Co-innovating tomorrow™

YOKOGAWA

Yokogawa Renewable Solutions

Waste to Energy & Biomass

Bulletin 53T01A02-06EN

YOKOGAWA WASTE TO ENERGY & BIOMASS SOLUTIONS

As existing fossil fuel reserves have come under pressure, the challenge of providing secure energy and power supplies has increased significantly due to both financial and environmental costs. Moreover, landfills are running out of capacity to handle increasing amounts of household and municipal waste.

Even though efforts to reduce, re-use and recycle waste have made some progress, other options must be explored. One such option involves extracting energy from residual non-recyclable waste, which also helps provide a balanced and secure energy portfolio.

Distributed Control System (DCS)

Yokogawa, the world's first DCS manufacturer, is playing a key role in waste-to-energy and biomass power plants. In the waste-to-energy (WTE) market in Japan, which is one of most advanced in the world, Yokogawa holds the leading share of control systems, which are used to control numerous boilers supplied by Japanese major boiler manufacturers.

Yokogawa's DCSs are also widely used in biomass power plants, and have built a solid track not only for conventional stoker-type boilers, but also for circulating fluidized bed (CFB) boilers.

Fire detection at biomass and WTE facilities

All plants are susceptible to aging and the concomitant problems in facilities, one of the most serious and common of which is fire. Once a fire breaks out, the damage may become significant, causing financial problems for the owner due to outage and maintenance.

And yet it is impossible to continuously monitor conveyor belts for fire by daily manual inspections. Yokogawa's solution is to monitor long-distance conveyors using fiber-optic temperature sensing technology, which is ideal for 24/7 monitoring along the entire fiber-optic sensor cable. Another useful solution from Yokogawa is a laser gas analyzer to detect or predict a fire. By monitoring the characteristics of even a small quantity of air suctioned from the closed conveyor belt, the system can identify the presence of monoxide and thus predict a fire.

Plant owners also face the problem of self-ignition of dry fuel, but usually balk at installing a new detection system due to the high cost of new cabling work and system setup. Yokogawa's wireless temperature transmitters need no such costly cabling and cumbersome setup. Installed at the fuel storage, they are perfect for online monitoring and fire prediction.

Regarding the inside of a silo, it is difficult to predict fires with a conventional carbon monoxide (CO) sensor due to flying dust. Yokogawa's laser gas analyzer is non-contact and effectively detects an increase in CO concentration when pre-ignition is occurring.

O_2 Measurement for combustion control

It is essential to measure the oxygen concentration accurately and immediately for optimal combustion control. Yokogawa's direct in-situ zirconia oxygen analyzer holds the top share for large boilers and is highly valued by many customers including biomass power plants.

Where the gas characteristics or facility conditions are unsuitable for zirconia sensors, Yokogawa's alternative is the tunable diode laser spectrometer (TDLS). This can rapid analyze the flue gas even if remnants of the combustion gas remain. Also, the laser sensor of the TDLS does not need to be replaced, thus keeping running costs low.

Continuous Emission Monitoring System (CEMS)

Emission monitoring is essential at industrial plants. To comply with the regulations and reporting requirements of local authorities, an online continuous emission monitoring system is mandatory in many countries and industries.

As a specialist supplier of sensors and analyzers, Yokogawa can also supply a total CEMS solution. With a combination of Yokogawa's high-end products plus third-party devices, the accuracy and flexibility of a Yokogawa CEMS solution can be provided.

Steam and Water Analysis System (SWAS)

Yokogawa offers a SWAS solution tailored for each user to analyze the quality of steam and water. In steam-generation applications, the quality of steam is crucial as any contaminants could adversely affect the performance of a high-pressure boiler, steam turbine or even the associated auxiliaries, posing a major threat to the functioning of the system.

Yokogawa also provides 24/7 servicing to ensure reliability by using the local service office or global call center.

