Energy-Saving Promotion Services

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Abstract

Because of laws and regulations such as the Energy Saving Law (Act on the Rational Use of Energy), the Promotion of Global Warming Countermeasures Act, and the Tokyo Metropolitan Ordinance on Environmental Preservation (The Tokyo Cap-and-Trade program), enterprises are required to achieve a great reduction of energy consumption in Japan.

Responding to the requests of our customers, we carefully investigate their facilities in order to realize the energy reduction target, propose energy saving methods through the effective facility management, introduce energy saving products, and carry out shipment and construction work. We also promote supporting services when customers submit associated reports and documents to the national authorities and related local government bodies.

Not limiting to any specific products, we always carefully research the customer's facilities and conduct simulations from all angles of various feasibilities for the customer facilities and propose the most effective energy saving solutions.

1 Preface

Triggered by the Great East Japan Earthquake in 2011 (the "Big Quake"), people's awareness of saving energy changed greatly. It made a situation where their lives shifted to a lifestyle in favor of energy-saving despite some inconveniences.

So far, the enterprises that are subject to the terms of the Energy Saving Law, the Promotion of Global Warming Countermeasures Act, etc., have made unusually challenging efforts to realize their responsibilities for the annual reduction of energy by 1%. Nevertheless, some of them failed to attain the goal of an annual 1% reduction.

With the outbreak of the Big Quake in 2011, many enterprises achieved big energy savings in the summer of 2011. We are now in an era where there appears to be a large change in the use of energy. Meiden Engineering Business Unit is proposing energy solutions that come from "outside the box thinking." This paper introduces some of these solutions.

2 Supporting Business Laws and Regulations Compliance

2.1 Energy Saving Law and the Promotion of Global Warming Countermeasures Act

Items to be reported are few and simple; however, in order to realize a targeted result, it is necessary to comprehend the effect and contents of energy-saving programs. In other words, we have to understand the customers' facilities in detail. In addition, since it is necessary to describe the medium and long-term plans, we have to draw up an energy-saving plan and propose it to the customer.

We cannot achieve any customer satisfaction by just writing a facility status report for the customer, but we must make an attractive proposal based on our medium and long-term range views for their facilities. In order to achieve energy saving according to the country's requirement, we have to fully appreciate the situation of all the related facilities through this very detailed, modest, and laborious work.

2.2 The Tokyo Cap-and-Trade Program

Compared with the standard year, emission of

carbon dioxide in 2010 to 2014 must be reduced by 6% to 8% (5-year average). This regulation is based on a report under which total energy consumption is converted into the volume of carbon dioxide. The initiative by enterprises should be directed toward the reduction of energy to be consumed, focusing mostly on energy-saving programs. If this target cannot be cleared, the enterprises have to buy-out the unachieved volume according to the Tokyo Emissions Trading System. Realizing energy saving by 6 ~ 8% annually on average in Japan is a very high hurdle; however, each enterprise is making every effort to realize the goal.

We possess a variety of proposals on energy-saving to help the customers get there. Our supporting services in regard to the submission of related reports are also offered.

3 Activities Concerned with Energy-Saving for Electrical Facilities

3.1 Use of Inverters

It becomes common to propose the use of inverters as energy-saving equipment for fans and pumps. If any such products exist, we always offer the introduction of inverters for effective energy-saving. Fig. 1 shows an example of an inverter installation.

Where water flow or airflow is controlled with valves and dampers, the inverters exhibit a solid resultant effect and electric power consumption is reduced to half in many cases. In particular, pumps used in air conditioning facilities generally have comparatively large capacities because water is transmitted. In many cases, the effect in terms of cost performance can result in a return on investment in a short amount of time of only one to three years. For example, in the case of a hospital in Tokyo, inverters were installed to serve two cooling water pumps, rated 3-phase, 400V, and 75kW. Before inverter installation, these pumps were operated at a power frequency. After installation, they are operated at 35Hz except during the summertime. As a result, power consumption had been reduced by almost half. In terms of the effect of cost, initial return on investment was attained in less than two years. At the time of the inverter installation, the flow rate of cooling water was investigated by means of an ultrasonic flow meter to examine possible influence on the absorption water cooling and heating machine. In order to investigate the effect of harmonics, we checked the amount of harmonics flow-out at the power incoming point. Based on the results of comparing before and after installations, we checked the degree of compliance with the harmonics guideline.

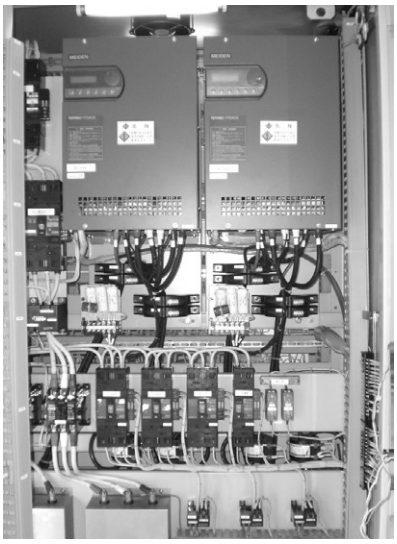


Fig. 1 Example of Inverter Installation

An example of an inverter installation is shown.

