



NEC's Contribution to Advanced Metering Infrastructures (AMIs)

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Abstract

Under the accelerating replacement of traditional analog electricity meters by smart meters featuring digital measurement and communication functions, the Japanese power companies made RFP (request for proposals) aiming at open procurement and the dissemination of the metering and communication block of the Advanced Metering Infrastructures (AMIs). This paper reviews the methodology and achievements of NEC with regard to AMI business procedures. It will attract the attention of power companies because of its potential for improving the efficiency of their operations and services for customers.

Keywords



smart meter, Advanced Metering Infrastructure (AMI,) lead management company, RFP, multi-hop method, 1:N method, Wi-SUN, ECHONET Lite, HEMS.

1. Introduction - Japanese Domestic AMI Market

After making requests for proposals aimed at open procurement and the dissemination of AMI metering and communication blocks, Japanese power companies have received a wide range of technical proposals and have selected a lead management company to perform wide-ranging integrations, including those entailing the pricing structures. Based on the "Japan Revitalization Strategy" approved at the Cabinet meeting in June 2013, the lead management company is preparing infrastructures aimed at the world-wide introduction of "Smart Meter" by the early 2020's.

2. What is "Smart Meter"

Unlike the traditional analog electricity meters, "Smart Meter" measures power consumption as a digital value and it has a communication facility for communicating the measured power consumption values to the power companies. The functions packaged in the "Smart Meter" are utilized in auto-metering for remote power consumption measurements, remote switching and the visualization of electricity use in households.

Whereas the traditional meters obtained metering data each month via the visual work of metering staff, "Smart Meter" can collect data every half hour. So there are great expectations that the data collected in this new way will be usable for various purposes.

"Smart Meter" can apply a large variety of communication methods such as the multi-hop method using the specified low-power radio and the 1:N method that makes use of the 3G or LTE. It is the function of the lead management company to propose a communication method that will meet the needs of each proposal.

3. NEC's Achievements in Introducing "Smart Meter"

Up to the present, NEC has achieved the introduction of communications parts in the "Smart Meters" of the power companies, as shown in **Fig. 1**. Below we comment on our approach as taken individually for each of these power companies.

3.1 Participation in the AMI Communication System of TEPCO

Tokyo Electric Power Co., Inc. (TEPCO) plans to intro-



duce "Smart Meter" of the largest scale in Japan to include 27 million meters by FY2020. It has already started to select its partners for building the AMI system.

Under these circumstances, NEC has applied for the invitation of the AMI proposals of TEPCO and has started participating in the projected joint promotion system that was organized together with Toshiba Corporation and the NTT Group on May 1st, 2013.

According to this system, NEC was in charge of part of the "Smart Meter communication block [1:N (3G method)]", which is the communication board to be built into the AMI, in collaboration with Toshiba (Fig. 2).

The key motives in our provision of the "Smart Meter communication block" were to attain a high enough quality and performance to play an important part in the network supporting the infrastructures, a production capability to meet an "Smart Meter" deployment project at Japan's largest scale and a reduction in the costs. Nevertheless, we succeeded in developing the product and starting the overseas production system by dealing with the key points mentioned above. This achievement was based on our full command of the technical knowledge obtained through past experience in wireless design/development as well as from our expertise that has been refined via domestic production.

The "Smart Meter communication block" developed jointly with Toshiba has been certified by the "Wi-SUN Profile for ECHONET Lite," which is an international stan-

dard for 920 MHz band specified low-power radio communication developed by the Wi-SUN Alliance at its first production attempt. This provides the "Smart Meter" installed in the area managed by TEPCO with advanced connectivity to equipment associated with the HEMS (Home Energy Management System)

3.2 Participation in AMI Communication System of KEPCO

Since 2006, NEC has been participating in and supporting the construction of the "New Metering System" project, which is the auto metering system of the Kansai Electric Power Co., Inc. (KEPCO).

