

Practical Use of a Remote Support Center for Waste Incineration Facilities

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Abstract

In June 2016, our remote support center for waste incineration facilities was established in Fujisawa City, Kanagawa Prefecture, and started real-time remote support services. The remote support center is intended to remotely monitor the on-site operation data, operational status and local situations through industrial television (ITV) images of each facility so that each facility can be operated stably. We are aiming to optimize plant operation and maintenance plan by data analysis. This paper presents an overview of the remote support center, and its structure, functions, operational performance for the past year or so, and outlook for the future.

Keywords: Waste incineration facility, Remote, Support, ITV, DBO, LCC, VPN, IoT, Optimization

1. Introduction

Recently, there has been an increase in package contracts, such as DBO (Design Building Operation), for the operation of waste incineration facilities. This requires greater responsibility from contractors, namely plant manufacturers and maintenance service companies, and they must offer more advanced facility control with an eye toward long-term operation. To meet this demand, each plant manufacturer is committed to remote support services for operation control from the head office.

Ebara Environmental Plant Co., Ltd. began remote support in 1993, but could not yet provide full support because a sufficient communication zone could not be secured and there were restrictions on the processing speed, band rate, and communication capacity of computers. In June 2016, we opened a Remote Support Center in Fujisawa City, Kanagawa Prefecture, and began real-time remote support services. The Remote Support Center aims to support the stable operation of each facility through remote monitoring of the on-site

operating state, data, and ITV (Industrial Television) images, and simultaneously improve efficiency using data analysis. It ensures smooth long-term operation and maintenance and provides high-quality operation services. This paper describes the operation of the Remote Support Center.

2. Overview

An overview of the Remote Support Center is shown in **Table 1**, and a conceptual diagram is shown in **Figure 1**.

Ebara's remote support system consists of the Remote Support Center (Fujisawa), the Haneda Remote Support

Table 1 Overview of Remote Support Center

| Item | Details |
|--------------------------|--|
| Location of installation | Remote Support Center (location: Fujisawa City) 1st floor: Office, meeting room 2nd floor: Remote Support Office, Visitor's Hall, On-call Room Haneda Remote Support Office (planned to open at the end of December 2017) |
| Network | High-speed internet VPN |
| Large-size monitor | 70-inch monitor |
| PC | DCS client PC ITV screen PC Operation assisting client PC Data server PC Software development PC |
| Start of operation | June 2016 |

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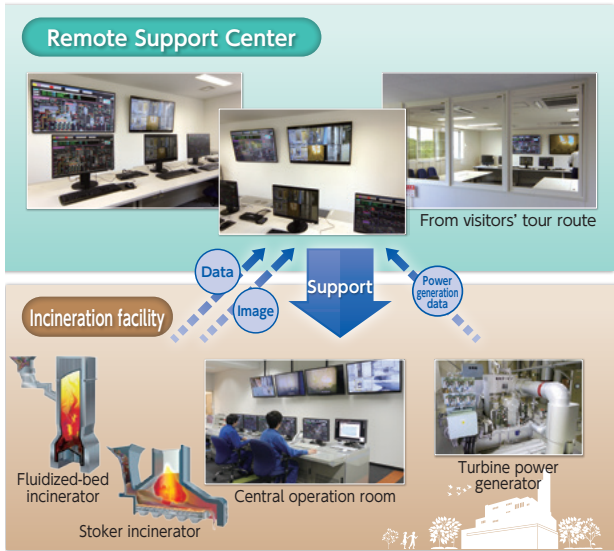


Fig. 1 Conceptual diagram

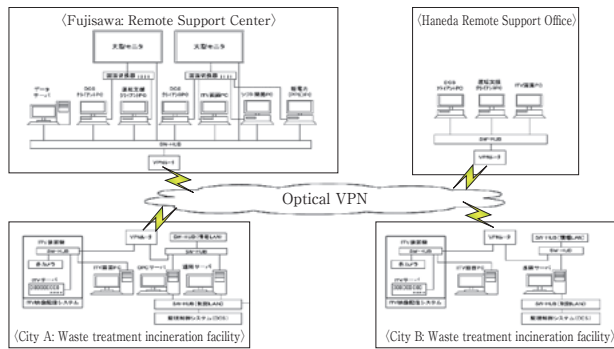


Fig. 2 System configuration diagram

Office (planned to open at the end of December 2017), and each plant facility. A server is prepared for each function to distribute the load. Data on each plant facility is regularly transferred to the Remote Support Center, where it is stored. The network uses an optical line-based high-speed internet VPN (Virtual Private Network) to prevent connection to external internet networks in consideration of cyber-security countermeasures. The system configuration is shown in **Figure 2**.

