

# Advanced Metering Infrastructure Data Platform in Housing: Standardization Strategy

Eunbi Ko

Standards Promotion Department of Standardization Division  
Telecommunications Technology Association  
Seongnam-city, Gyeonggi-do, Republic of Korea  
ebko2211@tta.or.kr

Guk Sik Jeong<sup>†</sup>

Standards Promotion Department of Standardization Division  
Telecommunications Technology Association  
Seongnam-city, Gyeonggi-do, Republic of Korea  
jgsigi@tta.or.kr

*Abstract*—The use of Advanced Metering Infrastructure (AMI) has become more prevalent in housing, as it helps to improve energy efficiency and energy management. Consequently, standardization of AMI data has emerged as a critical aspect of the growth and evolution of technology. This paper reviews and presents the standards activities related to AMI data, as the AMI data platform is crucial for developing standards for future smart energy services. This paper then discusses strategies for standardizing the AMI data platform in housing.

*Keywords*—Advanced Metering Infrastructure, data platform, housing, standardization

## I. INTRODUCTION

The introduction of Advanced Metering Infrastructure (AMI) deployment in the housing sector has brought about a new area of energy management and consumption analysis [1]. AMI systems use cutting-edge technology to collect, monitor, and analyze real-time data on energy consumption patterns within residential spaces [2]. This provides homeowners with valuable insights into their energy usage while enabling utility providers to optimize distribution networks and encourage sustainable energy practices. Nevertheless, the need for a standardized approach to data platforms becomes increasingly apparent as more AMI systems become prevalent.

The use of AMI systems in housing has increased significantly. These systems utilize smart meters, advanced communication networks, and robust data infrastructure to collect and transmit detailed data on energy consumption. They operate in a complex energy landscape, including electricity, gas, and heat sources. Electricity powers appliances, lighting, and electronics. Gas is used for heating, cooking, and hot water supply, while heat contributes to thermal comfort through space heating and hot water. The interactions between these energy sources emphasize the intricacy of energy usage in modern homes.

The energy landscape is complex, with various opportunities and challenges that go beyond individual energy

sources. A holistic approach is required to effectively manage energy, considering the interconnections and synergies between these sources [3]. This convergence of energy domains highlights the need for an integrated data platform to address the diversity of energy sources in housing.

Although AMI systems offer many advantages, challenges arise due to the different energy sources. Ensuring these systems are interoperable, scalable, and efficient data management is crucial. Standardized platforms are necessary to integrate data from diverse energy sources and enable seamless data exchange. Standardizing the AMI data platform in housing is essential to optimize energy consumption and achieve a more sustainable energy future.

Therefore, this paper briefly describes the current standardization status of the AMI data platform and presents future work directions for standardization of the AMI data platform in the housing sector for service development. In summary, the main contributions of this study are outlined as follows:

- This research provides a comprehensive summary of standardization issues and concerns related to AMI.
- The research examines organizations and project groups developing standards, along with domestic standards in Korea, addressing interoperability issues with AMI data.
- Challenges and future research strategies regarding standards for the AMI data platform in the housing sector are discussed.
- The results can accelerate the development of AMI data standards in housing, fostering a sustainable energy ecosystem.

The remainder of this paper is arranged as follows. In Section II, we present the background and needs for AMI standardization and discuss the formation of standards related to the AMI data platform. Section III of the paper describes a standardization strategy, while Section IV provides a summary of the main results and conclusions.

---

This work was supported by the Korea Institute of Energy Technology Evaluation and Planning (KETEP) and the Ministry of Trade, Industry & Energy (MOTIE) of the Republic of Korea (No. 2021202090028A).

## II. FORMATION OF AMI DATA PLATFORM STANDARDIZATION

### A. Overview of the AMI data platform

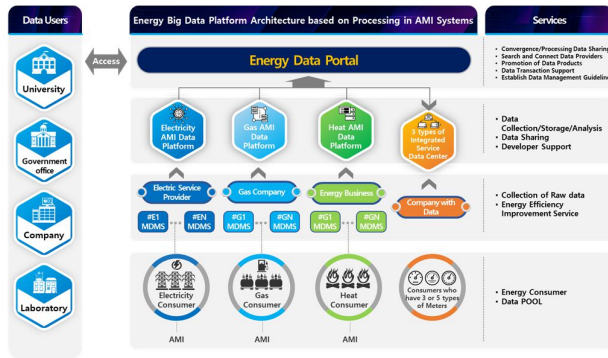


Fig. 1. Overview of housing AMI data platform standard development in Korea [4].