Distributed Control System (DCS)

One of the main challenges in combustion control at waste-to-energy plants is a calorie imbalance. With Yokogawa's deep expertise and supreme reliability, Yokogawa's DCSs are the trusted solution, not only for conventional waste fuel firing furnaces but also for gasification melting furnaces including direct melting furnaces.

Yokogawa's DCSs are also suitable for biomass power plants of any fuel type, including wood chips, cane residue and rice husks. The DCS systems are widely used for controlling both stoker-type and circulating fluidized bed (CFB) boilers.

Track record:

- ***27,500 systems overall***
- ***152 systems for waste to energy****
- ***101 systems for biomass***

*Including incinerators

Proven for gasification (direct) melting furnaces, CFB boilers, and stoker-type boilers

The leading DCS in the waste-to-energy market in Japan, which is one of the most advanced in the world, and chosen by all major furnace suppliers in Japan

YOKOGAWA WASTE TO ENERGY & BIOMASS SOLUTIONS

Fire detection for conveyor belt

Early fire detection for a long-length conveyor belt is a challenge in many biomass and WTE power plants, and is impossible by periodic patrols, even if done frequently, because a fire could occur at any time, anywhere. Yokogawa's solution is to use its DTSX fiber-optic temperature sensor that can monitor the temperature profile along the entire fiber-optic cable.

If the temperature rises due to a fire in an area anywhere along the cable, the DTSX will detect the change in temperature and immediately issue an alarm notifying the exact location of the fire to enable action to be taken immediately.

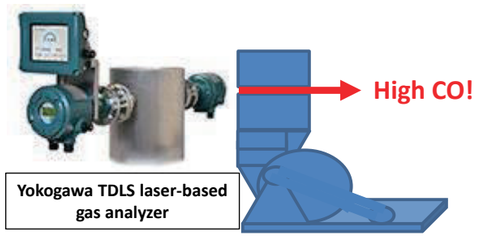
Unlike conventional linear heat detectors, the DTSX can display the average temperature at one-meter intervals and provide a graphical presentation of the temperature profile together with a picture or drawing of the facility. What's more, the DTSX can keep functioning even if fibers within the cable break or are damaged at a certain point.

Features:

- Continuous 24/7 real-time automated temperature monitoring
- Long-distance temperature profile monitoring
- Monitoring of complicated areas and locations

Another way of detecting or predicting fires is to install an accurate CO sensor inside the air suction duct of the conveyor. Yokogawa's TDLS laser-based gas analyzer offers flexible installation and accurate CO sensing. Once installed inside the suction duct, it accurately reads the CO concentration in the suction air and captures fluctuations that indicate a fire or pre-ignition somewhere along the conveyor belt.

Thanks to its non-contact laser sensor, the TDLS requires no replacement during maintenance.



To maintain redundancy of the fire detecting means at all times, it is sometimes recommended to install additional low-cost fire detection sensors. Yokogawa works closely with major fire detector vendors and can provide suitable detectors.

One unique fire detector that Yokogawa is able to provide is a UV sensor which can counter the effects of sunlight and thus avoid false detection. This sophisticated sensor is sufficiently accurate to detect even a small spark if close enough to the sensor, and will detect any fire once it grows to a sufficient size. The UV sensor communicates wirelessly.

Fire detection for storage area

Dry biomass fuel fire detection

Self-ignition of dry biomass fuel is a very serious issue for biomass power plant owners. However, it may be impractical to newly install fire detection cables in an existing plant due to the cost and difficulty of modification without affecting plant operation. Yokogawa's sensible, effective solution resolves such problems, by monitoring temperature inside the stock pile with a wireless temperature transmitter.

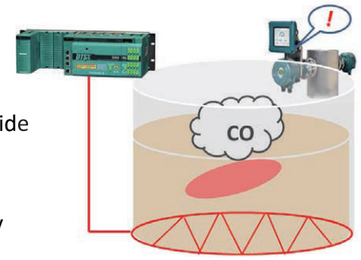
Yokogawa's wireless data transmission technology using the ISA100 protocol allows temperature data to be transferred from the fuel storage to the plant control center as frequently as at one-second intervals. Since a single access point can cover multiple wireless sensors (see the figure below), additional sensors can be installed within up to 500 meters from the access point, allowing flexible setup.

