Facility Energy Saving System Utilizing Butics

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Abstract

Systems for visualizing energy usage amounts are being commercialized and disseminated by various vendors but the most important operation of visualization is to remain at the level of graphical information generation. NEC proposes the implementation of optimum energy-saving environments by the following acts: 1) Creating links to specific business type systems, 2) Developing technologies related to such systems as information collection and graphic information generation to evaluation/analysis, 3) Additional functions for the future such as control and consultation support by emphasizing compliance with energy-saving laws and regulations.

Keywords

energy usage quantification, visualization, EMS, BEMS, HEMS, SEMS
EcoForest, Butics, SAFEWARE

1. Introduction

Japan is currently endeavoring to achieve greenhouse gas emission reduction targets under its obligation to the energy-saving laws and regulations defined under national and local government legislation.

Recently, we have developed a "system for visualizing energy usage," hereinafter referred to as the "Facility Energy Saving System" as an energy saving solution based on the centralized monitoring system "Butics (Building total information and control system)."

The Facility Energy Saving system can provide a mechanism that brings about energy-saving effects based on interconnection of the central monitoring system (Butics) and the security system (SAFEWARE). Butics is a building management system featuring the centralized monitoring of facilities and equipment used in a building (air conditioning, lighting, sanitary, etc.). SAFEWARE is an entrance/exit management system that controls entrances/exits to a building as well as to individual rooms.

The Facility Energy Saving system has already been introduced at the NEC Tamagawa Solutions Center and its functions are being enhanced further in order to improve the effects of its introduction.

At the NEC Tamagawa Solutions Center, the operations department analyzes the data obtained by the Facility Energy Saving System in order to discover wasteful energy usage etc. and to support the creation of a mechanism that can promote energy-saving activities.

2. Development Policy of Facility Energy Saving System

The R&D of energy management systems (EMS) is recently being advanced in various fields. Among the types of EMS as listed below, we are introducing the energy-saving BEMS in this paper.

1) BEMS: Building energy management system
2) HEMS: Home energy management system
3) SEMS: Store energy management system

The BEMS has been used in conjunction with Butics but as an EMS it will in the future be capable of supporting the concept of a smart grid. As it is a "fusion of a mechanism for storing low tariff electricity and electricity generated using solar panels," the development policy of the Facility Energy Saving system will be to develop a mechanism that can visualize the amount of stored electricity and the amount of energy usage and thereby to contribute to the formulation of effective energy-saving activities.

3. Features of the Facility Energy Saving System

The Facility Energy Saving System has the following features.

- **First page**

The schematic view on the first page (**Fig.1**) shows the current environmental situation in the form of an "EcoForest." A GUI (Graphical User Interface) based on NEC's

Fig. 1 A Schematic top page of the Facility Energy Saving System at NEC Tamagawa Solutions Center.

universal design is used to implement a human-friendly display environment that includes depicted robot characters.

- **Acquisition of facilities load data**

In general, the energy usage amount is calculated by acquiring system load data such as for air conditioning, lighting and sanitary installations among domestic facilities. However, as the core function is usually not energy saving, it has often been impossible to acquire detailed information. The quantification of the amount of wastage that is necessary for the energy saving analysis requires fine sensing of the energy usage of domestic facilities. Therefore, we repeated studies so that the Facility Energy Saving System becomes capable of collecting detailed information by connecting wireless sensor systems, loggers, LON terminals, PLC and other equipment required for information collection to the load systems. For interconnection with the Butics, we implemented an information acquisition solution using the BACnet interface which is compatible for use with the competing vendors' systems.

- **Information storage and graphic display**

Regarding information storage, the Facility Energy Saving system can save data from up to 10,000 load systems and display them graphically as a basic function. Users can thereby identify the result of a required analysis at a glance.

- **Load system control system**

While Butics, provides a demand monitoring function that is utilized effectively by the user, the Facility Energy Saving system provides functions for controlling individual load systems from the perspective of an IT platform (via administrative web page). The discovery and control of waste that is made possible by this function is expected to enhance energy-saving efforts.