In 1999, KEPCO commenced active R&D of auto metering in order to improve customer services and the efficiency of metering operations. After studies dealing with structure, techniques and operations, Japan's first field verification of the auto metering of a 3000-unit scale system based on the wireless multi-hop method was started in 2008. Following this, test operations in advanced areas were started in 2009 and these were deployed in all areas after 2012. The "Smart Meter" of KEPCO is designed to allow replacement of the communication block alone, the communication method can be changed according to the situation of each area.

One result on customer service of the construction of the auto metering system was publication of a website enabling visualization of electricity and simulation of energy saving. Customer services have also been improved by the possibility of remotely checking the customer status, which can reduce the time taken for customer inquiries.

Auto metering has also brought about big advantages for companies; such as in operational efficiency improvements, avoidance of electric shock incidents during meter reading work, discovery of illegal power usage, elimination of locations with metering difficulties and rationalization of equipment installations based on me-

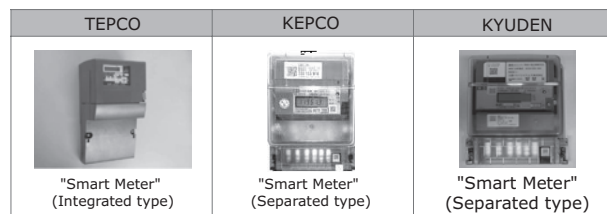


Fig. 1 Introductions achieved.

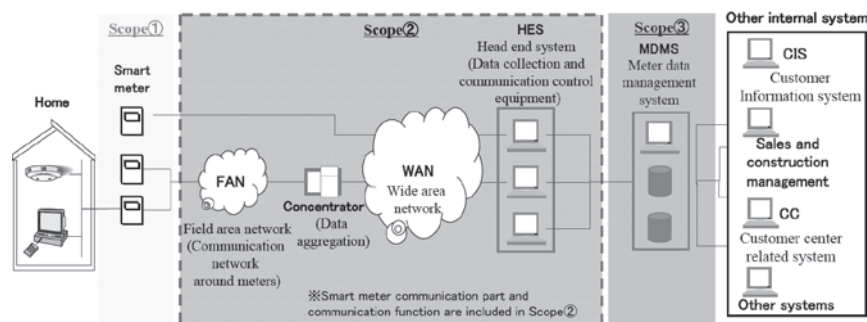


Fig. 2 Scope of the request of proposals by TEPCO.

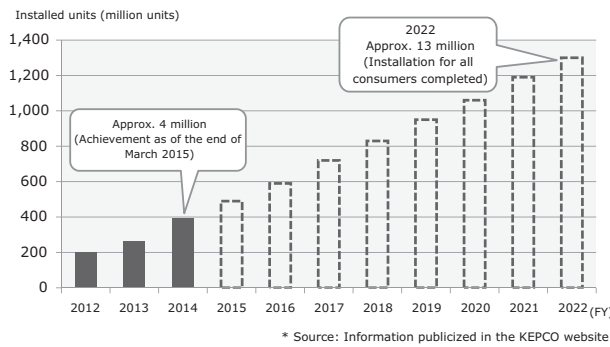


Fig. 3 AMI installation schedule of KEPCO.

tering data obtained every half hour.

KEPCO has installed about 4 million "Smart Meters" as of the end of FY2014 and is scheduled to replace all of its 13 million approx. meters by the end of FY2022 (Fig. 3).

At NEC, we have already delivered more than 1.2 million "Smart Meter" communication units together with server systems that are supporting KEPCO's new metering system.

Based on past achievements, we are planning to make new proposals for supporting the KEPCO system and are developing new services to support it.

3.3 Participation in the Smart Grid Common Communication Platform of KYUDEN

Kyushu Electric Power Co., Inc. (KYUDEN) started trial installation of the "Smart Meter" in 2010, aiming at providing a commercial service in the future. At NEC, we have been engaging in trial installations since 2011 and have developed the first "Smart grid common communication platform" by using the 1:N (WiMAX) public wireless communication system, which is the higher-level server for "Smart Meter" communication among the Japanese power companies, (Fig. 4).

