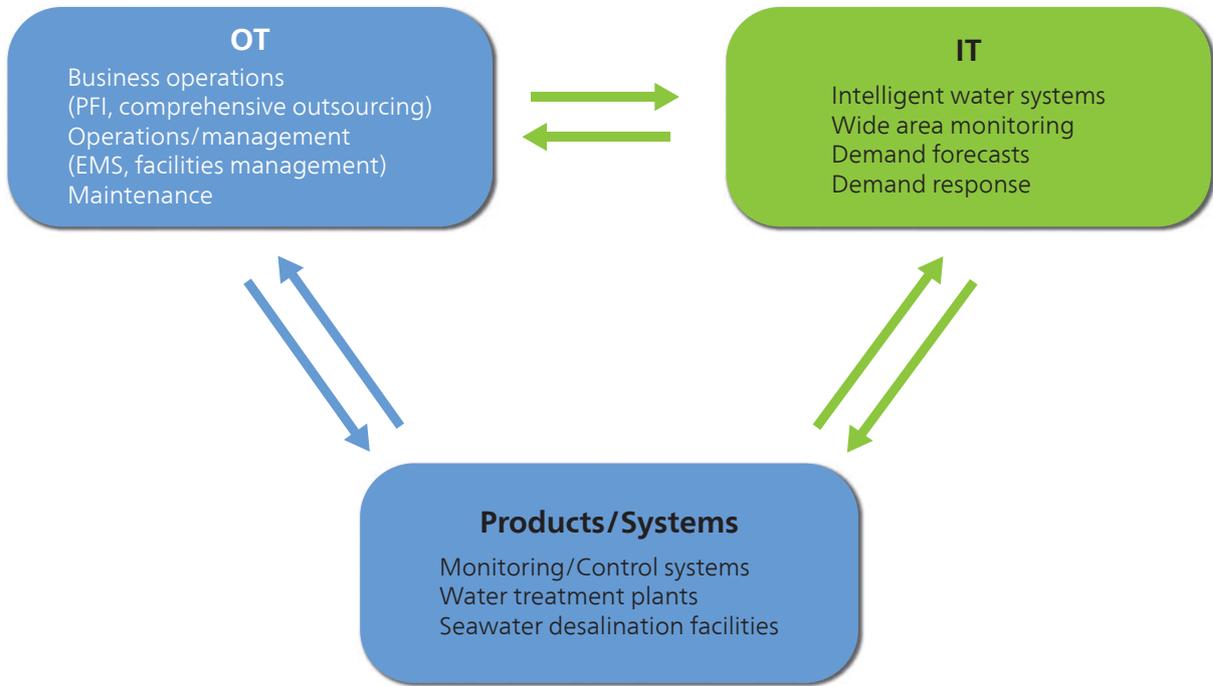


Water



PFI: private finance initiative, EMS: energy management system

1 Water environment solutions and services that leverage IT and the strengths of existing businesses

1 Outlook of Water Environment Solutions Technology

The Hitachi Group has been involved in the development of technologies that support the water environment for almost a century. We currently provide products, systems, and services in a wide range of fields including water resource preservation, flood control, water supply and sewage development, waste water treatment, and the reclamation and recycling of water. On the other hand, the Hitachi Group also proposes holistic solutions to issues concerning the water environment, and aims to provide new solutions and services that leverage IT and the strengths of existing businesses.

In the water environment solutions field, across-the-board optimization achieved through the linkage of products such as monitoring and control systems and water treatment plants with operational technology (OT) and IT is essential. Through collaboration over various technologies, Hitachi will continue linking innovations in water treatment and water supply management with other infrastructure such as electric power, thus ensuring the safety and security of the entire

social infrastructure and contributing to its optimization and sustainable development.

2 Central Monitoring and Control System for Yoshiba Purification Plant at Kuki City Waterworks and Sewage Department

Since starting operation in 1973, the Kuki City



2 Central monitoring and control system for Yoshiba Purification Plant at Kuki City Waterworks and Sewage Department

Waterworks and Sewage Department's Yoshiba Purification Plant (Saitama Prefecture), which draws water from the intake facilities of Saitama Prefecture and its own intake facilities, has been a key purification plant supplying 24,000 m³ of water every day, which accounts for approximately 45% of Kuki City's total water supply.

The monitoring and control system for these plants and facilities remotely monitors and operates Yoshiba Purification Plant, which is a manned facility, as well as the unmanned facilities of Honcho Purification Plant, seven intake facilities, and five water quality terminal stations. Hitachi recently delivered a liquid crystal display (LCD) monitoring and control console as part of the updating of the monitoring and control system delivered in 1998. The main features are as follows.

- (1) High reliability achieved through the adoption of a client/server architecture for the monitoring and control system and server duplexing.
- (2) Improved reliability through adoption of full-duplex Ethernet as the control local area network (LAN).
- (3) Improved reliability through direct connection of remote monitoring telemeters to the control LAN.