Recently, the use of AMI has gained popularity due to its ability to measure the amount of power used in real time and collect large-scale data. AMI is now being recognized as a valuable infrastructure for analyzing and utilizing big data in the energy industry. AMI is a crucial system in the housing sector that gathers large amounts of data. It comprises a bidirectional smart meter and other devices for transmitting and controlling electricity consumption information. AMI system provides consumers with real-time information about power prices and usage, which allows them to better manage their demand response. Additionally, it assists power providers in accurately forecasting demand and managing their loads more effectively. Through AMI system operation, the collection of power consumption data over an extended period can lead to a significant accumulation of big data in terms of quantity [4].

An AMI big data platform is currently being developed to handle large amounts of data related to electricity, gas, and heat. This platform is based on the data collected from the three main energy sources and provides real-time usage information and customized energy services. Also, the data collected from these AMI platforms will be used to facilitate connections and transactions between end-users through the ‘AMI data portal’ [5]. Fig. 1 shows an overview of the AMI data platform and services being developed in Korea.

### B. AMI data platform standardization for apartment houses

There are various international standards developing organizations (SDOs) and stakeholders, including the International Electrotechnical Commission (IEC), International Organization for Standardization (ISO), International Organization for Standardization/ International Electrotechnical Commission 1 (ISO/IEC JTC 1), and the International Telecommunication Union (ITU-T). These SDOs have developed many standards for topics related to AMI, such as smart metering and smart grid but have yet to focus on AMI data platforms.

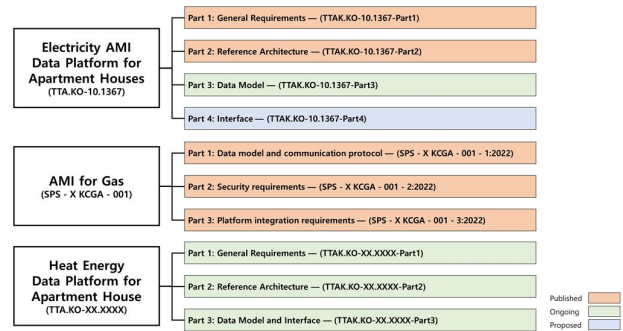


Fig. 2. Standardization structure of AMI data platform for apartment houses in Korea.

In Korea, Information and Communication Technologies (ICT) is to be standardized by the Telecommunications Technology Association (TTA). In the case of Project Group 424 in TTA (TTA PG 424), which is considered essential technology of the smart energy domain, standard development related to the AMI data platform is in progress to expand the scope of utilization of electricity and heat energy consumption data in apartment houses and to improve energy efficiency in operation and supply facilities. Regarding AMI for gas, the Korea City Gas Association has supported for collection of various data generated by smart gas meters in relation to the gas AMI data platform. They have also developed standards for the interoperability of smart gas meters. Fig. 2 shows the AMI data platform standardization structure using the published, ongoing, and future standards.

A brief description of the standards development in Korea follows.

- *TTAK.KO-10.1367-Part1, Electricity AMI (Advanced Metering Infrastructure) Data Platform for Apartment houses - Part 1: General Requirements*: It defines the basic requirements for building electricity AMI data platforms for apartment houses to expand the use of electricity AMI data for apartment houses and create energy efficiency performance [6].
- *TTAK.KO-10.1367-Part2, Electricity AMI (Advanced Metering Infrastructure) Data Platform for Apartment Houses - Part 2: Reference Architecture*: It addresses the reference architecture required to build the electricity AMI data platform for apartment houses according to the requirements defined in TTA.KO-10.1367-Part1. Also, it describes the components, interfaces, procedures, and example services of apartment houses' electricity AMI data platform [7].
- *TTA 2023-0542, Electricity AMI (Advanced Metering Infrastructure) Data Platform for Apartment Houses - Part 3: Data Model*: It provides a data model that collects AMI data for apartment houses' electricity and provides services using it to secure interoperability of the apartment building's electricity AMI data platform. This project is currently underway on TTA PG 424 (Smart Energy/Environment) [8].

