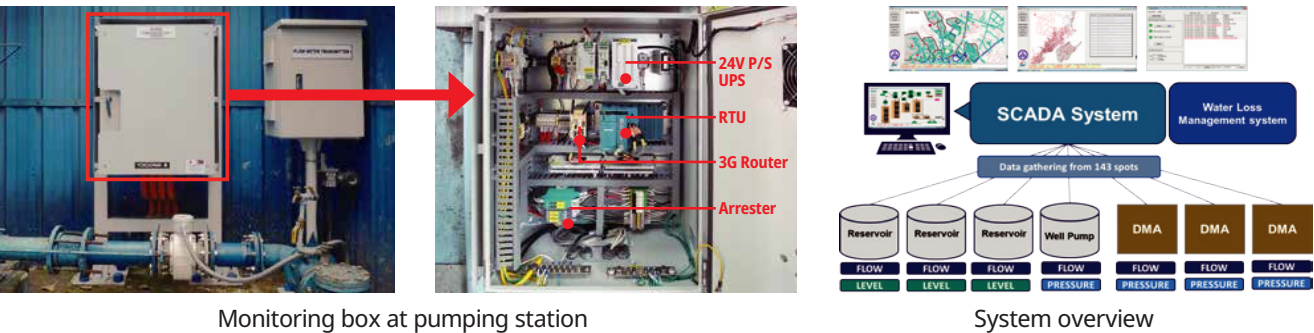
Executive Summary

The Metropolitan Cebu Water District (MCWD), a government body covering a very large water district in Cebu, needed to improve its water supply system to keep up with the growing demand. Accordingly, MCWD decided to construct a water supply monitoring system in a project funded by the Japan International Cooperation Agency.

The project involved installing a Supervisory Control and Data Acquisition (SCADA) system so that operators in MCWD's main office can remotely monitor and control the status of water supply in its service area.

Yokogawa Solution Service Corporation was responsible for engineering the SCADA system, setting up a water leakage management system, and installing flowmeters and other field instruments at 143 locations such as dams, reservoirs, pressure points, water pump stations, and district metered areas (DMA), throughout MCWD's service area.

All monitoring points such as DMAs and pumping stations, as well as pressure points installed with remote terminal units (RTU) for collecting data on flow, pressure, and pump status, transmit the data to MCWD's main office.



Yokogawa's solution visualizes the water distribution network to allow:

- 1) Real-time monitoring of operations of pumping stations to detect shutdown; and
- 2) Water leakage management by monitoring of historical flow and pressure data in each DMA to detect water leakage, analyze the actual pressure points and dispatch staff in order to reduce non-revenue water (NRW).

One effective way to increase the water supply is to reduce NRW, which also boosts revenues for MCWD. The combination of Yokogawa's SCADA system and water leakage management software helped MCWD reduce water losses and increase profit.

New Zealand

Irrigation

Project Outline

- Customer: Rangitata Diversion Race Management Ltd.
- Location: Canterbury Plains, New Zealand
- Application: Irrigation
- Completion: 2018
- Products: SCADA and RTUs

Key Solutions

- Reliable SCADA system under all conditions
- Intuitive web-based HMI for effective maintenance
- Data security in case of network failure

Executive Summary

Rangitata Diversion Race (RDR) Management Ltd. is responsible for the effective operation and maintenance of the Race including environmental management, forecasting, future planning and development.

When the company undertook a major project to improve control and visibility of the gate flows and take-offs on the Rangitata Diversion Race in the late 2000s, they selected Yokogawa New Zealand due to their reputation for quality, active presence on the South Island and ability to minimize total cost of ownership.

The Race comprises over 600 farms and 25 main gates and take-offs, connected via a radio network back to the FAST/TOOLS central monitoring station at Ashburton. Covering 110,000 square hectares, this huge project is prone to extremes of weather. The Race must operate year-round (more for power generation in winter), so all equipment must maintain utmost reliability under all conditions. STARDOM RTUs are renowned for high availability and advanced functionality allowing local web services for in-field activities as well as connectivity back to the FAST/TOOLS operations center for overall performance monitoring. The web HMI client provided by FAST/TOOLS reduced the administrative overhead of maintaining client software within RDR's operations team, with its graphics system providing a modern, intuitive interface.

STARDOM RTUs also proved ideal thanks to their low power consumption and tight integration with FAST/TOOLS for 'store and forward' of data. This complemented the wireless networking approach, providing data security for when the network was unavailable.

As an evolving system that can meet the changing needs of the Rangitata Diversion Race, FAST/TOOLS and STARDOM provides a firm foundation for operations and maintenance.



