

# Approach to Smart House Services

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Major house builders had been playing the central role in developing smart houses as residences that offer safe, secure and affluent lives. However, since the Great East Japan Earthquake, power shortages have become a serious problem and more and more entities have been introducing home energy management systems (HEMS) as a way to be self-sufficient in terms of energy and save energy in the event of a disaster. Also, consumer electronics makers and housing equipment makers have been proceeding with the development of new appliances in order to realize energy saving, energy creation and energy storage solutions for the home. One research company predicts that the market size of Japanese smart houses will reach 4000 billion yen by 2020. This paper describes the solutions that can realize Fujitsu's Smart House services which connect homes with society and communities via information and communications technology (ICT), and also create services that increase residents' QOL.

## 1. Introduction

Initially, major house builders had been playing the central role in working on smart houses to develop and release new products such as home energy management systems (HEMS) for the prevention of global warming and realization of a low carbon society.

However, in the wake of the Great East Japan Earthquake, power shortages have become a serious problem and smart houses, which are not only capable of meeting the recent needs for energy saving and reduced power consumption but also achieving "improved energy self-sufficiency" by making use of renewable energy, are attracting attention. This leads to use of devices such as photovoltaic (PV) power generators and storage batteries, controllable consumer electronics such as air conditioners and lighting fixtures, and smart meters and electric vehicles (EVs) expected to become widespread in the future, which can be connected to smart houses, allowing advanced linkage by means of HEMS devices.

In order for smart houses to support various services including home security, home healthcare and monitoring services in addition to visualization of energy, remote control and monitoring of consumer electronics must be realized, and this requires platform

software and hardware to be developed for home networks. The ECHONET Consortium,<sup>1)</sup> founded in 1997, has established the ECHONET Standard as one piece of platform technology. The ECHONET Standard is a common communication standard for connecting consumer electronics from different manufacturers to allow for easy provision of various services on networks for newly built and existing houses alike and it has been approved as an international standard.

This paper describes the Smart House services that Fujitsu has created by realizing a home network connecting a house, people and devices, or services for improved quality of life (QOL), and solutions capable of realizing smart houses that increase added value of living.

## 2. Trend of smart house market

The year 2011 is called the first year of smart houses in Japan. Initially, smart houses attracted attention in that they contribute to the prevention of global warming and realization of a low carbon society. Since the Great East Japan Earthquake, however, their function to allow energy self-sufficiency by energy creation and storage in the event of a disaster has become the focus of attention, leading to a rapid succession

of products related to smart houses being released by various companies. The smart house business has enjoyed the participation of players from a variety of industries such as consumer electronics manufacturers, housing equipment makers, communications manufacturers and automakers in addition to house builders up to now. The scale of the market related to smart houses in Japan is estimated to be 1.2443 trillion yen for 2011 and reach 3.4755 trillion yen in 2020.<sup>2)</sup>

However, different companies developed individual proprietary specifications for the purpose of differentiation, and this has made it difficult to connect devices unless they are made by the same manufacturer, resulting in a high-cost house that can only be afforded by a limited number of wealthy people because of the need for customization.

These situations have been changing since February 2012, when ECHONET Lite, a communication protocol established by the ECHONET Consortium, was approved by the Ministry of Economy, Trade and Industry (METI) as the standard protocol specifying a data communication procedure between HEMS-related devices.

In May 2013, the JSCA<sup>3)</sup> Smart House/Building Standardization and Business Promotion Study Group specified operation guidelines for the B route<sup>note 1)</sup> to provide power and other usage information from smart meters to the HEMS, paving the way for full-scale dissemination of smart meters for ECHONET Lite communications. Tokyo Electric Power Company aims to deploy about 17 million smart meters by fiscal 2018 and cover all the households it serves (27 million) by fiscal 2023. Kansai Electric Power Company also plans to complete smart meter deployment for all the households it serves by fiscal 2023 and the market for devices and services related to smart houses is likely to further expand.

In this market situation, HEMS is apparently going to play the key role in the promotion of smart houses in the future. The Smart House Information Platform Standardization Forum (eSHIPS)<sup>4)</sup> has defined a smart house as "devices capable of intelligent demand management of consumer electronics, housing equipment, energy creation devices (PV generators and fuel cells), energy storage devices (including stationary storage

batteries and EVs), etc. and a system platform that connects them." HEMS provides a network for connecting these devices in a house and control for intelligent energy management via a network and plays the role of a "control tower" at home.