3 Central Monitoring and Control System for Nikko River Upstream Purification Center at Ichinomiya Construction Office, Aichi Prefecture

The Nikko River Upstream Purification Center (Aichi Prefecture) treats 52,500 m³ of sewage each day* from the Nikko River upstream treatment zone consisting of Ichinomiya City and Inazawa City. Hitachi recently upgraded the aging monitoring and control facilities to enable monitoring and control of all water treatment facilities and the sterilizing and discharge facilities.

The main features are as follows.

- (1) Improved reliability through the adoption of a client/server architecture and server duplexing.
- (2) High speed communication of large volumes of data



3 Central monitoring and control system for Nikko River Upstream Purification Center at Ichinomiya Construction Office, Aichi Prefecture

achieved through connection of the controller to the gigabit control LAN.

- (3) Removal of console with mini graphic panel and replacement with LCD monitoring device.

* Treatment capacity as of April 1, 2015.

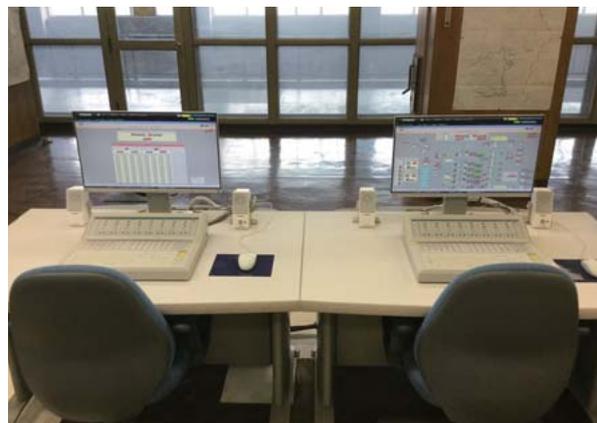
4 Monitoring and Control System for Joto Distribution Plant at Osaka Municipal Waterworks Bureau

Osaka City Waterworks Bureau's Joto Distribution Plant went into operation in July 1968 as the distribution plant of Toyono Purification Plant and it supplies water to the central and east areas of Osaka. Joto Distribution Plant uses gravity to distribute the water sent from Toyono Purification Plant downstream and it also stores surplus water in a distribution reservoir at night. In daytime when usage increases, the distribution center uses a booster pump to distribute the water and it also distributes the water from the distribution reservoir using a peak pump.

Hitachi recently delivered a monitoring and control system as part of the upgrading of monitoring and control facilities to increase reliability and optimize water supply management.

The main features are as follows.

- (1) Improved reliability through the adoption of a client/server architecture and server duplexing.
- (2) Improved reliability through adoption of a configuration consisting of a main system (duplex) and a backup system (single) for the controller that automatically controls the distribution pump, etc.
- (3) Optimization of management of water supply from Toyono Purification Plant based on data showing estimated rate of inflow to distribution reservoir sent from Kunijima Purification Plant's comprehensive water supply management system to this system.



4 Monitoring office for Joto Distribution Plant at Osaka Municipal Waterworks Bureau



5 Monitoring and control system for Nuta River Purification Center, Hiroshima Prefecture

5 Monitoring and Control System for Nuta River Purification Center, Hiroshima Prefecture

The Nuta River Purification Center (Hiroshima Prefecture) treats 23,800 m³ of sewage* each day from the Nuta River treatment zone, which consists of Mihara City and Higashihiroshima City. Recently Hitachi upgraded the center's aging monitoring and control system to enable monitoring and control of all water treatment facilities and sludge treatment facilities.

The main features are as follows.

- (1) Adoption of a client/server architecture using web functions.
- (2) Improvement of network reliability through the

adoption of an optical cable LAN (duplex) as the control LAN and the use of a dedicated optical duplex ring between controllers.