China

Wastewater treatment

Project Outline

- Customer: Beijing Etechwin Electric Co., Ltd.
- Location: Shuyang County, Jiangsu Province, China
- Application: Wastewater treatment
- Completion: 2018
- Products: DCS and Data Driven Modeling System (DDMO)

Key Solutions

- DDMO to optimize air-blowing rate of aeration tanks
- Interlink between DCS and DDMO to maximize energy saving

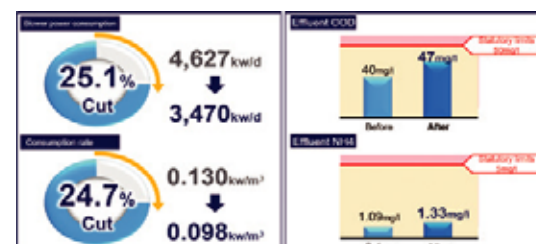
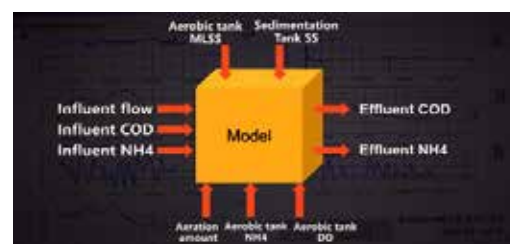
Executive Summary

Yokogawa used its control technology and Data-Driven Modeling for Optimization (DDMO) solution to boost the efficiency of a sewage treatment plant owned by Goldwind Environmental Protection Co., Ltd.

The plant is located in the northeast of Shuyang County, and its Phase I and II facilities treat 79,000 tons of sewage per day. As the plant serves an industrial area, almost the entire influent is industrial wastewater. This imposes a heavy load with large daily fluctuations, making it difficult to treat and hindering operation and maintenance. In addition, the Chinese government recently tightened regulations on effluent discharged from sewage treatment facilities, with severe penalties for violations. To meet the statutory limits, the sewage treatment process must be operated appropriately and stably.

In particular, proper aeration of each reaction tank is crucial because it affects the quality of discharged effluent. The air-blowing rate is usually controlled with a safety margin to ensure that the statutory limits are never exceeded, but this wastes power. As the aeration tanks account for at least 40% of total power consumption, optimizing the power consumed by these tanks will greatly help save energy for the entire plant.

To reduce excessive power consumption, a DCS was added to automatically control the blowers for the reaction tanks as well as the return sludge pumps, digestion liquid circulation pumps and sludge withdrawing pumps, while a DDMO solution estimates the quality of discharged effluent. DDMO performs sophisticated calculations using historical data on water quality and flow as well as the retention time in each process, and then determines the optimum air-blowing rate while maintaining effluent quality within statutory limits. This optimum rate is sent to the DCS, which then sets the air flow control setpoint. As a result, wasted energy at the aeration tanks is minimized; the electric power consumed by the blowers was successfully reduced by 25%.



India

Total system integration

Project Outline

- Customer: Bangalore Water Supply and Sewerage Board
- Location: Bengaluru, India
- Application: Total system integration
- Completion: 2015
- Products: SCADA and RTUs

Key Solutions

- SCADA system integration of the BWSSB water and sewage facilities over VHF and GPRS
- Stable Centralized SCADA Monitoring Center (CSMC) operation

Executive Summary

The Bangalore Water Supply and Sewerage Board (BWSSB) was one of the first water supply and sanitation utilities in India, having been set up in 1964 to meet the water supply and sewage disposal needs of the city covering an area of about 800 sq. km.

To supply clean water and treat sewage water, BWSSB has been developing various treatment facilities such as the new Centralized SCADA Monitoring Center (CSMC) in Bengaluru. This CSMC, partly funded by the Japan International Cooperation Agency, integrates BWSSB's existing water facilities in Bengaluru, allowing them to be monitored in real time.

Yokogawa India Ltd. (YIL) received a turn-key contract from BWSSB. YIL delivered the FAST/TOOLS SCADA system and STARDOM network-based control to CSMC. YIL was responsible for the design, supply, installation, testing, and commissioning, including a seven-year operation and maintenance contract for products delivered by Yokogawa.

The main facilities monitored by CSMC are:

- Water treatment plant/intermediate water pumping stations
- Ground level reservoirs
- Sewage treatment plants
- Intermediate sewage pumping stations
- More than 500 District Metered Area (DMA) data from third parties through an OPC server

To integrate BWSSB's widely dispersed facilities, telecommunication links are mandatory for SCADA. FAST/TOOLS can handle various telecommunication links and protocols, enabling remote facilities to integrate with CSMC over VHF and GPRS, achieving total system integration and data transmission. The total number of configured tags exceeds half a million.

