

Featured Articles

Condominium EMS Based on Information and Control Technology

Tomotaka Shimojo
Yukiteru Kato
Hiroaki Sato
Hiroyuki Hatsuzawa
Yasuhiro Masuda

OVERVIEW: Since the Great East Japan Earthquake of March 2011, electric power consumers in Japan have been installing EMSs in recognition of the need for energy efficiency and power saving, and for ensuring sufficient energy during periods of tight supply. However, one of the obstacles to the wider adoption of these EMSs is that it is difficult for small-scale consumers and others on low-voltage supplies to gain an economic benefit from their installation. Condominiums represent one category of such consumers. To reduce their power use and encourage energy efficiency, Hitachi has developed an EMS for condominiums that consolidates management of each residence in the building.

INTRODUCTION

As part of its business supplying energy management systems (EMSs) to various different types of electric power consumers, Hitachi has released an integrated xEMS for facilities such as buildings or factories, and a “condominium energy management system” (condominium EMS) that covers both private and communal areas in the condominium.

Among the features of these EMSs is the integrated xEMS that provides equipment and applications to suit the objectives and purposes of building or factory managers, whereas the condominium EMS is designed to provide services to condominium residents (ordinary consumers).

This article describes an condominium EMS jointly developed by Hitachi, Ltd. and Hitachi Building Systems Co., Ltd., and looks at the issues associated with the wider adoption of condominium EMSs and the outlook for the future.

WORK ON SYSTEMS FOR CONDOMINIUMS

Hitachi, Ltd. commenced sale of a security management system for condominiums in 2001. To date it has supplied access control services for both the communal and private areas of condominiums, including the use of smartcard authentication for entering the premises, to more than 60,000 residences. In collaboration with Hitachi Building Systems, Hitachi, Ltd. also operates a continuous 365-day service infrastructure, having

established two customer centers and more than 350 maintenance sites around the country.

Since the Great East Japan Earthquake of March 2011, policies for ensuring energy supplies have required efforts to be made not only by suppliers of electric power, but also by consumers. There has also been a public sector initiative relating to systems for condominiums, in the form of a project that commenced in FY2013 run by the Ministry of Economy, Trade and Industry to promote the installation of condominium EMSs (a project to accelerate implementation of smart mansions). By managing energy in ways that link residences together, the condominium EMS installation business not only encourages energy savings across entire condominiums, but it can also be expected to provide added value to residents, including the benefits of saving electricity.

Given this background, Hitachi’s condominium EMS development included integrating with the existing security management system and expanding its services to encompass systems for condominiums.

SYSTEM IMPLEMENTATION UTILIZING INFORMATION AND CONTROL TECHNOLOGY

Overview of Condominium EMS Functions

The newly developed system for condominiums combines both energy and security management functions. It is configured in a way that allows services

