

Water & Environment

1 Electromechanical Equipment DBM at Osaka Municipal Waterworks Bureau's Kuzuha Intake Station

The Osaka Municipal Waterworks Bureau's Kuzuha Intake Station established in 1968 is capable of passing 450,000 m³ of water each day. It intakes raw water from the Yodo River, and after passing it through a settling basin, uses intake pump equipment to transfer it to the Toyono Water Purification Plant 15 km away, which supplies the eastern and central parts of Osaka with tap water.

The time had come to update the intake pump equipment, monitoring and control equipment, and other machinery at the Kuzuha Intake Station, and the need for preparing a private power generator facility as a countermeasure in case of a prolonged power outage was urgent. To this end, the Osaka Municipal Waterworks Bureau decided to simultaneously implement the updates to major electrical systems and machinery, including construction of the private power generator facility and the new building to hold it in an efficient and economic manner using the unified design, build, and maintain (DBM) method. The detailed design and construction of a wide range of electrical systems, machinery, and architecture are now complete, and the facility has entered the operation and maintenance. The business overview and effects are described below.

(1) Project overview

Update of intake pump, electric motor, rotational speed controller, and other intake pump and monitoring and control equipment, construction of architectural structures

for housing private generator equipment to run the facility, and the operation and maintenance of equipment updated and newly constructed as a part of this project

(2) Overview of major equipment specifications

- Intake pump equipment: double suction horizontal shaft single-stage volute pumps (4)

Aperture 1,000 mm (horizontal suction) × 700 mm (horizontal discharge), regulated discharge amount of 125 m³/minute

- Private generators: gas turbine engine, rated output of 3,457 kW or higher (2)

Synchronous generator 3φ3 W 6.6 kV, rated output 4,000 kVA (2)

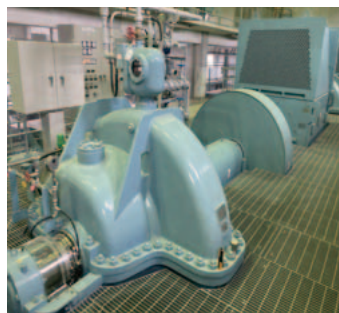
- Monitoring and control equipment: Centralized monitoring and control of Kuzuha Intake Station using a liquid crystal display (LCD) monitoring and control device and controller

(3) Benefits of the DBM method

- The method ensured consistency in the electrical systems, machinery, and housing architecture that were the focus of this project's work, ensuring the construction of a highly reliable system that will operate in a smooth and unified fashion.

- On-site construction was achieved during continuous operation of the intake facility while configuring and arranging the updated equipment with consideration given to the streamlining of updating and removal work.

- Formulation of a concrete operation and maintenance plan starting at the detailed design stage enabled equipment selection and construction that gave consideration to economic efficiency as well as operability and maintainability.



1 Intake pump equipment (left), private generator equipment (center), LCD monitoring and control device (right)

2 Cloud Service for the Water and Sewage Business

—Expansion of New Functions Utilizing AI in a Digital Solution for O&M Support—

In order to respond to a decrease in the number of experienced technicians as well as an increase in the number of natural disasters, the water and sewage industry is faced with the need for innovation that can ensure highly efficient and stable operation and maintenance that are not depending on specific individuals or locations while transferring the know-how of experienced technicians. In response to these needs, Hitachi has strengthened its lineup of data analysis system functions for streamlining operation and maintenance work using artificial intelligence (AI) and analytics in its water and sewage business digital solution cloud service for operation and maintenance (O&M) support. These new functions offer the following major advantages:

- (1) “Equipment state diagnosis function” enables condition-based maintenance (CBM) by collecting the state of pumps, blowers, and other equipment using Internet of Things (IoT) sensors
- (2) “Water quality prediction function” supports the optimization of chemical injection rates and other factors by predicting raw water quality with AI
- (3) “Plant operation support function” predicts future demand and proposes operation plans by using AI to learn operator know-how and decisions