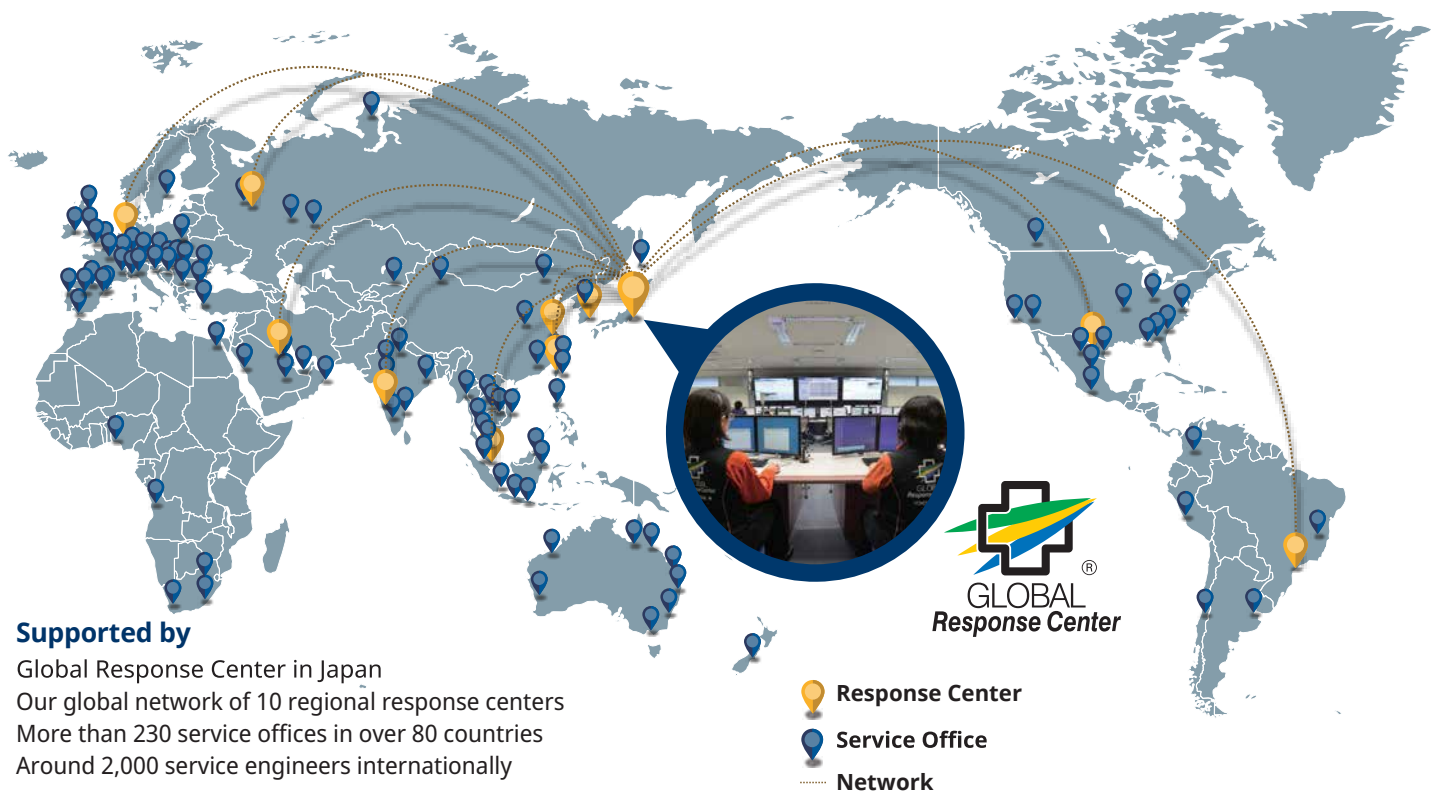
As a key infrastructure for both water and sewage related facilities, CSMC is required to run 24/7 without failing. To ensure stable monitoring, the SCADA servers and communication lines are all redundant. Firewalls protect cybersecurity, an access control system enhances security, and CSMC is monitored by CCTV. In addition to a UPS and battery backup, a diesel generator is on standby in case of power outages. Prompt service and support under the seven-year operation and maintenance contract keep CSMC running stably. With the powerful and stable SCADA system integration, BWSSB can monitor water supply and sewage treatment in Bengaluru in real time.



Antenna tower

Global Service Network

Our comprehensive global service network supports you 24/7.



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