Moreover, battery life is not a concern. Yokogawa's sophisticated technologies minimize the power consumption of sensors and extend the battery life to up to 10 years (depending on the conditions).

Silo fire detection

Some biomass power plants use a silo to store fuel and install a carbon monoxide (CO) detector to detect a fire. However, the flying ash inside the silo makes it almost impossible for a CO sensor to work properly.

Yokogawa's contactless laser-based gas analyzer solves this problem and stably detects an increase in CO concentration when pre-ignition occurs.

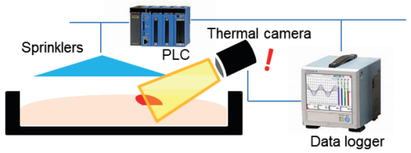


For the bottom of a silo where it is difficult to detect a fire, Yokogawa's DTSX fiber-optic temperature sensor securely monitors the temperature at the bottom of the fuel stock.

Waste storage fire detection

Self-ignition of a waste storage could damage surrounding facilities if the fire spreads. Yokogawa has long provided monitoring systems for fire prediction and detection. These consist of one or more thermal cameras, a data logger and a programmable logic controller (PLC). If the surface temperature monitored by the camera(s) rises to the threshold value preset in the data logger, a notification is sent to the maintenance staff by email and the sprinkler system is turned on by the PLC simultaneously.

When the thermal camera detects an abnormality in surface heat of the storage, the recorder sends a signal to the PLC to turn on the sprinkler system automatically.



YOKOGAWA WASTE TO ENERGY & BIOMASS SOLUTIONS

Oxygen concentration measurement for combustion control

It is essential to measure the oxygen concentration accurately without delay for effective combustion control of a boiler, and a direct in-situ zirconia oxygen analyzer is often used.

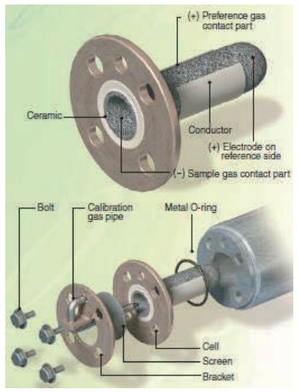
Thanks to its reliable quality and user-friendly operation, Yokogawa's direct in-situ zirconia oxygen analyzer is ideal for conventional, circulating fluidized bed (CFB) and stoker-type boilers used for biomass fuel combustion. It holds the top share for large boilers in Japan and has been chosen by customers in diverse sectors such as oil and gas, steel, power, and pulp and paper. Its robust sensor is comprised of a zirconia element and platinum electrodes connected to each other by a unique molecular bonding technique to prevent separation, thus ensuring long life and stable oxygen measurement.

It also offers ease of sensor replacement and features a lead-less electrode design that eliminates electrical disconnection and a special coating to prevent sensor deterioration.

- Molecularly bonded platinum electrode ensures strong adhesion and resistance to peeling
- Special coating prolongs sensor life and resistance to corrosive gases
- Fast response
- Easy replacement on site

Yokogawa Zirconia O2 Analyzer

Especially at waste-to-energy power plants in which the dust concentration in the flue gas is very high and may significantly affect the zirconia sensor's performance, Yokogawa's TDLS is widely used. As zirconia cannot be used when dust concentration is high, Yokogawa's laser-based TDLS is used instead, performing flawlessly without impact thanks to its contactless laser-based sensor.



The TDLS can also withstand high temperatures of up to 1,200°C, thus allowing accurate oxygen measurement at a point very close to combustion for optimum combustion control.

One of the major differences in use compared with zirconia analyzers is the range of coverage. Although a zirconia sensor is a point sensor, the TDLS has a wider range of sensing as it covers the gas within its line of sight.