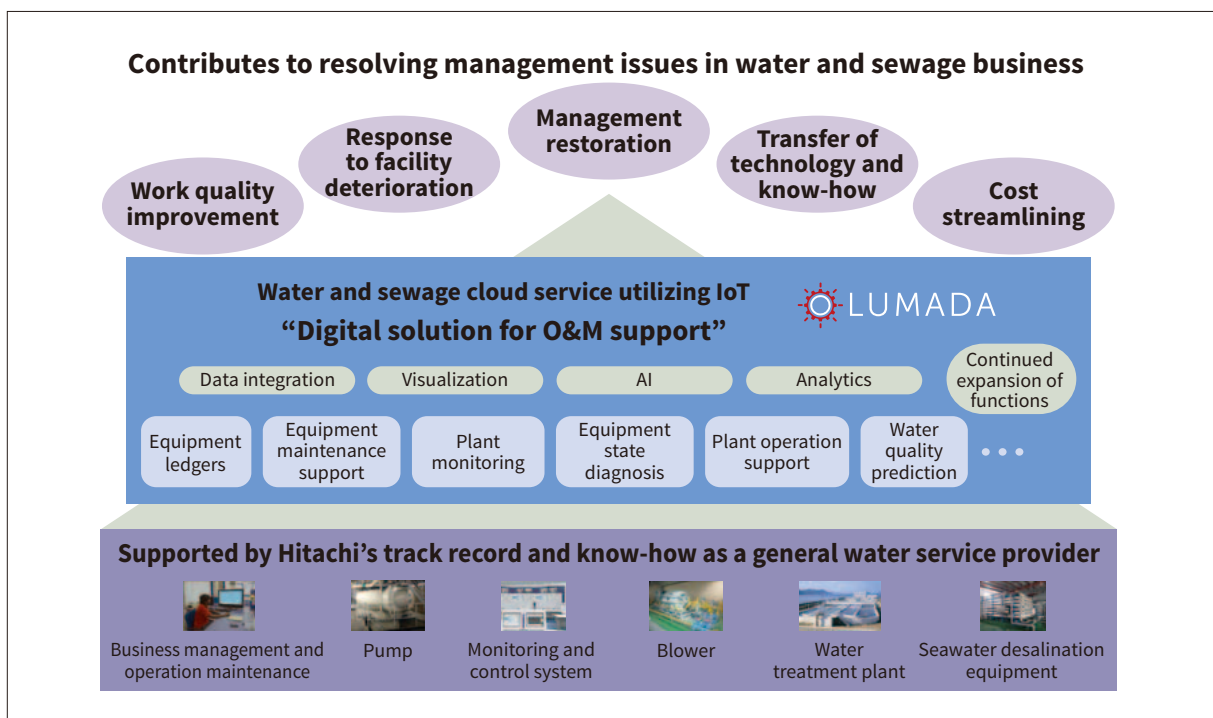
(4) “Data visualization function” calculates and displays indices useful for operation management and maintenance and combines them with summarized monitoring and inspection data in the cloud

3 Sewer Pipe Inspection Solution Using Compact Unmanned Aerial Vehicles



3 Sewer pipe inspection drone

Increasing numbers of domestic sewer pipes last serviced during a period of high economic growth have been deteriorating year after year. Although sewer pipes have been inspected using workers or vehicular robots in the past, some sewer pipes are in high-risk environments and



2 Conceptual diagram of digital solution for O&M support

have been difficult to inspect. To overcome this challenge, Hitachi has been developing a sewer pipe inspection solution using compact unmanned aerial vehicles (drones).

The main technological advantages, two of which Hitachi developed together with the Tokyo Metropolitan Sewerage Service Corporation, are (1) drones that can fly and shoot images while maintaining a constant distance from the wall and ceiling surfaces of the sewer pipes, and (2) a device that can insert and retrieve the drone from the surface. (3) An image processing technology that can improve image quality by correcting for blurriness in images shot by a drone flying at high speed, was developed by Hitachi on its own.

