Energy Saving Support Services

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Abstract

Enterprises (in Japan) are required to achieve a sharp reduction of energy consumption by laws and ordinances, such as Act on the Rational Use of Energy (Energy Conservation Law), Act on Promotion of Global Warming Countermeasures, and Tokyo Metropolitan Environmental Security Ordinance (Carbon Dioxide Total Emissions Reduction Obligations).

In order to attain an initial target energy reduction, it is necessary to grasp the conditions of energy use of target facilities, and amount of consumption. Based on such data, it is necessary to make a plan for energy conservation. Based on such plan, our customers will then conduct energy saving-related construction works and implement management and then report the results of energy saving.

To cope with customers' needs, we offer equipment and units that can easily measure and record the amount of energy consumption and environmental data. We also offer ideas for energy conservation and introduce energy-saving products for heat and power. We provide such facility installation services and various support services for customer energy-saving.

1 Preface

According to year 2030 energy demand prediction based on "long-term energy supply-demand outlook" [released in July 2015 by Agency for Natural Resources and Energy ("ANRE"), the Ministry of Economy, Trade and Industry ("METI")], Japan will strive to achieve the goal of reducing crude-oil-equivalent energy consumption of 50.3 million kL through drastic energy conservation ("energy-saving" hereafter) while maintaining an annual economic growth of 1.7%.

To realize this target, both government and private sectors are working on various action program. For example, there is a Top Runner Program (stipulated by ANRE of METI). This Top Runner Standard is applied as a yardstick in high energy consumption efficiency of equipment. Initially, there were 11 applicable categories. This figure, however, slowly increased as high as 31 categories as of March 2015. It is anticipated to increase further in the future. Along with this trend, the Energy Conservation Grand Prize system was put into force to give awards to companies, business operators promoting energy conservation at their offices, factories, and also to any products and business models featuring excellent energy conservation performance. In the Fiscal 2016, 132 applications were made for the award.

As stated above, energy saving awareness has widely spread in the society and energy-saving technologies are becoming essential in many industrial fields. This paper introduces not only our energy-saving products but also comprehensive on-going energy-saving services.

2 Preliminary Survey Service

To realize energy conservation, it is necessary to grasp the current situation. We check for customer's power or heat target ranges: overall office, inside of the factory or the building, and lastly, the number of target facilities. Next, we check the quantity of energy consumption at each facility, operating time and frequency. If we can collect detailed data, then later planning for energy saving becomes easier.

In many cases, overall data of a factory are available but data for each machine are not, as such data were not measured in the past. In such a case,

we lend data collecting units that can easily collect data. Fig. 1 shows an external appearance of data acquisition units for Lending. The features of this equipment are easy to set up as each unit is wireless. These units measure and store data on the amount of energy used and environmental data (temperature, humidity, and the intensity of illumination) in many places simultaneously. Fig. 2 shows a trend graph by the data acquisition units. The trend graph can be easily displayed and it can also be used for measurements after the completion of energy-saving measures. This capability received a positive review from our customers as it enables the smart visualization of energy data that were not formerly possible.

Future planning and budgeting are also important to customers. It is important to get such varied information and draw up an energy-saving plan.

(a) Web server unit

(b) Measuring sensor unit (wireless type)

Fig. 1 Data Acquisition Units for Lending

A Web server unit and a wireless measuring sensor unit are shown.

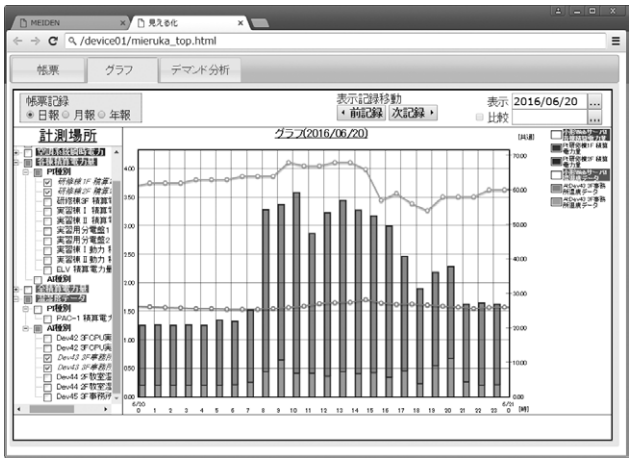

Fig. 2 Trend Graph by the Data Acquisition Units

A screen example of Web trend graph is shown.