Our services are based not only in the pursuit of values of simply an energy-saving effect, but also on establishing credibility with the customers by our meticulous responses to their requests.

3.2 Light Emitting Diode (LED) Lamps

General attention is being drawn from the benefits of replacing conventional bulbs with LED lamps because of their immediate power-saving effects and long operational life. They are expected to improve their performance characteristics and expand the market penetration and applications in the future.

We conducted experimental tests on outlines such as the characteristics of LED lighting, safety, etc. as part of our technical services for energy-saving, as both a new lighting facility and also to propose the efficient use of LED lamps by utilizing them in already existing facilities.

To be specific, our Technical Center was set up as an experimental test facility and existing lighting facilities were replaced by LED lamps. For each LED lamp replacing approach proposed by multiple manufacturers, we made quantitative evaluations with respect to the effect of power consumption reduction, emission heat losses, color rendering property, comparison of illuminance, etc. Table 1 shows an example of the evaluation list. Based on

Table 1 Evaluation of LED Lamps Replacing Fluorescent Lamps

The evaluation was made specific to the characteristics of LED lamps in comparison with existing fluorescent lamps and existing stabilizer connection type (replaceable type only for wire-free lamps).

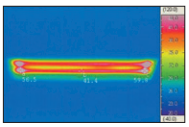
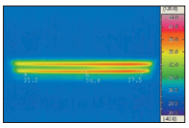
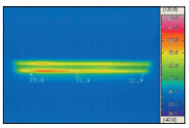
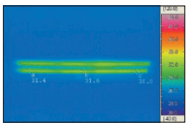
		Power consumption (W)	Average illuminance (lx)	Color rendering property	Mass (g)	Heat dissipation effect
Existing lighting	Fluorescent Lamp (FL)	72	315	Ra: 73	260	
LED lighting	A	56	320	Ra: 85	430	
	B	56	241	Ra: 80	398	
	C	40	178	Ra: 74	268	

Fig. 2 Installation Example of Automatic Low-Voltage Power Factor Controller

This equipment is used for the control of 5 banks, rated 3-phase, 400V, and 220kvar. The effect of 40% to 50% suppression is expected for the 5th harmonic current. Reactive power of a transformer is compensated for in order to produce an allowance in transformer capacity.

the results of this verification, we offer replacement with selected LED lightings which are most suitable to the respective customers' facilities.

3.3 Automatic Power Factor Controller

Presently, power factor controllers are often adopted for the improvement of a power factor at 6kV power receiving points (feeders). This equipment makes it possible to improve the power factor only at an incoming point in a single manner; this method is cost effective. Recently, however, the increasing trend to improve the power factor is on the low voltage sides. In this section, the power factor controller used on low voltage side (3-phase 200/400V) is introduced. This equipment is a device with an energy-saving feature. Namely, reactive power flowing in a transformer is controlled in order to maintain the power factor at almost 100% in the transformer. As a result, the transformer capacity can have more allowance or flexibility and this contributes to the reduction of losses. After the Big Quake in 2011, demand for in-house power generating systems increased substantially and this tendency has accompanied problems of harmonics inflow (related to equivalent reverse-phase-sequence currents). If features of power factor improvement on low voltage side are utilized favorably, we can respond to such issues by controlling the 5th harmonic current.

There are series reactors which account for 6% of overall system configurations. As a result, under some conditions, 40% to 50% of the 5th harmonic current can be decreased. In facilities meeting such conditions, the low-voltage power factor controller is an excellent product with which to address the harmonics issue in a simple manner. For installations, we offer suitable capacity equipment by grasping the load conditions by measurements, selecting the equipment capacity, setting up of the number of banks, and by these elaborated measures. Fig. 2 shows an installation example of an automatic low-voltage power factor controller.

4 Other Possible Energy-Saving Programs

4.1 Automatic Cleaning Equipment for Ball Type Heat Exchanger

After the National Team Minus 6% Campaign in Japan, many people felt that setting air conditioners at 28℃ in the summer and 20℃ in the winter was a kind of mandatory energy-saving duty felt by

many people. Air conditioners are a product used every day by many people. It is also a high power-consuming product. This section introduces energy saving equipment, using an example of turbo-freezers and absorption type freezers installed in comparatively large-scale facilities.

Equipment that provides a heat source may raise or lower its efficiency greatly with small variations in the system. The same thing can be said with turbo-freezers and absorption type freezers. If daily maintenance is neglected, it will greatly deteriorate the rate of efficiency. The system introduced here is intended for the automatic cleaning of heat exchangers for cooling water. It is a system that reduces energy consumption by maintaining high efficiency.