Furthermore, it seems that the role taken on by HEMS in the future is not limited to a function to adjust energy supply and demand. In the housing market in Japan, demand for new construction is inclined to decrease due to the impact of the declining birthrate and aging population and the age of "surplus houses" has already begun with the total number of houses larger than the total number of households. Society has stopped focusing on increasing the "quantity" of housing supply and stopped seeking "quantitative satisfaction" (flow-oriented society) that had been growing via the scrap-and-build approach. Together with support in terms of policies such as the Long-life Quality Housing system, society is making a sea change to seek "qualitative satisfaction" (stock-oriented society). From now on, the "quality" of housing that can be used for a long time by maintaining the existing house will gain importance. Under these circumstances, HEMS is expected to take on the role of controlling the financial aspects of living, along with the safety, security and comfort of residents according to their lifestyles. This is because HEMS has the potential of being able to control all devices related to the house.

METI has specified a smart meter B route,<sup>note 2)</sup> PV generator, storage battery, fuel cell, EV/plug-in hybrid vehicle (PHV), air conditioner, lighting fixture and water heater as the eight priority devices for HEMS interconnection but the linkage potential of HEMS is not limited to these devices. In addition, HEMS can potentially connect to all house-related devices including a surveillance camera, temperature/humidity/illumination sensor, earthquake sensor, electric door lock,

note 1) Route from smart meters to the HEMS in a building.

note 2) A smart meter is a measuring instrument that can digitally measure consumption of electric power or such like, it has a communication function installed and one unit is installed per house. This communication function makes it possible for the smart meter to connect with electric power companies and with customers via a network. The network that connects a smart meter and a HEMS is called the "B route." And the network that connects a smart meter and a power company is called the "A route."

electric blind and bath/body fat scale and its presence is expected to increase as the core device that improves QOL. In the future, the market for various house-related services including those for safety/security of living, comfort, health, crime prevention and monitoring will develop from HEMS as the starting point.

### 3. Fujitsu's idea of smart house

Fujitsu has proposed a vision for a new society called a Human Centric Intelligent Society and states its idea of how information and communications technology (ICT) will contribute to future business and society in the Fujitsu Technology and Service Vision.<sup>5)</sup> It presents the "new role of ICT" as accelerating removal of complexity and bringing about social innovation and business innovation.

In the field of smart houses, consumer electronics are becoming increasingly advanced and diverse as is shown by energy generation and storage devices. In addition, devices such as smartphones have become widespread and an environment that offers availability of a network service anytime and anywhere is being put in place. Meanwhile, lifestyles are becoming diversified and needs of consumers come in an infinite variety. The role of ICT for improving the QOL of people living in these conditions is to equip the house with information and create and offer new value from that information. To equip a house with information, a home network platform is required on which devices and sensors are connected and their use and status are computerized for management. The information collected is intended for speculating about the diversified lifestyles and needs, which will be the key to improving the QOL.

With the aim of promoting home network platform deployment, developing technology for making use of the key information, collaborating with business partners that take advantage of the technology and offering new value to residents, Fujitsu is working on the smart house business. The following section describes our first approach.

### 4. Cloud-type HEMS service: Enetune-Home

Fujitsu agreed to develop and operate a smart community business jointly with Mitsui & Co., Ltd. and established a new joint company together called Future

City Solutions Ltd. on December 12, 2012.

Activities of Future City Solutions have started with commercialization of HEMS through the provision of the cloud-type energy management solution developed by Fujitsu for houses across the country via business channels developed by Mitsui. Then, it intends to collect and store data obtained from the solution, and such data can be utilized for creating new resident services such as those related to healthcare, welfare and administration, leading to the realization of a local energy management service business in the future.

Based on this concept, Future City Solutions offers Enetune-Home, a cloud-type HEMS service.