3 Our Programs for Energy Conservation

Examples of energy-saving proposals are introduced below and each proposal is shown as a case of electrical energy and heat energy.

3.1 Electrical Energy Case Reduction

3.1.1 Expansion of Inverter Application Range to Medium-Voltage Motors

For measures relating to fan and pump energy-saving, we propose the use of inverters which is fairly common. Fig. 3 shows an example of inverter installation and Fig. 4 shows power reduction by inverters. When the wind volume and flow rate are controlled by using valves and dampers, the amount of power consumption reduction is small even though wind volume and flow rate are lowered as the dashed line shown in Fig. 4. When an inverter control system is adopted, however, power consumption is reduced effectively as in many cases, the wind volume and flow rate are lowered.

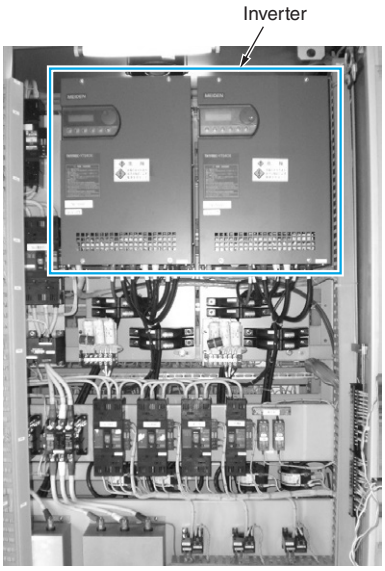

Fig. 3 Example of Inverter Installation

An example of inverter installation is shown.

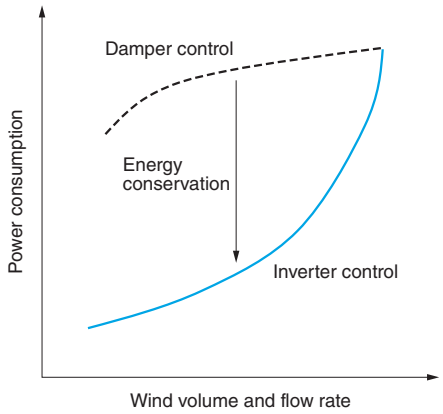

Fig. 4 Power Reduction by Inverters

An image of power consumption is shown based on comparison between damper control and inverter control.

Fig. 5 LED Lighting at a Parking Lot

An example of LED lighting is shown. It is a renovation from a conventional metal halide lamp system.

Formerly, inverter control was an applicable technology for low-voltage motors rated at 400V etc. Recently, however, by the rapid development of Insulated Gate Bipolar Transistor (IGBT) devices, inverters applicable for medium-voltage motors rated 6.6kV were commercialized. Compared with a low-voltage motor, a medium-voltage motor consumes a lot of power. A wide range of power conservation can be expected if an inverter control system is adopted for medium-voltage motors.

3.1.2 Use of Light Emitting Diode (LED) for Lighting

For the energy-saving of lighting, the use of LED is a top choice. Currently, a wide variety of LED lighting is available and the reduction of LED's power consumption and LED prices is making rapid progress. Since market LED offerings come in a variety of versions, our customers have difficulty selecting the suitable one for their specific needs. Considering customer requirements, we propose suitable LED products taking into account the balance between efficient power consumption and price.

It is not prudent to simply change conventional lighting into the LED type. Without considering the particular characteristics of LED lighting, such as directivity of light and color rendering properties (Ra), the user may notice a different and distracting visual color after renewal from the prior lighting source. To prevent this, we use simulation technology and examine the lighting position(s) and the number of lights to make an optimal design a proposal for LED lighting.