Workers no longer need to enter manholes to conduct inspections, and can instead simply control a drone in order to visually monitor the insides of a sewer pipe while observing the footage shot by the drone's forward camera. Also, since the drone can be flown at high speed, this makes it possible to conduct inspections more efficiently over a long distance. These technologies will continue contributing to the realization of safer and more efficient sewer pipe inspection work.

4 Technology to Reduce the Risk of Automatic Bar Screen Shutdowns in Pumping Station while Improving Operation and Maintenance

As sudden, short-duration rainstorms have grown more frequent and intense in recent years, the need for pumping station equipment that can operate in a stable fashion without stopping has grown increasingly urgent. However, the automatic bar screens that remove the trash and other objects that also flow into a pumping station often suffer

from a problem whereby sediment that flows in with the rainwater interferes with the rake's operation as it piles up before the automatic bar screen, leading to emergency shutdowns.

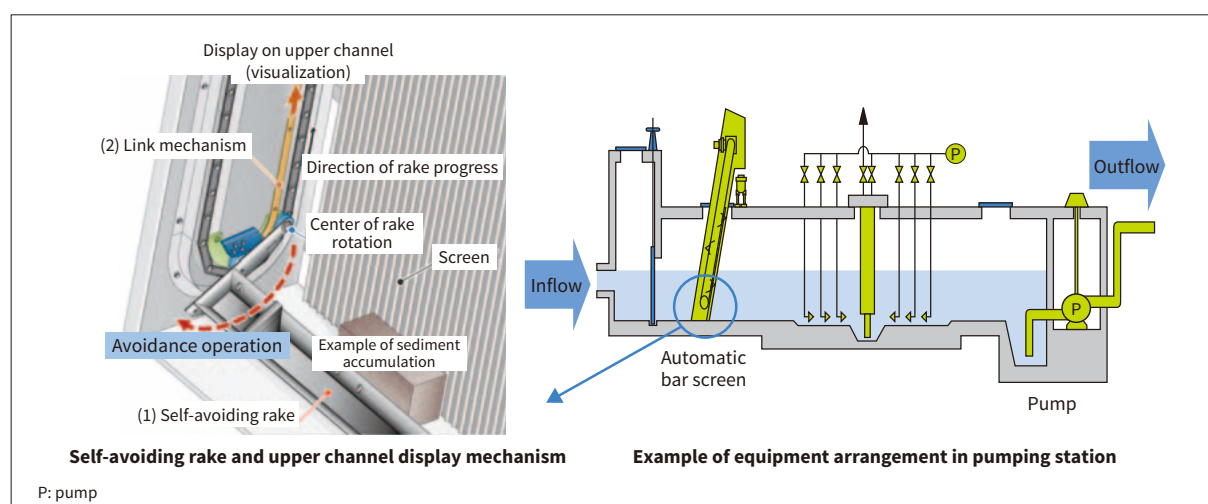
Also, when it comes to operation and maintenance as well, since a pumping station's channel is usually covered by water, it is not possible to visually confirm how much sediment is piled up on the channel. In the past, this would necessitate a great deal of confirmation work entailing draining all of the water on the channel on a day with fair weather.

As a solution to these problems, Hitachi devised an improvement that can enable the stable and continuous operation of the automatic bar screen through the application of a self-avoiding rake with an oscillation mechanism that automatically avoids piled up sediment. Furthermore, the rake's avoidance operation is shown on a display above the channel using a link mechanism, thereby achieving visualization of whether or not sediment has accumulated.

Hitachi will continue proposing the use of this technology at pumping stations, both as a flooding countermeasure as well as a way to improve operation and maintenance. (Hitachi Plant Services Co., Ltd.)

5 Mixed Combustion Engine Generator Using Hydrogen and Biofuel and Applications for Utilization

As social conditions surrounding global warming countermeasures include global initiatives such as Renewable Energy 100% (RE100) and Sustainable Development Goals (SDGs), Hitachi has also announced a goal of reducing CO₂ emissions. At the same time, the company



4 Technology to reduce risk of automatic bar screen shutdowns in rainwater pumping station while improving operation and maintenance



5 Hydrogen mixed fuel generator

is working to contribute to improvements in customer value by providing companies seeking to reduce CO₂ emissions with products and technologies that can save energy while supporting a shift to carbon neutrality.