2.1 Sharing of duties

The Remote Support Center (Fujisawa) is under the management of the field service department and provides support for the appropriate waste incineration operation of each plant facility. The Haneda Remote Support Office will help the design engineers of each facility cope with problems attributable to design. Duties related to operation control are clearly shared between

Table 2 Overview of data servers

| Server | | Overview |
|-----------------------|---------------|---|
| Remote Support Center | Data server | Server that can automatically collect DCS data and ITV image data on each plant facility and store it for a long period (several years). |
| | Remote server | Server for displaying on the DCS client PC the same screens as those of the DCS of each waste incineration facility. |
| Each plant facility | OPC server | Server that stores operation data, warnings, operation history data, etc. on the DCS for a long period and is accessible from the Remote Support Center to transmit data. |
| | ITV server | Server that stores important images of the plant facility. These images can be accessed and viewed from the Remote Support Center. |

the management and design departments so that the remote support system can provide effective and efficient support.

2.2 Server function of each plant facility

There are three servers at each plant facility for distributed management. An overview of the servers is shown in **Table 2**.

3. Functions

In FY2016, we did not remotely operate plant facilities, but monitored the operating state of each plant facility, analyzed data, and advanced proposals to improve operation and control. Remote support was provided only in the daytime (for eight hour periods).

Remote operation of incinerators began in FY2017. The Remote Support Center will remotely collect data and identify issues concerning remotely operated incinerators. The Remote Support Center will be able to provide 24-hour support and further expand services. The relationship between the Remote Support Center and each plant facility is shown in **Figure 3**, and the current functions of the Remote Support Center

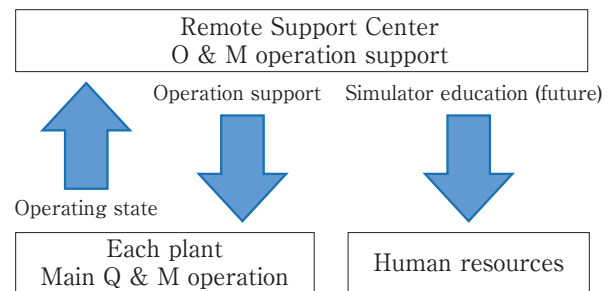


Fig. 3 Relationship between the Remote Support Center and each plant facility

are described below.

3.1 Remote technology support functions

3.1.1 Remote monitoring function

At the Remote Support Center, they can display the same screens (plant flow display, trend chart, measured values, warning list, etc.) as those of the DCS (Distributed Control System), enabling the center to monitor the condition of each plant facility, including the temperature, pressure, flow rate, and each unit's operating state.

The combustion state and respective units can also be checked in real time with ITV images. Using the DCS screens and ITV images in combination makes it possible to provide accurate operation support remotely based on multifaceted information. Multiple terminals are installed in the Remote Support Center, and up to two can be allocated randomly to each plant facility, ensuring concurrent remote monitoring of multiple plant facilities.

3.1.2 ITV monitoring function

As described earlier, the ITV monitoring function displays ITV images of each plant facility in real time. ITV images of each plant facility accumulate as image data and are used to analyze the past operating state of the plant facility.

In consideration of the expansion of support to remote support using ICT (Information and Communication

Technology) devices with more sophisticated functionality, the system is configured to display and store images from wearable cameras and other devices operators will wear in the future.

3.1.3 Data storage functions

The Remote Support Center's data servers regularly receive a variety of event data from each plant facility and store it. The event data includes form data (daily, monthly, and annual reports), warning data, operation history, trend data (one-minute intervals), and current value data. An overview of the data storage functions is shown in **Table 3**.

3.2 Improvement of operation quality

3.2.1 Prevention of problems

At each plant facility, when a limited number of operators are monitoring the operation of the plant facility at night, sometimes only one operator will stay in the central control room and is apt to overlook abnormal values, warnings, etc. or mistaken operation.

At present, the Remote Support Center regularly keeps track of the current state of each plant facility, analyzes and evaluates data, and provides support. It is expected that abnormalities and unusual phenomena will be detected early through real-time remote support for each plant facility, thereby preventing problems in the future.

3.2.2 Optimization of operation

Based on the collected data, the Remote Support Center assists plant facilities in improving operation with the aim of reducing environmental burdens, utility expenses, and LCC (Life Cycle Cost) and realizing energy-saving operation. We will maximize boiler efficiency and power generation efficiency through appropriate operation according to the quality of waste and minimize the consumption of chemicals while complying with the exhaust gas standard.

It will also aim to realize more sophisticated operation control and the optimization of combustion control by analyzing big data on operation and equipment functioning and making use of cutting-edge ICT.

