Current Status of "Smart Metering" Initiatives in the City Gas Industry

Hajime Furusawa General Manager, Smart Meters and Metering Systems Section, Technology Development and Solutions Dept., Tokyo Gas Co., Ltd.

1. Introduction

Starting with the introduction of intelligent gas meters with a built-in microcomputer in 1983, the city gas industry of Japan has been developing advanced gas meters with additional safety features.

There is now a growing expectation that advanced meters, by providing an interface for transactions with customers and serving as a "visualization" tool, may help create an energy-efficient low carbon society. The Study Group on the Smart Meter Scheme, organized by the Ministry of Economy, Trade and Industry (METI), conducted discussions last year and agreed that well-coordinated initiatives between the government and private sector are needed in order to install smart meters at virtually all customers by early in the 2020's, which is a target stated in the revised Strategic Energy Plan of Japan.

Moreover, the Great East Japan Earthquake has highlighted the role of smart meters in improving energy security. Therefore, smart meters are important devices that support energy businesses and are expected to attract growing attention.

2. Overview of the Study Group on the Smart Meter Scheme

2.1 Background of the Discussions

The Study Group on the Smart Meter Scheme was set up in fiscal 2010 to help Japan create an energy-efficient low carbon society by using smart meters to provide customers with detailed information on their energy usage patterns, to make them aware of energy conservation and motivate them to use energy more efficiently. The Study Group discussed specific measures to achieve the following target included in the revised Strategic Energy Plan of Japan: "To install smart meters at virtually all customers by the early 2020's, after thoroughly evaluating cost-effectiveness, etc."

2.2 Main Topics

The Study Group on the Smart Meter Scheme first clarified the concept of smart metering (defining it in both narrow and broad contexts), reviewed its history overseas, and studied the status of initiatives in Japan. The Study Group then examined broader topics such as expected benefits, functions, types of data to be handled, communication infrastructure, and privacy/security concerns, identified the challenges for widespread use, and finally suggested future actions.

Representatives from the city gas industry reported on their smart metering initiatives, described the history of usage of intelligent gas meters since their introduction in 1983, and discussed the industry's work on ultrasonic meters, which are the latest type of electronic gas meters. This work is summarized in a report prepared by the Study Group, in a section titled "Efforts by Gas Utilities".

It was suggested that gas utilities, like electric utilities, should "announce and then execute programs for achieving the targets of the Strategic Energy Plan." The city gas industry will therefore address problems through actions such as demonstration programs, and the Study Group on the Smart Meter Scheme will check the progress each year in principle.

Outline of the Report: Requirements for Smart Meters and Handling of Information

○ Requirements for smart meters

- Functional requirements: tele-metering and remote control of switches/valves
- Information to be handled (referred to as "power consumption and other utility service data"): power consumption, reverse flow measurements and time data; the measuring interval is 30 minutes (For gas, gas consumption and time data are to be handled; the measuring interval is one hour.)
- Receivers of information: bi-directional information supply for the benefit of both customers and electric/gas utilities
- Timing of information supply: In principle, and assuming the present scope of services, data on any given day shall be made available by the next day at latest.

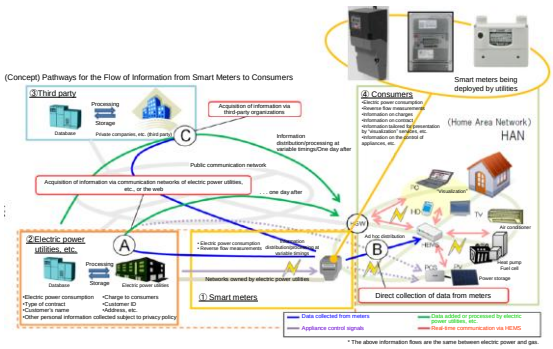
○ Handling of power consumption and other utility service data

- Power consumption and other utility service data must be properly distributed by utilities to customers. For informing customers effectively, such data must be made available to customers as soon as possible.
- No restrictions should be imposed on the pathways of information from smart meters to customers. However, the possibility of real-time distribution of data should be explored

soon.

- Arrangements for protecting personal information are required for addressing privacy and security concerns.

Concept: Pathways for the Flow of Information from Smart Meters to Consumers



3. Deployment of Advanced Gas Meters

3.1 Development and Deployment of Intelligent Gas Meters

The city gas industry's involvement with advanced gas meters started with the development of intelligent gas meters with built-in microcomputers and various safety features. Within about 10 years, intelligent gas meters had been installed at more than 90% of customers, and at virtually all customers by about 15 years.

Intelligent gas meters have various safety features including flow monitoring, pressure monitoring, and seismic sensing, with shutoff occurring upon detection of an abnormality.

3.2 Development and Deployment of Ultrasonic Gas Meters

Even after intelligent gas meters were introduced, the industry continued to incorporate more advanced features into gas meters while reducing their costs. In 1988, intelligent gas meters with a communication interface were rolled out, and in 2005, ultrasonic gas meters for residential houses were released.