- **Energy-saving act support tool (Basic)**

The Japanese Energy Saving Act defines the management standards of the lighting intensity and air conditioning of buildings as well as of the facilities and equipment of factories. The Facility Energy Saving System complies with the management standards of the Energy Saving Act and is capable of analyses (graphic display generation) by identifying the circumstances of each load system.

- **Features to be available as proposed extensions**

1) Point getting competition: By using the principles of competition a sense of accomplishment will be given to users.

2) Area control: Personal control (lighting & air conditioning)

Time		8:30	9:00	9:30	10:00	10:30	11:00
Time division		Night	Preparation time				Business hours
Lighting SW	Kitchen lighting	Off	On →				
	Guest seat lighting	Off		On →			
	Indoor sign lighting	Off				On →	
	Passage lighting	Off				On →	
Air conditioning/ ventilation	Kitchen air conditioning	Off	On →				
	Guest seat air conditioning	Off				On →	
Kitchen	Cooker for noodle	Off		On →			
	Fryer	Off			On →		
	Electromagnetic cooker	Off			On →		
	Oven grill	Off				On →	

Fig. 2 Improvement program / management standards (Example of a restaurant).

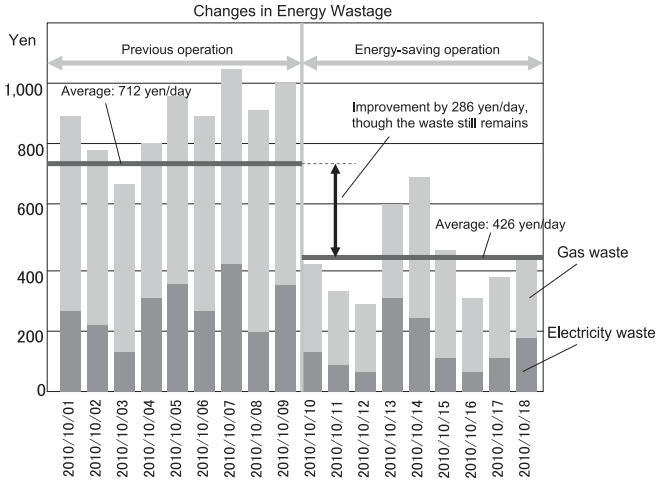

Fig. 3 Achievement analysis (Case of the restaurant shown in Fig. 2).

3) Energy-saving law/regulation support tool: Long- and mid-term programming and reports

Fig. 2 and **Fig. 3** show examples of the proposed functions for the Facility Energy Saving System (improvement program and achievement analysis based on management standards).

4. Differences between the Butics and the Facility Energy Saving Systems

The differences between the Butics and the Facility Energy Saving systems lie in "Who needs What for Which purpose."

1) Butics (Central monitoring system)

Used by a building administrator for managing the status of building facilities.

2) Facility Energy Saving System

Used by the personnel in charge of energy saving as well as general employees in their everyday energy-saving activities.

Consequently, the purpose of Butics is for the centralized monitoring and control of the status inside the building, and that of the Facility Energy Saving System is to visualize the situation of energy-saving management standard observance activities in real time and to enhance energy-saving awareness by promoting the enforcement of the requisite countermeasures.

5. Smart Building Solutions

We proposed the "Smart Building Solutions" in the latter half of 2010. This concept aims at providing solutions by positioning Butics and SAFEWARE as a foundation and to then combine the Facility Energy Saving System with them. The ultimate aim is the implementation of personal control, i.e., the provision of an optimum environment.

6. Introduction, Received Orders and Energy–Saving Effects

6.1 System Introduced in Obayashi Corporation Technical Research Institute (Main Building)

We developed a "hands-free entrance/exit and attendance management system" (hereafter referred to as the hands-free entrance/exit system) jointly with the Obayashi Corporation construction company and introduced it in the Technical Research Institute of the corporation (**Fig. 4**). Japanese entrance/exit management systems usually require a card to be held over a card reader device before permitting passage. However, the hands-free entrance/exit system makes it possible to enter or exit a building by authenticating the carried RF tag at each passage. Personal authentication is also used in interconnecting Butics with the personal air conditioning/lighting of each person's seat in the office. When the person is not in his or her seat, the air conditioning/lighting is automatically turned off in order to reduce the amount of electrical energy usage. It is expected that this solution will reduce CO_2 emissions by about 40%.

