Smart Houses – HEMS Initiatives –

— *Certification of Smart Meter Communication* —

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1. Introduction

This article introduces the situation of smart electric energy meters in Japan, especially with regard to their certification.

Since meters are thought to be a key element of smart houses, it has been decided that they must be able to work closely with HEMSs (Home Energy Management Systems). However, meters are only provided by electric power companies, whereas HEMS services will be provided by other companies via open markets. This means that the meters are public goods installed in all houses and shared by many related businesses. In this regard, securing the interoperability and communication performance of these devices is of key importance in creating an environment for cooperative services.

A smart meter consists of three parts: (1) an electric power meter that has been certified based on the Measurement Act, (2) a communication unit that carries information between the meter and the electric power company (using communication methods specific to this particular company), and (3) a communication unit that provides data to the HEMS. As previously described, the communication units for (3) must all use the same standard protocol defined by the industry in Japan, and are required to pass SMA certification (to certify compliance of the smart meter's application layer) to ensure conformity.

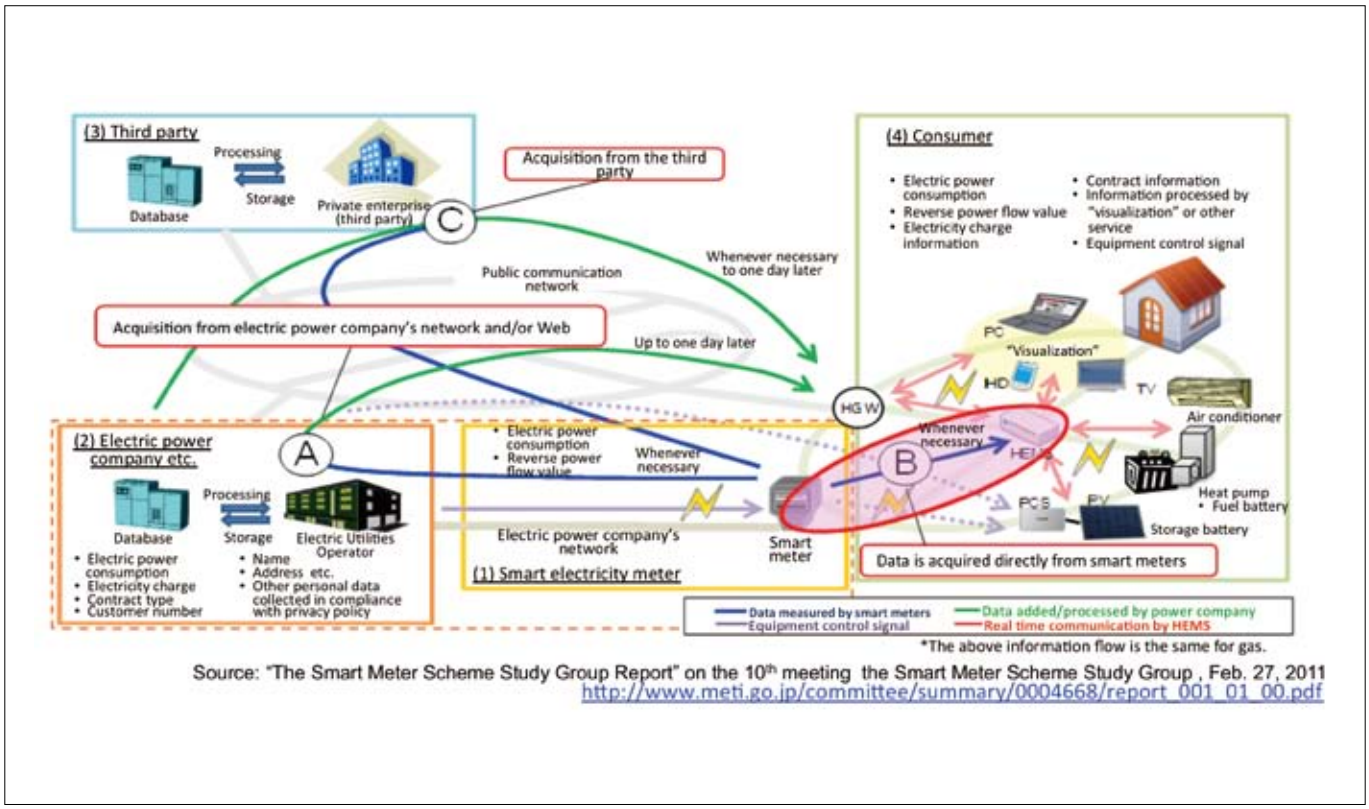
SMA certification has been in operation since April 2014. As a result, certified smart electric energy meters have been installed in limited areas since September 2014 by Tokyo Electric Power Co., Inc., and since the October 2014 by Chubu Electric Power Co., Inc.