#### 4.1 Purpose of provision

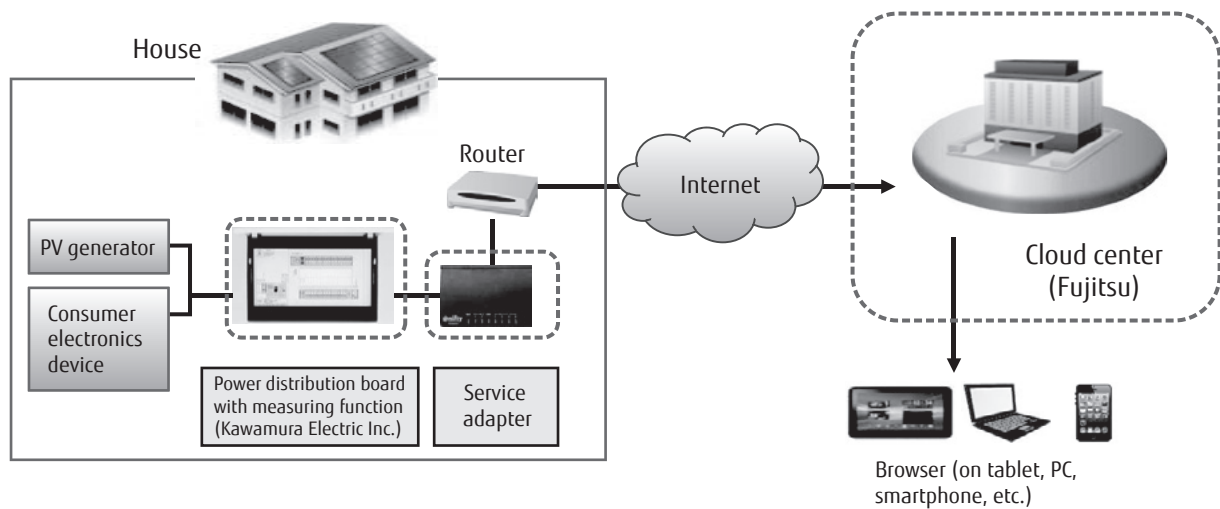
As the initial service, Enetune-Home mainly provides visualization of electric energy information in a house. The electric energy information for the entire house and each circuit (connection) of the power distribution board (such as the living room, air conditioner and PV generator) is collected from the power distribution board with a built-in power meter through a virtual private network (VPN) to be stored into the center. The stored electric energy information is in turn processed and aggregated for calculating approximate electricity rates to generate information for visualization. The generated information for visualization can be graphically displayed with a browser on a PC, tablet, etc. so that a service can be provided that helps people to save energy. The business of Future City Solutions will be in the form of selling services to house builders and construction firms and the management functions for the services must be offered as well.

#### 4.2 Enetune-Home system overview

**Figure 1** is an overview of the system configuration that realizes the service. Offering of the service is premised on providing consumers with combinations of the following devices and services.

- Power measuring device that supports ECHONET Lite
- Internet line connection service
- VPN connection device
- VPN service
- Display device

The Internet line connection service is open



**Figure 1**  
System configuration overview.

and there is no restriction. The display application is developed in compliance with HTML5, which allows information to be viewed with devices such as PCs and tablets.

For the power measuring device that supports ECHONET Lite, VPN device and VPN service, we discussed with Future City Solutions and conducted connection verification with the following service and product as the initial recommended device and service.

- Personal L2 Cloud service of NIFTY Corp.
- en Station EcoEye series of Kawamura Electric Inc.

Services of Future City Solutions are offered as combinations of the devices and services mentioned above.

### 4.3 Features of Enetune-Home

The following describes three features of Enetune-Home.

First, it is provided as a cloud-type service. While it is initially provided as an electric energy visualization service, by making use of the information and combining it with other types of information, we intend to create new resident services in the future. These services will become more convenient by offering them as network services and we have decided to provide a cloud-type service in view of its scalability.

The second point is that, as mentioned in the system overview above, the support for ECHONET Lite has allowed the service to be independent of specific

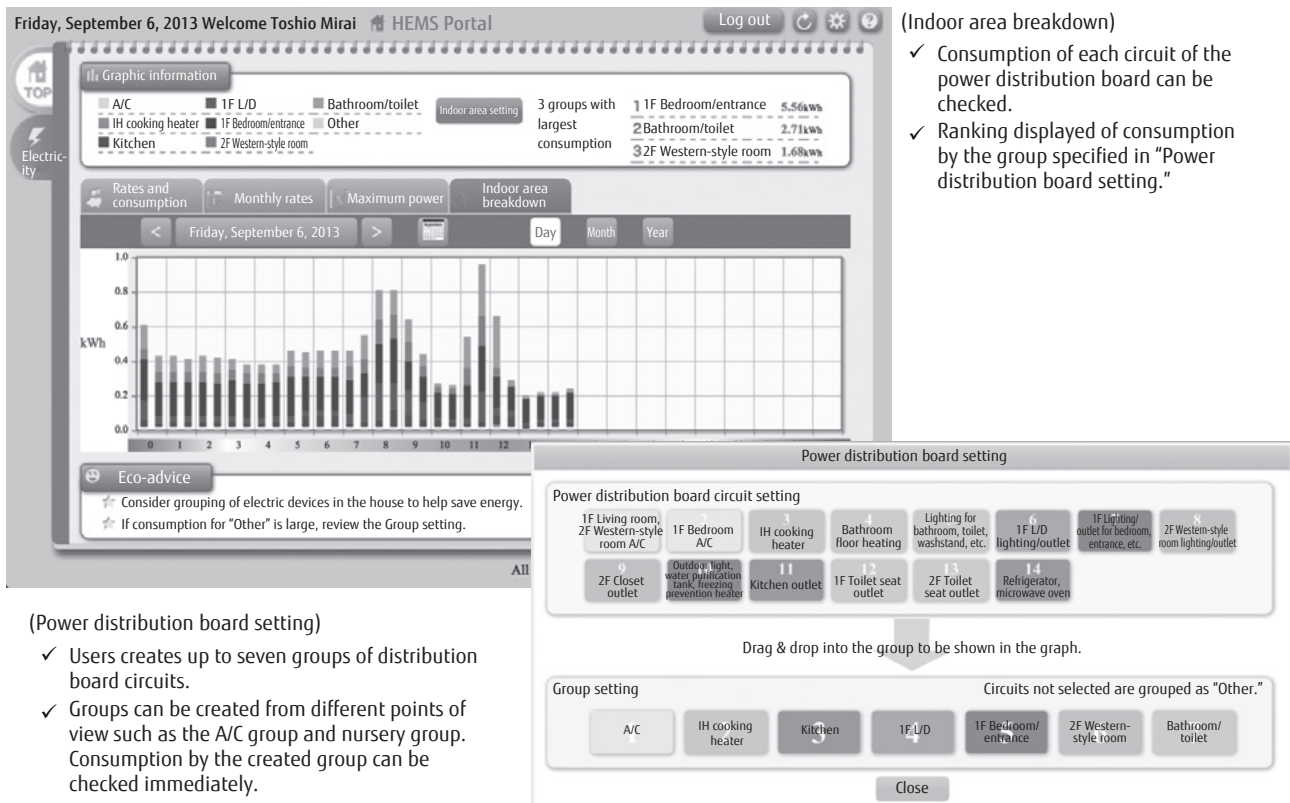
devices. In reality, the service will be provided after trouble-free operations with connection devices have been verified. In view of providing services to various businesses, an open linking system is effective.