Ultrasonic gas meters are fully electronic, with no moving parts in the measuring unit. These smart gas meters offer compactness, communication interface expandability and low power consumption. Thanks to the replacement of mechanical parts by electronic components, the meters are also highly durable and reliable. Moreover, the modular packaging of electronic devices has greatly reduced the number of components, thus increasing the functionality while reducing the cost of mass production.

Ultrasonic gas meters

4. Development and Use of Advanced Communication Systems

4.1 Automatic Tele-metering Systems

Tokyo Gas performs automatic tele-metering of about 0.5 million customer sites within its service area, including those that would otherwise be difficult to meter (excluding the HHT method, automatic tele-metering is performed by city gas utilities at more than a million sites). Since most automatic tele-metering systems today use customers' telephone lines, IP networking using customers' broadband connection is an obvious next step forward.

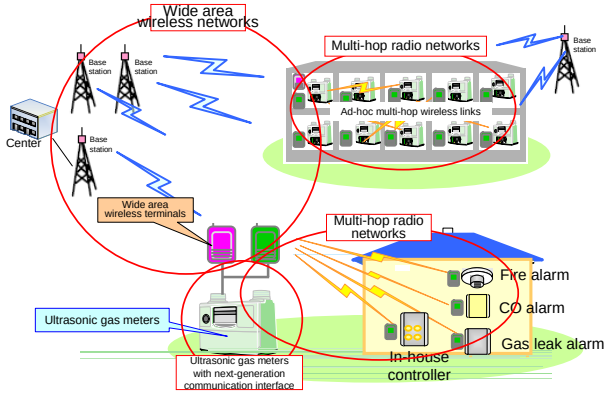
4.2 Communication-based Services

Utilities also use the automatic tele-metering infrastructure to deliver paid value-added services for home security, home automation, care for elderly family members, etc. Since 1988, Tokyo Gas has been offering such services under the brand of My Tsuho Services, to which about 0.5 million households have subscribed.

4.3 Development of Ubiquitous Metering System

In addition to the existing needs for tele-metering described above, there is a growing need for tele-metering (including the HHT method) due to the growth in the number of customer sites that are difficult for metering personnel to access (e.g. condominiums with an electronically locked entrance). There is thus an urgent need not only for meters that can communicate but also for a highly reliable communication scheme.

Ubiquitous Metering System



Since fiscal 2006, three gas utilities of Japan have been jointly developing Ubiquitous Metering Systems. The purpose is to ensure the continuous availability of services by introducing a communication infrastructure independent from the customers' communication lines and to deliver the advantages and excellent functionalities of the Advanced Metering Infrastructure (AMI) for providing safety, security, and care oriented remote monitoring services and energy-efficiency ("visualization") services.

5. Standardization of Technical Specifications

5.1 Gas Meters

The technical specifications for ultrasonic gas meters have already been standardized within the city gas industry, and the major components for metering of city gas and metering of LPG are compatible.

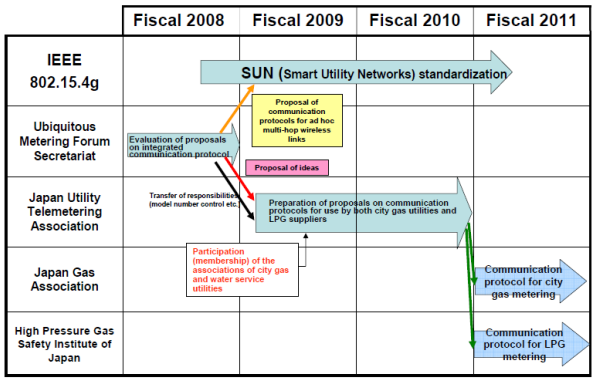
5.2 Communication Systems

Technical specifications for communication systems (wireless communication systems, in particular) are being standardized. With regard to the Ubiquitous Metering System, which will be the next-generation communication system, we aim to standardize the specifications not only in Japan but also globally.

Particularly for ad hoc multi-hop wireless links for short distance communication, we are dispatching staff to a wireless communication system international standardization committee of IEEE (IEEE802.15.4g) to help review the specifications and participate in the repeated negotiations and adjustments. The specifications proposed by Japan are expected to be accepted this year as IEEE standard specifications.

Regarding the standardization of specifications among various utility service providers in Japan, we submitted our proposals to Japan Utility Telemetering Association (an NPO) in fiscal 2009, and completed the adaptation process at the end of fiscal 2010. We expect them to be incorporated into both Japan Gas Association and High Pressure Gas Safety Institute of Japan's recommended specifications.

Trend in the Standardization of Communication Technologies



(Compiled from materials prepared for the Ubiquitous Metering Forum of April 24, 2009)

6. Conclusion

In view of the need to distribute information on energy consumption to help create an energy-efficient low carbon society, make meters smaller, and strengthen energy security, especially following the great earthquake, the development of ultrasonic gas meters, which are small, communication-enabled smart gas meters chosen by the gas industry, is expected to add value to gas businesses in the future.

We will therefore identify technical challenges through demonstration programs, etc., verify the effectiveness of HEMS that we have already made available to limited customers, develop the communication infrastructure, and lead cross-industry initiatives to overcome challenges such as lowering the communication costs and meter costs.

Reference: materials prepared by the Study Group on the Smart Metering Scheme, METI