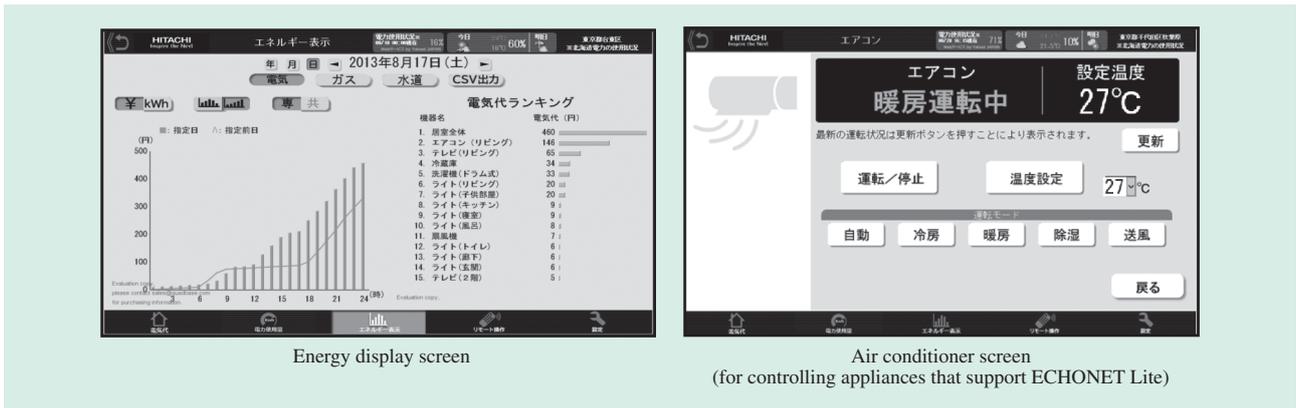


Fig. 1—Web Screens for Services to Individual Residences.

The service provides screens that allow each residence in a condominium to view its energy use, control home appliances, and so on.

to be selected from among the available functions in order to suit customer budgets and requirements.

The main energy management functions that the condominium EMS provides for individual residences are as follows (see Fig. 1):

- (1) Measurement and presentation of energy use
- (2) Remote control of appliances that support ECHONET Lite*1
- (3) Setting of energy use targets and alarm notifications

- (4) Distribution of e-mails requesting emergency power savings at times of tight supply

The main energy management functions for communal areas are as follows:

- (1) Measurement and presentation of energy use
- (2) Remote control of air conditioning, lighting, and other utilities

*1 ECHONET Lite is a registered trademark of the ECHONET Consortium.

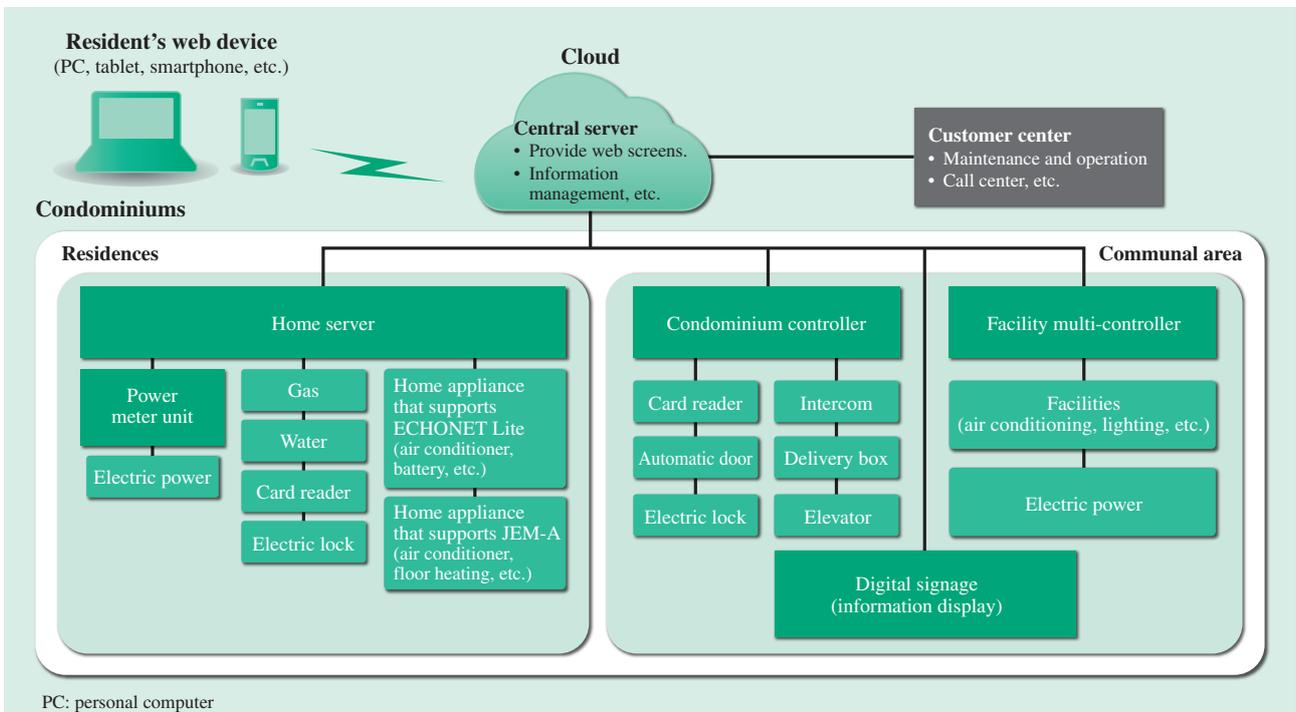


Fig. 2—Block Diagram of Condominium System.