In biomass and waste-to-energy plants, the TDLS is also used for monitoring carbon monoxide.

Yokogawa TDLS

Applicable for direct installation onto the gas pipe

Continuous Emission Monitoring System (CEMS)

Emission monitoring is essential at industrial plants. To comply with the regulations and reporting requirements of local authorities, an online continuous emission monitoring system is mandatory in many countries and industries.

As a specialist supplier of sensors and analyzers, Yokogawa can also supply a total CEMS solution. With a combination of Yokogawa's high-end products plus third-party devices, the accuracy and flexibility of a Yokogawa CEMS solution can be provided.

Yokogawa's continuous emission monitoring system for utility boilers and heating furnaces uses an infrared gas analyzer to monitor the carbon monoxide, carbon dioxide, nitrogen oxide, sulfur dioxide, methane and oxygen concentrations in the flue gas, helping the user comply with environmental regulations.

CEMS cabinet

- A complete self-standing cabinet including Yokogawa infra-red analyzer and a sample conditioning system
- Simultaneous measurement of oxygen (O_2) plus up to four components from nitrogen oxide (NO), sulfur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2) and Methane (CH_4).

Yokogawa Infrared gas analyzer IR400

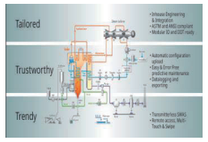
Steam and Water Analysis System (SWAS)

Yokogawa has over four decades of experience in providing tailored and packaged analyzer solutions to customers in diverse industries such as power, oil and gas, petrochemicals and chemicals.

Yokogawa offers a SWAS solution tailored for each customer to analyze the quality of steam and water. In steam-generation applications, the quality of steam is crucial as any contaminants could adversely affect the performance of a high-pressure boiler, steam turbine or even the associated auxiliaries, posing a major threat to the functioning of the system.

One of the causes of unplanned shutdowns of a power plant is contaminants present in steam or water. This can be avoided by installing a SWAS, which performs online monitoring of various critical process parameters such as pH, conductivity, dissolved oxygen, silica and phosphates.