Power generation using mixed fuel that combines hydrogen with biofuel offers the following advantages in an engine generator supplying carbon-neutral power:

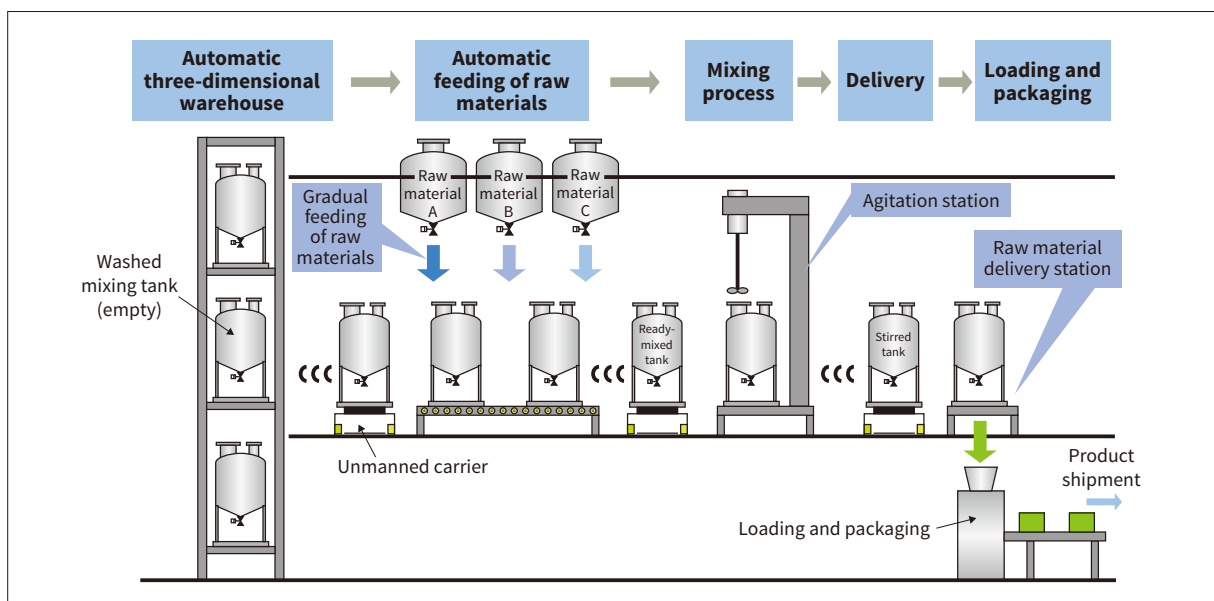
- (1) Does not require hydrogen as highly purified as in a fuel cell
- (2) Can generate power using only biofuel when there is a shortage of hydrogen
- (3) Biofuel component is also carbon-neutral, and power systems can be interconnected

This type of generator can also be used for time-shifting industrial and other surplus power with hydrogen on holidays and other days when the private photovoltaic power facilities of factories are not active.

6 Pipeless System for Food

As consumer needs grow increasingly diverse, Hitachi is working to develop production plants specializing in small quantity, large variety production for the food and chemical industries. Unlike the traditional fixed-piping method (fixed-piping method), the pipeless system uses compact moving tanks, and by producing while transferring multiple tanks at the same time, it can shorten the time required to switch between products while enabling the efficient and simultaneous production of a large number of product types. It also offers the advantage of easy expansion of equipment through the addition of movable tanks. Furthermore, in this pipeless system, the movable tanks attach to and detach from each station's function (delivery, agitation) automatically, making it possible to automate production (making production unmanned), either fully or partially, by combining it with compact, low-floor unmanned carriers.

Hitachi plans to provide customers with high-quality equipment that can provide peace of mind by using a simulator developed in-house to conduct productivity evaluations for customers considering installing equipment, based on the customer's manufacturing information (production process, lead time of each process, production volume, numbers of types of products, etc.). (Hitachi Plant Services Co., Ltd.)



6 Block diagram of pipeless system for food