The condominium system has a cloud-based configuration consisting of a central server with residence and communal area devices in the condominium connected via a network. The residence devices consist of a home server and a power meter unit and the devices for communal areas consist of a condominium controller, a facility multi-controller, and an information display for digital signage. The home server combines both energy management and security management functions. The facility multi-controller and condominium controller provide energy management and security management functions, respectively.

- (3) Automatic control of equipment during times of tight electric power supply
- (4) Use of digital signage to encourage power saving

The system also includes existing security management functions that are not covered here.

Ensuring Reliability of Cloud Service

The condominium system has a cloud-based configuration that consists of a central server with residence and communal area devices in the condominium connected via a network (see Fig. 2).

The functions of the central server that manages the condominiums includes providing web screens for performing actions such as viewing power use or remotely controlling equipment, exchanging information with residence and communal area devices, and various forms of information management. The security of the cloud system is ensured by implementing countermeasures against web application vulnerabilities and by encrypting data such as residents' e-mail addresses or passwords. The system also uses virtualization and redundancy for the central server to ensure fault tolerance. To prevent unauthorized external access when web screens are used for the remote control of equipment connected to residence and communal area devices, these devices are designed to only accept control commands from the central server via encrypted communications.

Configurable Devices to Suit Customer Needs

Whereas past residential devices have only supported security management functions, Hitachi has developed a new home server and power meter unit that also support energy management functions (see Fig. 3).

The exit security management functions included in the home server are a card reader interface (I/F) used for smartcard authentication and an electric lock I/F for door lock control. The energy management functions consist of a local area network (LAN) I/F to the power meter unit that handles power measurement at the distribution board, a pulse input I/F for gas, water, and other meters, and a control adaptor I/F for the control of appliances that support standards such as JEM-A and ECHONET Lite.

Because it incorporates so many I/Fs, the home server allows residences to combine services from a wide range of options. And, integrating both energy and security management functions into the same device saves space and cuts device costs.

The power meter unit, which uses a current transformer installed on the residence's distribution

board to measure power use, was developed as a separate device from the home server. To make efficient use of space and to minimize wiring requirements, it has been designed to be small and to offer a choice of either a fixed-wire or wireless LAN connection to the home server. This facilitates installation in existing condominiums where it can be difficult to find space for the unit and install additional wiring.

For communal areas, the system uses a facility multi-controller that is already used as an energy management device in factories and other buildings, and a condominium controller that is already used as a security management device for condominiums.

The facility multi-controller includes a contact output I/F for equipment control, a LonWorks^{*2} I/F, and a pulse input I/F for energy meters. It provides functions such as displaying information about energy use and controlling equipment remotely by exchanging information with the central server.

The condominium controller has I/Fs for connecting to card readers, automatic doors, electric locks, intercoms, delivery boxes, elevators, and other condominium facilities. Its functions include using a card reader for smartcard authentication to unlock doors (automatic doors and electric locks), displaying information on the lobby unit of the intercom, and temporarily lifting security to allow use of delivery boxes or elevators.

^{*2} LonWorks is a registered trademark of Echelon Corporation registered in the United States and other countries.