The following sections present the background of smart meter certification, the framework of the certification, and the future prospects.

2. Background: Smart Meter Route B

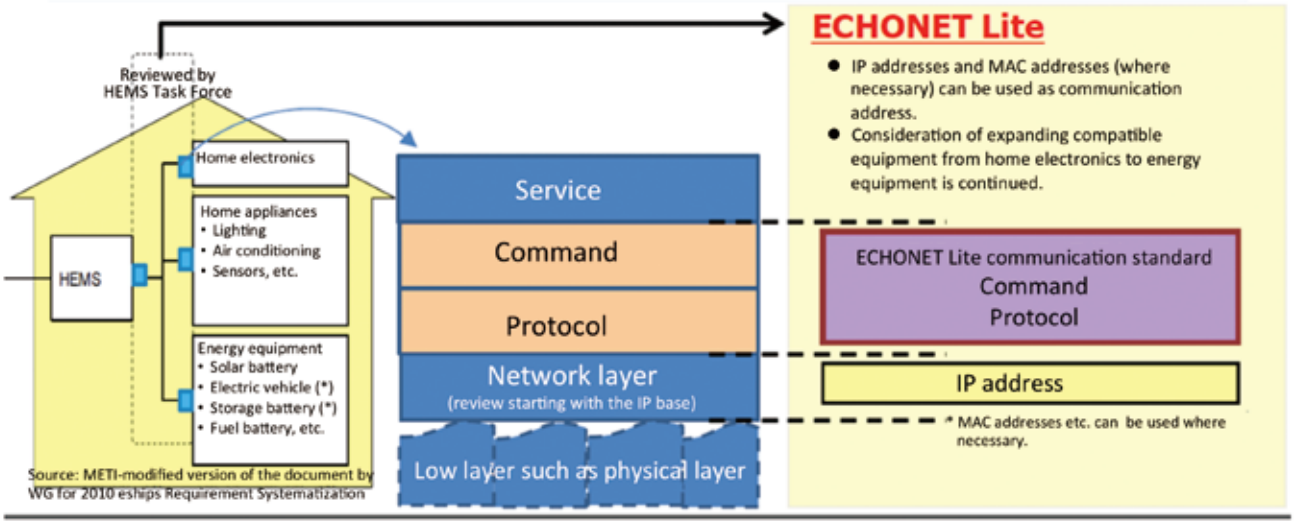
In this section, we first explain what are meant by the terms "smart meter" and "route B", and we discuss the significance of route B (the target of the certification).

Figure 1: Routes for Smart Meter Communication



Source: "The Smart Meter Scheme Study Group Report" on the 10th meeting the Smart Meter Scheme Study Group , Feb. 27, 2011
http://www.meti.go.jp/committee/summary/0004668/report_001_01_00.pdf

Figure 2: The position of ECHONET Lite in a HEMS



Source: Interim report (draft) by Smart House Standardization Study Group
http://www.meti.go.jp/press/2011/02/20120224007/20120224007-2.pdf

A smart meter is generally defined as an electronic meter that is equipped with a bidirectional communication function that allows the electric power company to read the meter and, if necessary, operate a breaker remotely. Such meters are also expected to create cooperative services with HEMSs.

A more detailed description can be found in a report by the Smart Meter System Study Group [1], which was established in May 2010 to discuss the basic concepts of smart meters, their introduction, and their future prospects. This report set the direction of smart meter deployment in Japan and triggered their introduction.

The smart meters being introduced on a wide scale in Japan are capable of cooperating with HEMSs. Another significant point is that all smart meters communicate using the same protocol, allowing any private company or electric power companies to access the same information in a common format. It is therefore no exaggeration to say that the smart meters in Japan are revolutionary, cutting-edge devices.

Here we describe the communication routes whereby data is obtained from smart meters. Currently, there are three routes, called routes A, B and C. Figure 1 shows a conceptual illustration of each route.

These routes were set forth in the report by the Smart Meter System Study Group. Route A is the route used by electric power companies, mainly to obtain meter data for billing. Route B is a newly introduced route, with which the meter data can be obtained directly from the meter by household equipment. Route B has the following three noteworthy characteristics:

i) Its data is no different from the data obtained via route A (i.e., identical to the electric power meter information for billing).
ii) Ordinary consumers are able to obtain this data with relatively little expense and effort.
iii) It provides better real-time data on electric power consumption than route A.

Point i) was published in the distributed material of the 14th Smart Meter System Study Group meeting, and was underwritten by the Ministry of Economy, Trade and Industry. For electricity providers, especially new entrepreneurs, this is the most important point in researching businesses that utilize the route B information. Of course this information is also useful for helping ordinary consumers save on their electricity bills.