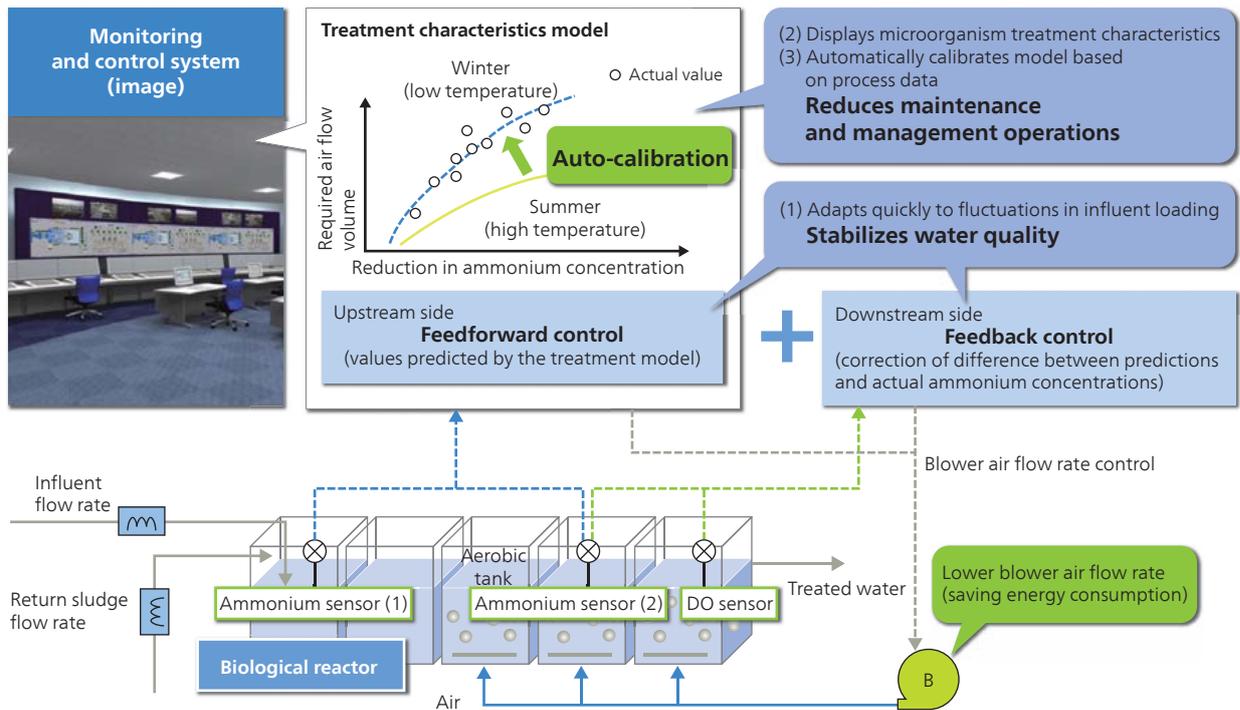
(3) Improvement in the efficiency of handover between nightshift and dayshift managers through a posting function that shows when equipment is undergoing inspection or undergoing maintenance and a bulletin board function for leaving messages for the person taking over.

(4) Provision of an open system enabling users to make online changes to message titles, list of bulletins, list of failures, with or without a record and failure category.

* Treatment capacity as of the end of FY2014.

6 Efficient Nitrification Control System with ICT and Publication of Guidelines for B-DASH Project

For two years since FY2015, Ibaraki Prefecture and Hitachi has undertaken full-scale demonstration into "Demonstration of Efficient Nitrification Control with ICT," under contract to the National Institute for Land and Infrastructure Management (NILIM) of the Ministry of Land, Infrastructure, Transport and Tourism as part of that ministry's Breakthrough by Dynamic Approach in Sewage High Technology (B-DASH) Project. The demonstrated nitrification control system has a function for controlling blower air flow rate to quickly adapt to fluctuations in influent



B: blower

6 Nitrification control system demonstrated in B-DASH Project

loading, a function for displaying treatment characteristics, and an auto-calibration function for the blower air flow calculation model, and it is designed to stabilize water quality, lower blower air flow rate (lower electric power consumption) and reduce maintenance and management operations.