The third feature is the visualization service that is initially offered. It is capable of acquiring electric energy information for each circuit of the power distribution board as shown in **Figure 2** and detailed visualization and analysis for the respective rooms and consumer electronics devices is possible. Specifically, it allows consumers to group circuits of the power distribution board in order to check electric energy information. For example, electric energy information for each room can be compared between days, months and years, thus achieving a system that allows consumers to be aware of their electricity use, for example allowing them to see that “the energy consumed in the living room yesterday was higher than usual.”

### 4.4 Functions of Enetune-Home

The following describes the functions offered by Enetune-Home.

- 1) Collection/storage of electric energy information  
Various types of electric energy information are collected from power measuring devices connected with the indoor power distribution board and stored for a certain period.
- 2) Graphic display of electricity rates and consumption



**Figure 2**  
Service to visualize household energy use.

Power consumption for each month of a year, each day of a month and each 30-minute period of a day ("year/month/day") and approximate rates calculated based on the power consumption are graphically displayed.

3) Graph of monthly rates

Electricity rates for one month from the first day to the end are approximately calculated for graphic display.

4) Maximum power usage

Maximum instantaneous current for year/month/day is graphically displayed.

5) Graph of PV power generation status

When PV generation equipment is connected to the power distribution board, the power sales value (metered portion only) for year/month/day is graphically displayed.

6) Grouping for each branch circuit of power distribution board

Indoor area/device/display name are specified for

each circuit of the power distribution.

7) Display of power distribution board circuits by group

Power distribution board circuits are grouped and electric energy information for year/month/day by the group is graphically displayed.

8) Ranking display

Ranking is displayed based on the information collected/stored.

## 5. Future developments

Lastly, this section describes future developments of the smart house business rolled out by Fujitsu.

First, we will develop the cloud-type HEMS service to promote visualization of household energy and energy saving by guidance for energy use. This service can significantly reduce the development and operation costs borne by middle-ranking construction firms and builders that do not offer or commercialize HEMS services. Meanwhile, dynamic data including energy

data obtained from HEMS and static data such as house performance values and house history data can be combined for analysis, which will indicate the performance and deterioration state of the house and can be used for new stock services such as renovation. In the future, in line with the dissemination of consumer electronics compliant with ECHONET Lite, we intend to offer functions to further improve the convenience of consumers such as remote control of consumer electronics.

For discussing the services, we find the following three perspectives important.

1) Economy

A system that allows comprehensive management and maintenance/operation of devices for achieving energy creation/storage in general households for the purpose of demand and supply balancing of limited resources and sustainable society

2) Habitability

A system that contributes to preparedness against disasters and safety/security in the wake of the Great East Japan Earthquake of 2011

3) Sociality

Realization of houses that can be used comfortably for long periods according to the lifestyles of residents in view of the focus on existing houses due to the declining birthrate and aging population as well as decreased number of households

Then, we will make use of these features to launch new businesses and discuss provision of services.

1) My house business

Overall management ranging from room arrangement to introduction of objects including facilities and consumer electronics and their installation and maintenance

2) My life support business

Support for smartification of daily lives of residents

3) Life planning support business

Support for smartification of the house and lives of the family including history of action and financing

## 6. Conclusion

We are introducing solutions that can realize Fujitsu's Smart House services which connect homes with society and communities via information and communications technology, and also creating services that improve residents' quality of life.

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