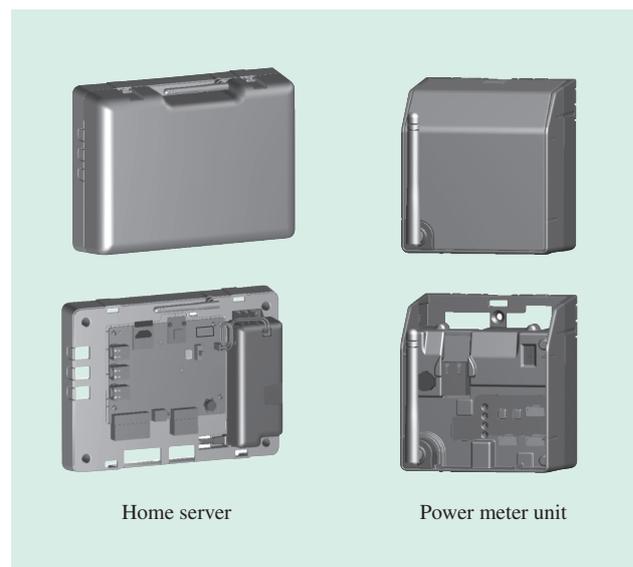


Fig. 3—Home Server and Power Meter Unit.

The home server and power meter unit are designed as separate devices in order to provide flexibility in terms of where they are installed.

Since the amount of communal equipment differs depending on the size of the condominium, the facility multi-controller and condominium controller do not share common hardware. Instead, their design allows a choice of how many units to install depending on factors such as the type and quantity of facilities. They also support a digital signage service for communal areas. Using a display installed at the condominium entrance or other location, this can be used for applications such as encouraging awareness of power saving among residents or providing them with information such as news and weather reports.

ISSUES WITH WIDER USE OF CONDOMINIUM EMSS

As property developers become more concerned about issues such as energy and the environment, the number of condominiums that proactively install condominium EMSs is increasing.

If condominium EMSs are to be used more widely, there is a need to go beyond simply saving power through equipment control or by presenting information on energy use, to providing added value that will contribute to the saleability of condominiums. Furthermore, with electricity deregulation anticipated to expand the number of choices for residents and lead to more intense competition, other important

factors will include the establishment of regulatory frameworks and the development of services that lighten the burden on residents and deliver the benefits of system installation.

FUTURE OUTLOOK

Hitachi aims to raise awareness of power saving among residents through measures such as setting targets for energy use and integrating these with digital signage, and to improve the benefits to residents of installing these systems by, for example, working with service providers (electric power consolidators) who can supply power to an entire condominium at lower cost via a shared high-voltage connection. Hitachi also intends to offer incentives to encourage power saving so that services will continue to be used after the system is installed, and to offer additional welfare services, particularly for the elderly.

CONCLUSIONS

This article has described Hitachi systems for condominiums, particularly condominium EMS functions.

In the future, Hitachi intends to continue adding value to condominium systems to offer convenient services that are safe, secure, and trouble-free.

ABOUT THE AUTHORS



Tomotaka Shimojo
Security System Engineering Department, Security & Energy Solutions Division, Urban & Energy Solutions Division, Infrastructure Systems Company, Hitachi, Ltd. He is currently engaged in the planning of security and energy solutions.



Yukiteru Kato
Security System Engineering Department, Security & Energy Solutions Division, Urban & Energy Solutions Division, Infrastructure Systems Company, Hitachi, Ltd. He is currently engaged in the promotion and engineering of security and energy solutions.



Hiroaki Sato
Security System Center, Security & Energy Solutions Division, Urban & Energy Solutions Division, Infrastructure Systems Company, Hitachi, Ltd. He is currently engaged in the development of security and energy management systems.



Hiroyuki Hatsuzawa
Security System Center, Security & Energy Solutions Division, Urban & Energy Solutions Division, Infrastructure Systems Company, Hitachi, Ltd. He is currently engaged in the development of security and energy management systems.



Yasuhiro Masuda
Service Platform Development Department, Security & Energy Solutions Division, Urban & Energy Solutions Division, Infrastructure Systems Company, Hitachi, Ltd. He is currently engaged in the development of security and energy management systems.