As for point ii), a HEMS controller device that has gained SMA certification for route B is necessary to obtain data from the smart meter. In general, route B communication is scheduled to start earlier than route A. (Figure 2)

Those characteristics are premised on an open standard and secured by third-party certification. The communication protocol in route B, ECHONET Lite, is an open standard, which means that all sorts of information related to route B are published, and the essential data set is identical across the smart meters of all electric power companies. The ECHONET Lite specifications are published by the ECHONET Consortium [2]. Guidelines to the configuration and operation of route B have also been published by a committee [3]. It has thus been ensured that all the necessary information for conducting business related to route B is publicly available.

With regard to point iii), it is worth noting that route B also provides data on the instantaneous electric power consumption, which shows how much electricity is being consumed by the

whole household at any particular moment. This information is almost useless without real-time handling, so route B is the only way it can be delivered. As described in the use cases shown in the guidelines, if consumers are presented with information about their instantaneous power usage through a HEMS (or are able to fetch this information at will), then they can be expected to take energy/electricity-saving actions such as turning off unnecessary appliances or adjusting the temperature settings of air conditioners. Alternatively, a warning message can be issued when too much electricity is being used, which can be useful for preventing circuit breakers from tripping unexpectedly.

The other information that can be obtained via route B, such as the cumulative energy consumption measured at every fixed period of time, and the current time, are fixed so as to be identical to the information used for billing that is obtained via route A. Other information related to billing, such as billing rates, is not currently available via route B, although new entrepreneurs entering the electricity retail business are expecting this situation to change in the future.

3. Framework of Route B Certification

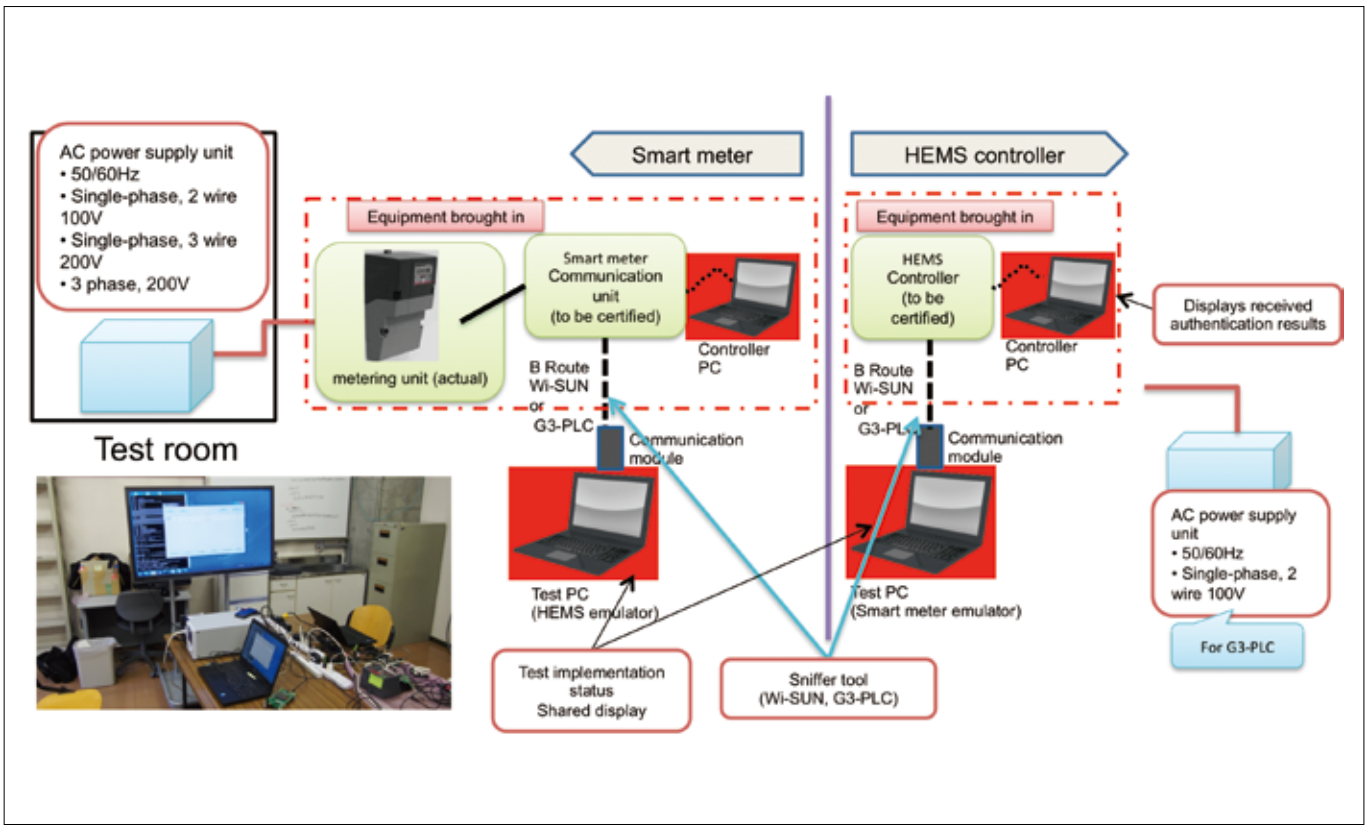
So far we have explained the characteristics of smart electric power meters and route B. In this section, we describe the framework of certification according to the guideline [3].