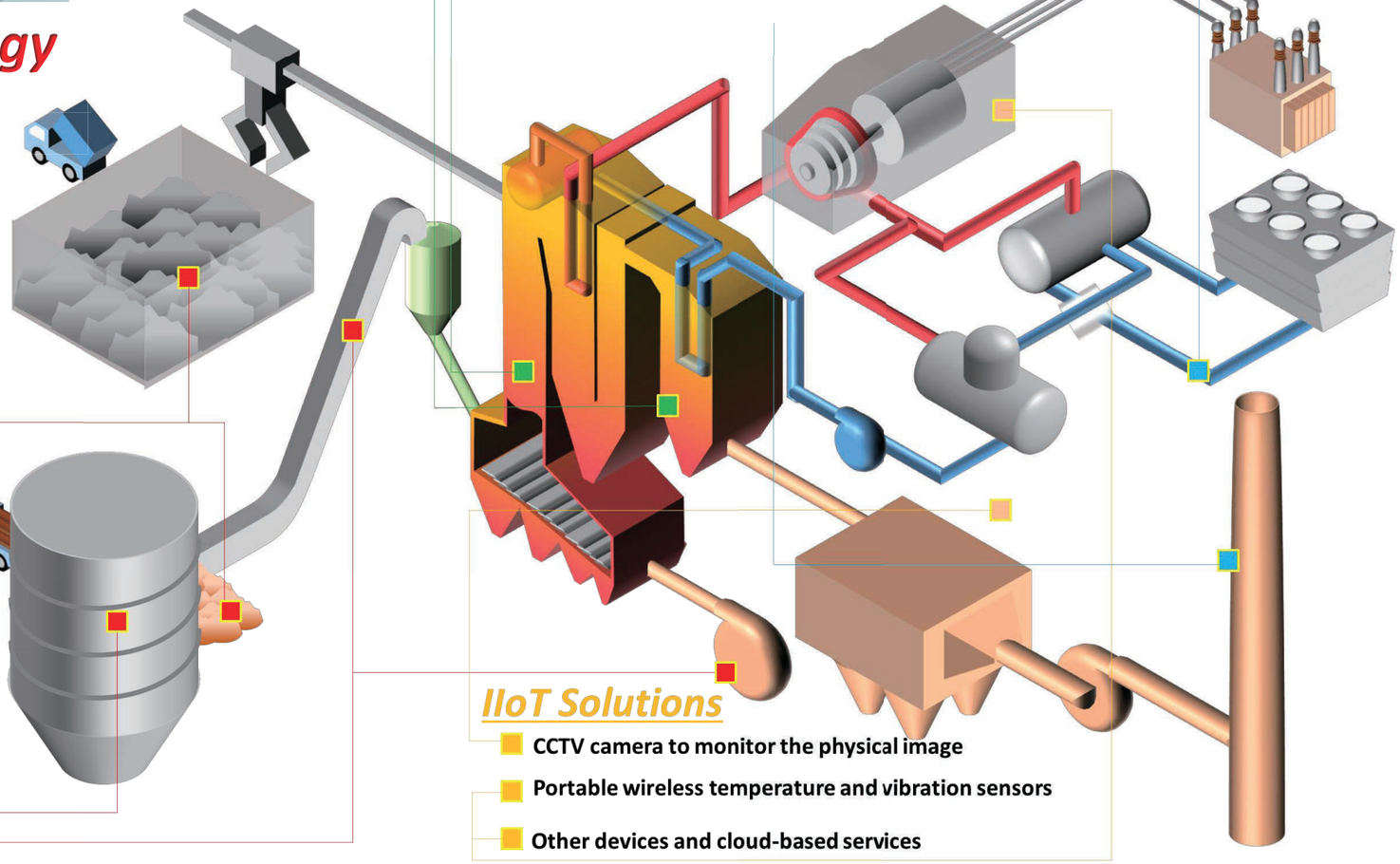
SWAS systems offer a wireless configuration option. Various analyzers in different clusters such as boiler feed water and superheated steam areas can be connected to a common router, which is further connected to the control room via a gateway and management station. All of these connections can be completed without having to lay sensor cables. This helps eliminate special tubing required for connection from process tapping points to the SWAS room and also the cost of sensor cabling to the control room, as well as facilitating the addition of measurement points in future.



Overall Plant Control

- Distributed Control System (DCS)

Leading share of waste-to-energy plant control in Japan



Emission and Water Analysis

- Continuous emission monitoring system
- Steam and water analysis system

Oxygen and Carbon Monoxide Measurement

- Oxygen measurement for combustion control
- Carbon monoxide measurement for flue gas monitoring