In the trial installation of "Smart Meter," we have already installed some tens of thousands of communication units (WiMAX method) and we have confirmed the effectiveness of communications through the smart grid common communication platform.

The smart grid common communication platform that we have developed for the trial installation is composed of several servers that perform the required functions and roles and enable provision of a common format, independent of multiple communication methods and operation services. This is in order to achieve the two purposes set at the start of the development. These are "to allow operational systems to communicate with communication equipment without awareness of the com-

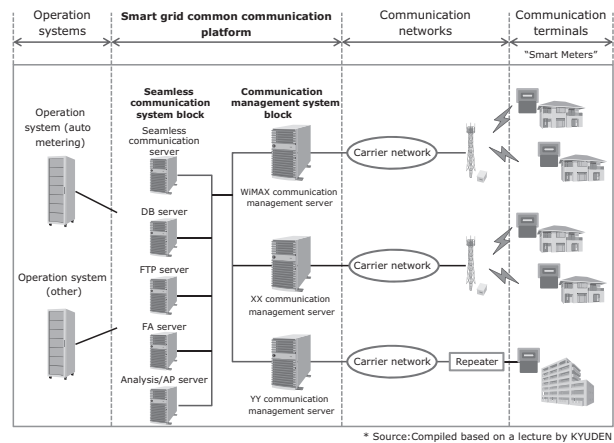


Fig. 4 System configuration of KYUDEN's smart grid common communication platform.

munication method in use" and "to enable communications with communication equipment without awareness of the differences in multiple communication methods".

In the future, we are planning to contribute to the dissemination of the system platform by providing it with the capability of accommodating the smart grid-related systems that will come in the future and the extensibility for facilitating the addition of new operating systems.

4. Conclusion

At the NEC Smart Energy Business Unit in charge of AMI business, we believe that the communication terminals for the "Smart Meter" are a critical platform for securing the collection of metering data.

In particular, we believe that the liberalization of the resale of low-voltage to small-scale users in April 2016 will lead in launching various services based on the network described in this paper. We are also planning to continue further advancements and additions of the communication terminal functions in order to meet market trends. Some of the proposed approaches to be taken are discussed below (Fig. 5).

(1) Consideration of the application of next-generation communication methods

In addition to the currently provided communication methods, including the PHS, wires LAN, WiMAX and 3G, we are also planning for the expansion of the communication terminal lineup in order to prepare for next-generation communication methods, such as the LTE.

(2) Approach to joint metering

Assuming that the advancement of the joint metering of gas and water consumption is to come in

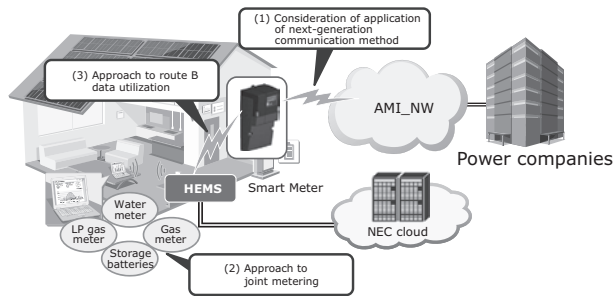
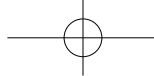


Fig. 5 Image of future approaches.

the future, we will participate in joint demonstration activities with gas and water suppliers and we will also start investigations into the communication interfaces that are intended to be used.

(3) Approach to route B data utilization

We will also advance studies for utilizing the route B data by means of visualization of metering information with the HEMS, as well as those for creating new services such as those for development into energy management systems based on NEC's big data analysis technology.

At NEC, we intend to continue collaboration with the power companies and the lead management companies in order to contribute to the continued dissemination of AMI in the fields of communications and ICT.

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