A key point is that it requires the following three forms of third-party certification:

i) Certification of the lower communication layers (media part),
ii) ECHONET Lite certification (protocol layer of ECHONET Lite), and
iii) SMA certification (application layer of ECHONET Lite).

For i), the guidelines specify eligible methods for the physical layer and the layers below layer 4, and two methods are adopted by the electric power companies. The primary communication method is 920 MHz wireless communication (Wi-SUN(IP)) and the complementary method is power-line communication (G3-

Figure 3: SMA certification test system



PLC). A third-party certification test ensures conformity up to layer 4 (UDP) including the physical layers. Certification of both communication methods has already started.

For ii) and iii), the HEMS Certification Support Center at Kanagawa Institute of Technology has been named as the third-party certification organization by the ECHONET Consortium [4], and started providing certification in April 2014. For the purpose of securing conformity and interoperability, the center requires that the actual devices are submitted for both smart meter and HEMS controller testing.

Figure 3 shows the configurations of the SMA certification test system.

Note that all the three certifications must be granted in the correct sequence. After successfully completing the SMA certification test, a registration certificate is issued and the device is publicly listed on the ECHONET Consortium web site.

As of 12th February 2015, there are already 19 devices that have achieved SMA certification and registration (eleven smart meters and eight HEMS controllers), and this number will grow steadily when smart meters are introduced in earnest.

The HEMS Certification Support Center at Kanagawa Institute of Technology is also performing interoperability tests (IOTs) on SMA certified and registered devices. By introducing the actual smart meters from multiple electric power companies, an IOT laboratory is provided to the applicants for SMA certification. These interoperability tests are indispensable to developers because they make it possible to provide customers with services that are reliable but are also differentiated from the services offered by other companies.

4. Future Prospects

Environmental measures for the full-scale introduction of smart meters are now in an advanced stage of preparation. From now on, service providers are expected to clearly present the merits of improved interoperability. The government's involvement will probably shift towards the study of new services valuable to consumers, and how to facilitate those businesses.

Converting the smart house market to an open platform business is essential for the growth of this market. ECHONET Lite is an open platform and occupies a key position. The government is focusing its efforts on the cultivation of new business associated with smart houses through this platform.

In the future, it is expected that various new forms of business will emerge to make use of electricity usage data, especially data gathered through smart meters and HEMSs, and to provide related services. In particular, since there will have to be many services rooted in a particular region, we think that there is a pressing need for the cultivation of HEMS integrators that can respond to the needs in each region and provide their residents with the services they require. This is a new form of business that is expected to create circumstances that will cultivate housing ventures in housing business areas. This would take the form of a HEMS integrator service as a professional fusion of network technology and residential services.

The introduction of smart apartment blocks (condominium energy management system; MEMS) is also being promoted. The smallest unit of a MEMS is a HEMS, and the application of ECHONET Lite to small-scale BEMS such as tenant buildings is also being studied. In the future, this market is expected to grow in the same way as for smart houses.

At the same time, the emergence of many products and services that are useful to users (residents) will also be required. It is essential to create "living innovation" in order to realize smart houses that are of value to the people that live in them. It is essential for smart houses to provide a new kind of living environment that nobody has experienced before, where household electrical appliances, facilities and IT equipment work together cooperatively.

Finally, we would like to send a message to all businesses that are responsible for the growth of smart houses in the future.

As a major step towards the introduction of smart houses throughout Japan, smart house (HEMS) businesses based on the ECHONET Lite open standard interface have now started. This highly significant development demonstrates that initiatives such as the use of open standards, the open publication of various guidelines, and the creation of a third-party certification scheme have resulted in an environment where anyone can participate, and in the future we will promote activities to facilitate the creation of an open HEMS platform that will benefit everyone.

We are looking forward to seeing how things turn out in the future.

REFERENCES
[1] Report of the Smart Meter System Study Group
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[4] Smart House Research Center Web Site
(http://sh-center.org/hemsinfo/1755)