An example of lighting in a parking lot changed to LED lighting is introduced below. **Fig. 5** shows a view of LED lighting in a parking lot. The existing lighting system was composed of 29 metal halide lamps of 1.05kW each. This type is 30% to 40% brighter than mercury vapor lamps. For LED lighting, we chose low-price LED lamps with a lower power consumption.

We then selected an LED lighting rated at 45,840lm and 280W. Although the total luminous flux was 44% of the former lighting system, we elected this selection by predicting the intensity of illumination through preliminary simulation. We confirmed that sufficient illumination was available. As a result, we achieved almost the same level of illumination while the power consumption was reduced by 73%. With 29 LED lamps installed for the renovation, we realized the reduction of power consumption could be achieved by 22.3kW.

In addition, we recently made many proposals for electric energy reduction by using human sensors or illuminance sensors. Under this system, the illuminance level is reduced to 5 to 10% while there are no people present, and returns to 100% illuminance level when it senses the presence of people. When sufficient illuminance by sunlight is available in the daytime, the lighting system is off. This is an incremental way of maximizing efficient power saving.

As described above, the LED lighting system can create a great energy-saving effect. Going forward, we expect that almost all lighting systems will eventually be changed into LED lighting. As such, we will keep proposing the above energy-saving methods.

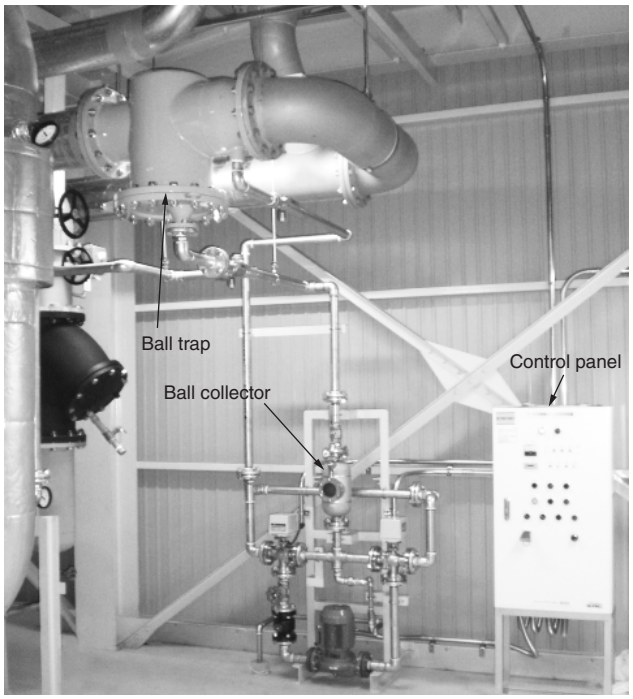

Fig. 6 XAC Using Sponge Balls

An overall view of a 1-trap single system is shown. This system is composed of the ball trap, ball collector, valve unit, and the control panel.

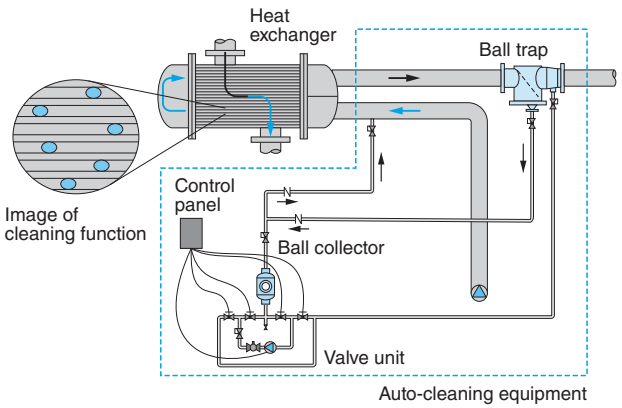

Fig. 7 Behavior of Sponge Balls Flow Controlled by Auto-Cleaning Equipment

Sponge balls from the ball collector pass through the heat exchanger and the ball trap, and return to the ball collector again.