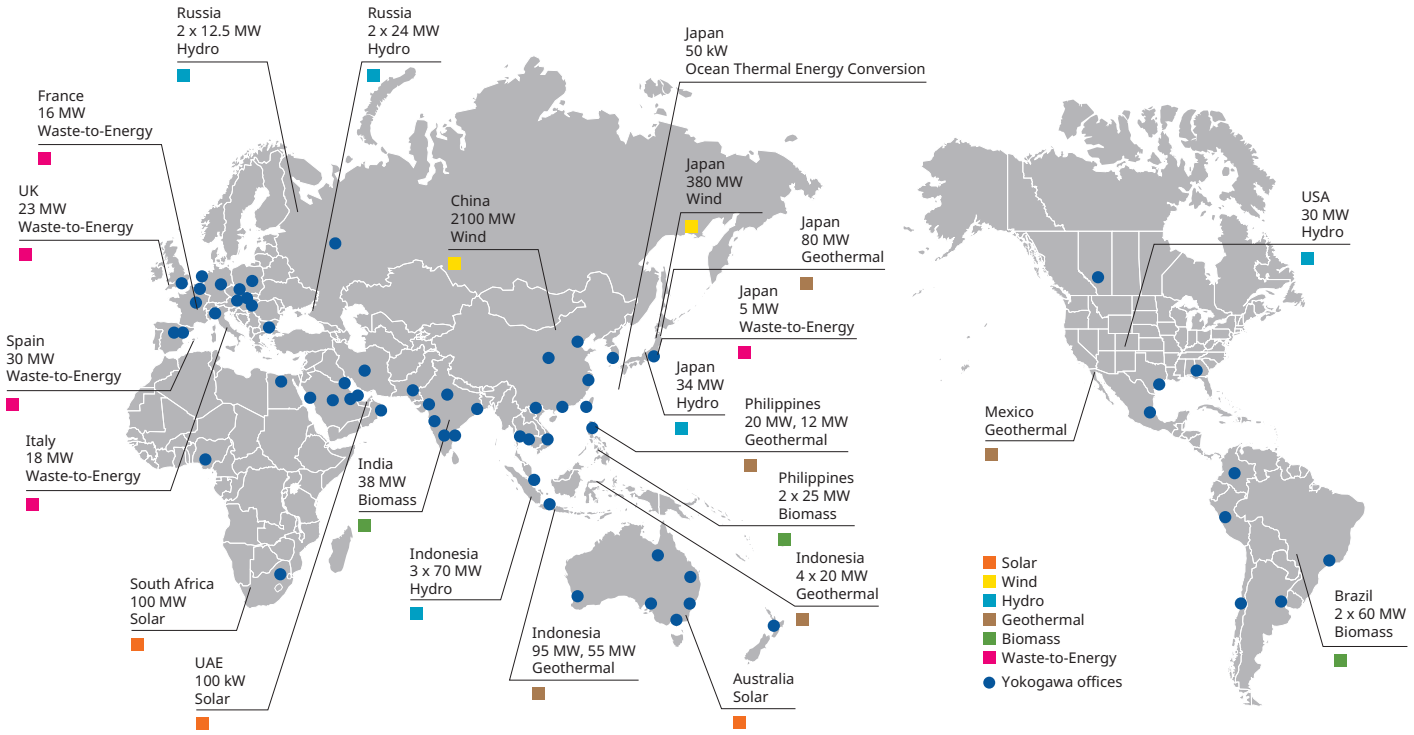
Fire Detection

- Storage yards (internal and external)
- Conveyor belts
- Silos

IIoT Solutions

- CCTV camera to monitor the physical image
- Portable wireless temperature and vibration sensors
- Other devices and cloud-based services

Yokogawa's renewable energy projects



OpreX™ Yokogawa achieves operational excellence by providing products, services, and solutions based on the OpreX comprehensive brand that cover everything from business management to operations.

YOKOGAWA ELECTRIC CORPORATION
World Headquarters
9-32, Nakacho 2-chome, Musashino-shi, Tokyo 180-8750, Japan
http://www.yokogawa.com/

YOKOGAWA CORPORATION OF AMERICA
12530 West Airport Blvd, Sugar Land, Texas 77478, USA
http://www.yokogawa.com/us/

YOKOGAWA EUROPE B.V.
Euroweg 2, 3825 HD Amersfoort, The Netherlands
http://www.yokogawa.com/eu/

YOKOGAWA ENGINEERING ASIA PTE. LTD.
5 Bedok South Road, Singapore 469270, Singapore
http://www.yokogawa.com/sg/

YOKOGAWA CHINA CO., LTD.
3F TowerD Cartelo Crocodile Building,
No.568 West Tianshan Road, Shanghai 200335, China
http://www.yokogawa.com/cn/

YOKOGAWA MIDDLE EAST & AFRICA B.S.C.(c)
P.O. Box 10070, Manama,
Building 577, Road 2516, Busaiteen 225, Muharraq, Bahrain
http://www.yokogawa.com/bh/

Visit our website at:
https://www.yokogawa.com/industries/power/renewable-energy/

Represented by:

Printed in Japan, 910(KP) [Ed : 01/c]

YOKOGAWA Co-innovating tomorrow™