The automatic cleaning equipment for a ball type heat exchanger is also an effective system for freezers and compressors where shell and tube type of heat exchangers are accommodated. This equipment is used for air conditioners, but it is also used for manufacturing systems and generators. We project that its application range will be wider in the future. In this system, balls made of natural rubber always flowed inside the tube that is intended to pass the cooling water so that no scale or slime can attach. When installing this equipment in already existing facilities, the tube inside must be washed in advance until the thermal efficiency is equivalent to that at the time of new installation is attained (scale, slime, etc. are fully removed). The typical system components are briefed below.

4.1.1 Parts Configuration

Fig. 3 shows the system overview. The system is composed mainly of the ball trap, ball collector, valve unit, and the control panel. Rubber balls travel between the ball collector and the ball trap inside the heat exchanger.

4.1.2 Effect

When components of scale and slime contained in cooling water are separated inside the tube, the efficiencies of heat exchangers are generally lower than the normal level by 10% to 30%. When normal heat exchanger efficiency can be maintained by using automatic cleaning equipment for ball type heat exchangers, values from efficiency improvements means reducing the amount of energy consumption. Generally speaking, annual energy cost often exceeds 100 million Japanese yen in many cases. If this cost can be reduced by 10% to 30%, this can be regarded as one of the most useful methods for energy saving.

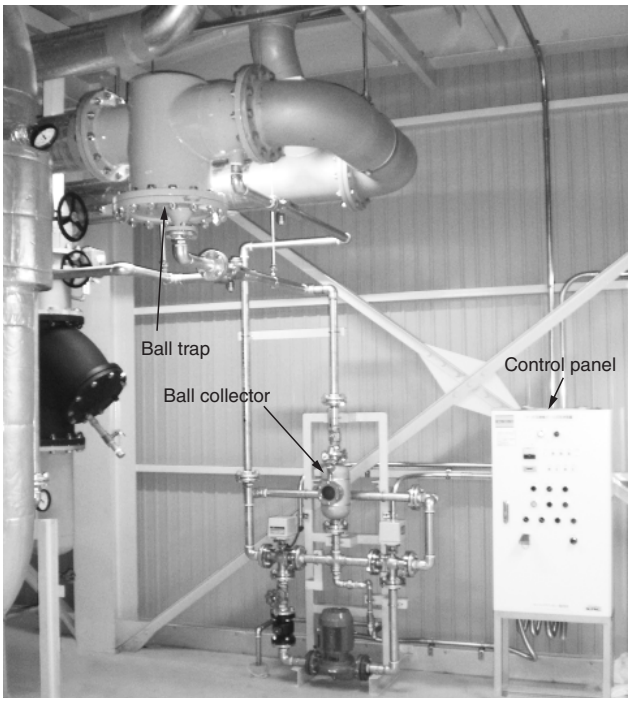


Fig. 3 System Overview of Automatic Cleaning Equipment for Ball Type Heat Exchanger

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

4.2 Indirect Water Spraying Cooler

This is an applied product which is energy-saving for an outdoor unit of a package-type of air conditioner where the heat evaporation of water is utilized. There have been other products that increase the effect of cooling by spraying water directly on an outdoor unit. In such cases, however, there have been problems such as corrosion in radiator panels and deposit of scale. As such, we use special filters so that water is evaporated without spraying it directly in order to lower the ambient temperature by a maximum of 10℃. This is an aid for efficient operation of an air conditioner. Fig. 4 shows an installation example of an indirect water spraying cooler.

4.2.1 Construction

This machine consists of a special filter and a controller. The special filter is affixed to an outdoor air conditioning unit. It comes in a structure where drop-state water is sprinkled upon the upper part of the special filter.

4.2.2 Effect

According to the verification of a building done last summer, more than 13% of power demand was curtailed. On a day in the summertime when it was comparatively hot and humid, it was proven that ambient temperature had been lowered by 5℃ to

Fig. 4 **Example of Indirect Water Spraying Cooler Installations**

An overall view of the system is shown. The system is installed on a rooftop.

7℃. We, therefore, consider the lowering of ambient temperature by 10℃ not an impossible task.

5 Postscript

We conduct site surveys, and measuring investigations, and then we investigate and propose the most effective and feasible measures for energy-saving. We always communicate with our customers and offer options in good faith. After getting consent from our customers based on thorough understanding, we propose how to proceed with the options we propose.

To promote energy-saving measures is low-profile and monotonous work. One needs to find very small, practically invisible, amounts of waste and amass such findings one by one. Technologies and approaches obtained in the past are very valuable. We continue to utilize previous achievements to develop and offer new innovations, approaches, and products to our customers.

We are never satisfied with the status quo, and continue to keep innovations moving forward in order to obtain full satisfaction from our customers. As a selected supplier, we will continue to contribute to the maintenance needs of each customer by offering better maintenance services.