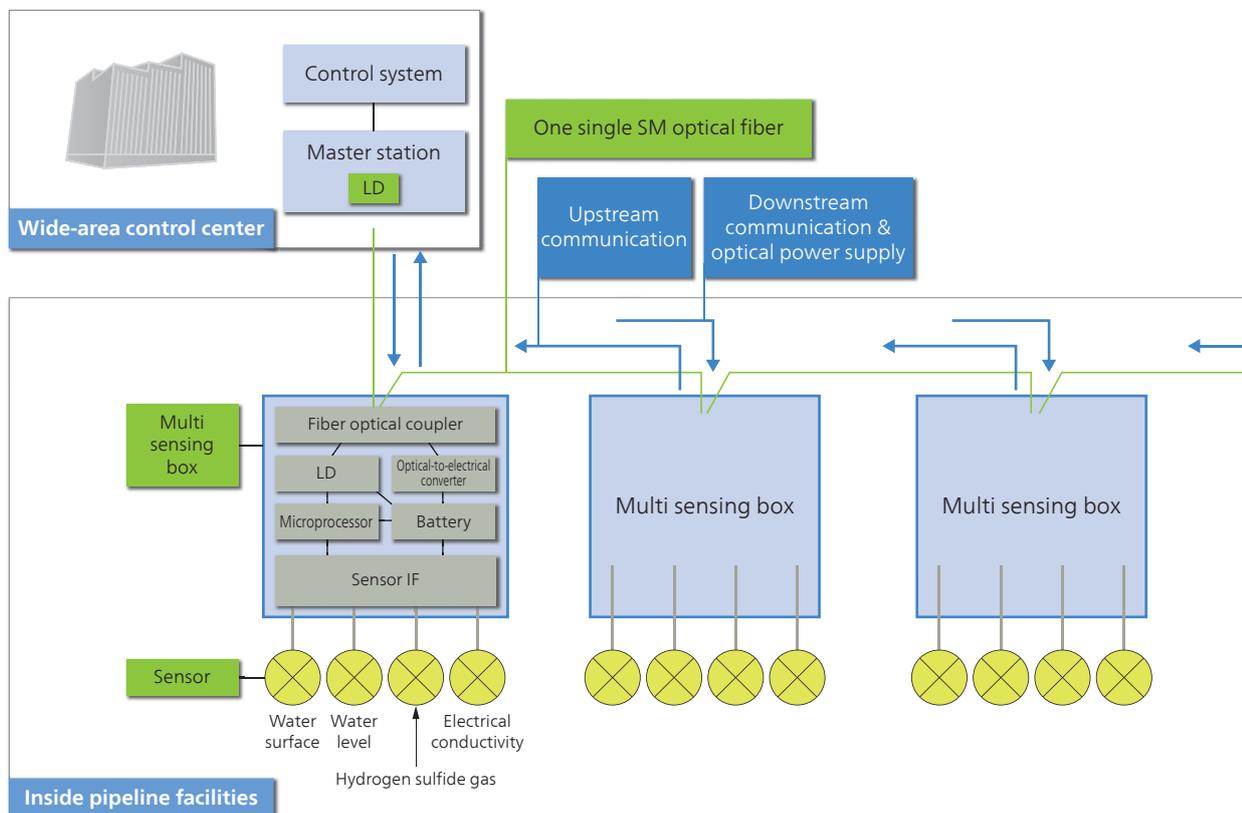
In the demonstration conducted at the Kasumigaura Wastewater Treatment Plant in Ibaraki Prefecture in FY2015, over a total of 98 days of operation, the system reduced the blower air flow rate by 17% compared to constant control of dissolved oxygen (DO), while maintaining an average treated water ammonium concentration of 0.3 mg-N/L (less than the target average of 1.0 mg-N/L). Following approval of the demonstration results by the evaluation committee, Hitachi and Ibaraki Prefecture then ended the demonstration. Moreover, guidelines for introducing the technology in sewage works summarizing the conditions for application of the system and procedures for estimation of introduction, etc. based on the demonstration results were published by NILIM in December 2016.

those engaged in the maintenance of the infrastructure are decreasing. Thus, much more efficient maintenance and management based on an understanding of the actual status of facilities is required. Information about the level and quality of water and concentration of hydrogen sulphide gas in sewer lines is especially useful for maintenance and management. However, sewer lines have no power source and are difficult to inspect and it has always been difficult to measure such information on an ongoing basis.

To address these issues, Hitachi developed a new sensing system using optical fiber in collaboration with Tokyo Metropolitan Sewerage Service Corporation and Japan Sewer Optical Fiber Technological Association. This technology uses just one strand of single-mode optical fiber to deliver optical energy to a multi sensing box several kilometers away and also enables bidirectional communication. It is also possible to connect different types of sensors to the fiber via multi sensing box. The system also has a self-diagnosis function based on the assumption that maintenance will be difficult in sewer pipes. By the remote sensing of the sewer pipe environment by the sensors connected to the multi sensing box, the system will contribute to solving maintenance and management-related problems including infiltration and inflow, combined sewer overflows and deterioration of pipes.

7 Optical Fiber Multi-sensing System

In spite of the aging infrastructure of the sewer system,



LD: laser diode, SM: single mode, IF: interface

7 Optical fiber sensing system

8 Entry to Water Landscape Business

Hitachi Aqua-Tech Engineering, Pte. Ltd. (HAQT) has been supplying seawater desalination reverse osmosis (RO) membrane systems to resort hotels, local authorities and engineering companies. It has now entered into the business of providing water landscape facilities that complements the current desalination systems business so as to expand opportunities for receiving orders from resort hotels and commercial facilities and to further strengthen competitiveness.

In April 2016, HAQT merged with Aqua Works & Engineering Pte. Ltd, which is mainly involved in the supply of water landscape facilities. HAQT now provides a one-stop solution offering products such as pool filter systems, underwater lighting equipment, fountains and water play equipment. Its services also encompass feature and landscape design, supply and maintenance. In the future, HAQT will use its network of customers to expand the water landscape business in the Maldives and other Asian countries, aiming to expand business not only as a simple water treatment provider but also as a systems integrator using water to enrich lives.



8 Example of delivery of fountain facilities (top) and example of delivery of pool facilities (bottom)