3.2 Thermal Energy Case Reduction

3.2.1 Heat Exchanger Automatic Cleaning System (XAC) Using Sponge Balls

Air conditioners are indispensable for any large buildings. They consume a huge volume of thermal energy. In this paper, a turbo chiller and absorption type chiller which are used in relatively large facilities, are introduced as an example of energy-saving targets. Both turbo and absorption type chillers are equipped with heat exchangers where heat is exchanged by cooling water. These heat exchangers have a construction where cooling water flows through the shell and tube section※1. While operation is continued, scale※2 or slime※3 is precipitated inside the tube, and this reduces heat exchange efficiency. For this reason, operation must stop periodically for the chemical cleaning to remove deposited scale or slime.

Fig. 6 shows an XAC using sponge balls and Fig. 7 shows the behavior of sponge balls flow controlled by the auto-cleaning equipment. In this equipment, the heat exchanger for cooling water is automatically cleaned to maintain the high target efficiency for the reduction of energy consumption. This system is composed of a ball trap, ball collector, valve unit, and control panel. The sponge balls move from the ball collector at predetermined intervals and pass through the heat exchanger tube. They are collected at the ball trap and then go back to the ball collector. The sponge balls scrub the inner surface of the tube to prevent the deposition of scale and slime.

If the scale or slime contained in cooling water is precipitated inside the tube, it is generally believed that the efficiency of the heat exchanger is reduced by 10% to 30%. When XAC using sponge balls is installed, it becomes possible to realize energy conservation because we can maintain the original efficiencies for the heat exchanger.

4 Customer Support

We offer the following customer support services in Japan.

4.1 Energy-Saving Diagnosis

We visit our customers to obtain information about conditions of installation and operation of the target facilities for energy-saving measures. In so doing, we grasp detailed information about the customer's site which is difficult to ascertain only by checking the drawings, and also grasp future plans and budget from the customers to propose comprehensive energy saving measures for them.

4.2 Application for Government's Subsidies

By the METI, a subsidy system was established in relation to energy conservation. Thanks to

this system, the customer can reduce their facility introduction costs. To be eligible for this system, however, it is necessary to obtain information about the public invitation for such an early application and make preliminary preparations as promptly as possible due to the short application acceptance period. In addition, it is necessary to clear the document review screenings to get subsidies. It is important to know the correct template for writing the application.

After successful introduction of the facilities, it is then necessary to submit a report of the attained reduction of energy consumption to the proper authorities. We offer support for such required paper work.

4.3 Statutory Reports

In regard to the Energy Conservation Law, Act on Promotion of Global Warming Countermeasures, and Tokyo Metropolitan Environmental Security Ordinance, customers must submit various reports and related documents to authorities such as the amount of energy consumed, the amount of reduction, and an energy reduction plan. In particular, our support services include several meetings with our customers on energy reduction planning for energy-saving achievement. In implementation, we provide technical support to enable our customers to clear the energy-saving goal. We also provide supporting service during the submission of report summing up the overall energy-saving activities.

5 Postscript

Since facilities and their operating conditions of each customer vary, the contents of optimal energy-saving plan will differ for each customer. Accordingly, it is important to conduct a site survey and measurements survey to grasp the situation on-site. We need to study a future plan and cost-planning for necessary facility introduction.

The energy-saving activities should be continuous as one-time energy saving-measures work is not sufficient. The customers must continue to implement follow-up actions such as maintenance work for continuous energy conservation, another energy-saving planning for new energy reduction targets, and taking measures for them.

Given the aforementioned, we recognize that energy conservation is vital for society in the future. We will make every effort to grasp the energy usage situation in customer facilities and we will offer optimal energy saving proposals to our customers.

(Notes)

※1. Shell and tube: A construction consisting of many fine round tubes arranged in a large casing shell where heat exchange is produced between the fluid flowing in the casing and other fluid passing through the bundle of heat transmission tubes.
※2. Scale: Calcium and magnesium compounds dissolved in water.
※3. Slime: A lump of microorganisms in a muddy and viscous state.