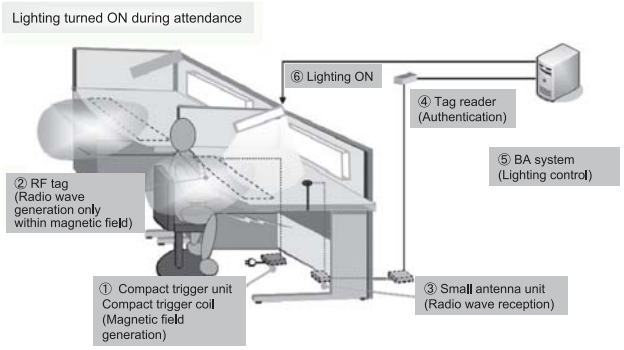

Fig. 4 Hands-free entrance/exit and attendance management system.

6.2 Facility Energy Saving System for Manufacturing Industry

The targets of the energy-saving study for the manufacturing industry cover all of the facilities at a factory and these include buildings such as the office building, assembly lines and space used by cooperating firms at the same premises. Since the facilities at the factory are used for a long period, it is usually fairly difficult to accurately quantify the load systems. Below, we will describe energy-saving techniques for the manufacturing industry.

- **Proposals for the manufacturing industry**

When a building such as a plant that has been running over a long period promotes energy-saving activities, it often makes do with the introduction of a simplified system by diverting the existing system because huge costs would be necessary if investment in or extension of facilities is under-

taken. The following are the proposals we made to company A.

1) Demand control of incoming power (Contracted power peak cutting)

Automated control of demand visual management by Butics.

2) Identification of electricity usage amounts of cooperating firms and of their energy-saving activities

Automatic power meter reading (Improvement of meter reading work efficiency).

3) Unnecessary power consumption (Discovery of wastage)

The administrator can discover power wastage using the visualization function of the Facility Energy Saving System and control power remotely via the web.

4) Awareness for energy-saving activities

The energy-saving target values are visualized based on the energy-saving law (definition of management standards) and enhancement of employee awareness, so that energy-saving activities of the employee participation type can be deployed.

For example, according to a provisional calculation, a manufacturing company possessing casting equipment that consumes electricity equivalent to 100 million yen a year can reduce the electricity cost by more than 10% by updating their system to a Butics one and by introducing a Facility Energy Saving System.

7. Future Issues

Following the obligations of the emissions trading system adopted following the Japanese Energy Saving Act, the Tokyo metropolitan government established a related code in 2010. The national government decided to make it mandatory to establish similar codes in Tokyo and three surrounding prefectures by April 2011 and it is said that the same policy will be expanded to major cities in Japan. With the emissions trading system, the energy saving shortfall would be compensated for by purchasing credits. As the introduction of the environment tax and a rise in the electricity price are also expected the indications are that businesses will be required in the future to adopt more active environmental measures.

With regard to the future, NEC is planning to develop and provide “algorithms,” or the basis and targets of control systems that will contribute to sustained energy saving procedures (strategic optimum environmental simulation) as early as possible.

8. Conclusion

As described above, we have interconnected the Facility Energy Saving System with the Butics and SAFEWARE systems and have enhanced their functions in order to accelerate energy-saving measures. The policy guiding us in the future will be as follows.

- **Continual enhancement of functions in accordance with external environmental concerns including conformity with the established energy-saving laws and regulations**

- Functional enhancement of the Facility Energy Saving System -

We also intend to enable visualization of management standards, simulation functions and consulting services, etc.

- **Provision of cloud-computing services**

It is our intension to standardize the platform, arrange its applications and to thereby aim at the provision of cloud-type services.

- **Challenge to overseas strategies**

We intend to develop systems that can be deployed in our overseas businesses such as those in China.

In closing this paper, we would like to express our gratitude to all persons concerned for their participation in the development of the systems represented in the Facility Energy Saving System.

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