3.2.3 Optimization of warnings

In operation support, it's important to have warnings that inform operators of abnormalities with plant facilities. However, if there are frequent warnings with a

Table 3 Overview of data storage function

| Overview of function | |
|----------------------------|---|
| Form data storage | This function imports form data for customers stored in the server of each plant facility into the Remote Support Center and automatically stores the data. The day's data can also be transmitted from each plant facility to the Remote Support Center as needed. |
| Warning data storage | This function imports the warning format (CSV file format) stored in the server of each plant facility into the Remote Support Center and automatically stores the data. |
| Operation history storage | This function imports the operation history format (CSV file format) stored in the server of each plant facility into the Remote Support Center and automatically stores the data. |
| Trend data storage | This function converts the trend data stored in the server of each plant facility into CSV file format and transmits it at the request of the Remote Support Center. |
| Current value data storage | This function imports the current value data (digital signals (operation signals etc.) and analog signals (temperature, pressure, etc.)) stored in the server of each plant facility and stores the data at the request of the Remote Support Center. |

low degree of importance or criticality, operators may be more likely to disregard these warnings, causing the risk of taking serious abnormalities lightly. To prevent this, we work to analyze and organize warnings and actual phenomena and improve the quality of operation control.

3.2.4 Optimization of ACC (Auto Combustion Control)

Since before remote support was introduced, the field service department and design department cooperatively have been improving the function of the ACC, which controls the combustion of incinerators and also prepared an operation standard for the ACC. In verifying the function and effect of remote support, it was confirmed that the plant facilities that had introduced remote support and were in a position to easily evaluate the results and effects of this commitment had successfully standardized incinerator operation and improved the performance of the ACC as expected. We will introduce this achievement to other plant facilities.

3.2.5 Application of improvement of operation quality to other plant facilities

To improve the quality of operation of other facilities, we will work on horizontal expansion of achievements obtained from the optimization of operation conditions according to the quality of waste, which were improved through remote support.

3.3 Optimization of maintenance plans making use of the IoT (Internet of Things)

We will cooperate with Ebara Corporation to provide important components (pumps and fans) with sensors to analyze the operating state of each component and plant process data and conduct failure prediction and diagnosis for the purpose of assisting plant facilities in developing a maintenance plan that will contribute to safe operation and the minimization of the LCC. In the future, we will consider using AI (Artificial Intelligence) technology etc. and pursue the optimization of the maintenance and renewal of each component based on a remaining life assessment.

3.4 Operation support for plant facilities as power generation plants

Waste incineration facilities with high-efficiency power generation equipment operate as power generation plants according to the planned value balancing system

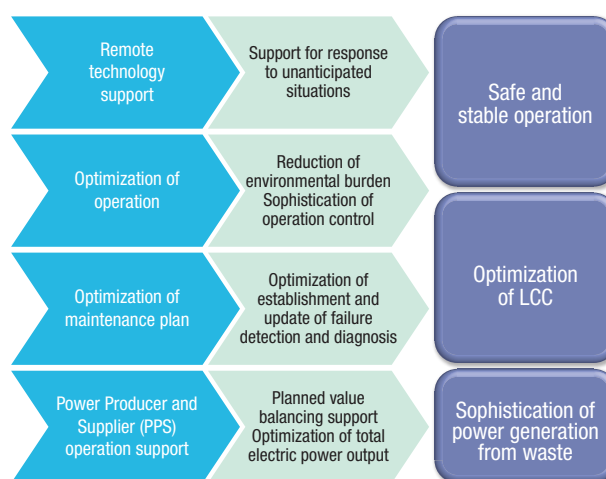


Fig. 4 Effects expected from introduction of functions

based on the revised Electricity Business Act. The Remote Support Center will provide supply-demand adjustment support for them in collaboration with our Power Producer and Supplier department. We are planning to introduce to the plant facilities a system that will directly link a 30-minute-block power generation plan developed by each plant facility to the electric power supply-demand control system. Each plant facility will operate as a power generation plant based on the power generation plan it developed. The Remote Support Center will have the function of checking the supply-demand balance and supporting the effective operation of power generation plants by placing plant facilities under integrated control.

A summary of the effects expected from the introduction of the above functions is shown in **Figure 4**.

4. Operation System and Extensibility

Skilled engineers support the operation of plant facilities operating in Japan and respond to unexpected situations accurately and promptly. In FY2016, the Remote Support Center provided remote support for two waste treatment facilities. In FY2017, it began remote support for another five, totaling seven waste treatment facilities. Remote support services are now provided for 24 hours a day, and support personnel have been increased accordingly. We will expand and enhance the support system in response to the increase of the number of plant facilities that have introduced remote support.

5. Conclusion

The development of ICT technology has brought us into the era of remote support for the optimization of operation of waste incineration facilities through online monitoring or big data analysis. We are determined to establish a system capable of supporting more waste incineration facilities and to improve operation efficiency and quality.

In conclusion, we would like to thank all those who helped in this project.

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