- *SPS-X KCGA-001-1:2022, Advanced metering infrastructure(AMI) for gas - Part 1: Data model and communication protocol*: It proposes the architecture for gas Advanced Metering Infrastructure (Gas AMI) using smart gas meters, promoting interoperability with a generic data model and communication protocols [9].
- *SPS-X KCGA-001-2:2022, Advanced metering infrastructure(AMI) for gas - Part 2: Security requirements*: It supports secure communication and authentication requirements in Gas AMI [10].
- *SPS-X KCGA-001-3:2022, Advanced metering infrastructure(AMI) for gas - Part 3: Platform integration requirements*: It presents the necessary procedures and interfaces for integrating smart gas meters with the Gas AMI platform, including communication establishment for transmitting data to operation management systems [11].
- *TTA 2023-0536, Heat Energy Data Platform for Apartment House - Part 1: General Requirements*: It provides requirements for a platform to share heat energy data in shared housing, promoting energy efficiency for consumers, complexes, and suppliers. This project is currently underway on TTA PG 424 (Smart Energy/Environment) [12].
- *TTA 2023-0537, Heat Energy Data Platform for Apartment House - Part 2: Reference Architecture*: It defines the reference architecture for a residential heat energy usage big data platform to expand the use of residential heat energy consumption data. This project is currently underway on TTA PG 424 (Smart Energy/Environment) [13].
- *TTA 2023-0358, Heat Energy Data Platform for Apartment House - Part 3: Data Model and Interface*: It defines a data model and interfaces to improve consumer, complex, and supplier energy efficiency by expanding data collection and sharing. This project is currently underway on TTA PG 424 (Smart Energy/Environment) [14].

### III. AMI DATA PLATFORM STANDARDIZATION STRATEGY

The AMI data platform standardization strategy for apartment houses focuses on the collection of electricity, gas, and heat data and derives domain-specific insights from various data-driven services. This is because the AMI data platform for apartment houses plays an important role in improving energy efficiency and operational effectiveness through the collection and management of energy consumption information. Therefore, standardization strategies for electricity, gas, and heat energy data platforms are required to enhance interoperability, data security, and efficient analysis across diverse energy sectors and are discussed beneath.

#### A. Data Format and Protocol

Ensuring that the data format and protocols are standardized across electricity, gas, and heat energy data

platforms is important for enabling seamless data exchange between different devices and systems. A uniform data format improves compatibility and makes it easier to share data efficiently.

#### B. Data Security and Privacy Protection

Protecting energy consumption data is crucial. Therefore, encryption, access control, and other security mechanisms to keep user information safe and confidential need to be considered for standardization.

#### C. Data Quality Management

Maintaining data accuracy and consistency is important for decision-making through effective analysis. Thus, it will be possible to guarantee the reliability and validity of data for analysis results by developing and defining data quality management standards.

#### D. Data Integration

Developing standards for interoperability is essential to integrating data across electricity, gas, and heat energy platforms. Such standards will facilitate comprehensive analysis and informed decision-making based on integrated energy consumption information.

## IV. CONCLUSION

As the use of AMI technology to manage energy consumption becomes more prevalent, there has also been a growing interest in standardization. In this paper, we reviewed the standardization efforts for AMI data and the current state of apartment houses in Korea. To promote efficient energy consumption, a big data platform that aggregates and distributes real-time data on electricity, gas, and heat usage. We also discussed an approach to developing a standard strategy for the AMI big data platform in housing to offer valuable services in the future.

## ACKNOWLEDGMENT

The authors would like to thank the Korea Smart Grid Association (KSGA) for the support provided during the writing of this article.

## REFERENCES

- [1] A. Ghasempour, "Advanced Metering Infrastructure in Smart Grid: Requirements, Challenges, Architectures, Technologies, and Optimizations", in *Smart Grids: Emerging Technologies, Challenges and Future Directions*, Nova Science Publishers, pp. 77-127, 2017.
- [2] B. Paul and R. Palit, "Smart Metering in Infrastructure-Less Communication Environments and Applicability of LoRa Technology", *Smart Metering Technologies*. IntechOpen, Dec. 15, 2021.
- [3] M. Fodstad, PC del Granad, L. Hellemo, B. Knudsen, P. Pisciella, A. Silvast, C. Bordin, S. Schmidt, J. Straus, "Next frontiers in energy system modelling: A review on challenges and the state of the art," *Renewable and Sustainable Energy Reviews*, 160, 2022,
- [4] L. Changhoon, "Trends in AMI Big Data Platform and Service Development in Housing," *The Korean Institute of Electrical Engineers* 70, 8, pp. 9-16, 2021.

- [5] L. Changhoon, "Smart Grid Technology Trends and Future Prospects," The Journal of The Korean Institute of Communication Sciences, 38(9), pp. 71-77, 2021.
- [6] TTAK.KO-10.1367-Part1, Electricity AMI (Advanced Metering Infrastructure) Data Platform for Apartment houses – Part 1: General Requirements.
- [7] TTAK.KO-10.1367-Part2, Electricity AMI (Advanced Metering Infrastructure) Data Platform for Apartment houses – Part 2: Reference Architecture.
- [8] TTA 2023-0542, Electricity AMI (Advanced Metering Infrastructure) Data Platform for Apartment Houses - Part 3: Data Model.
- [9] SPS-X KCGA-001-1:2022, Advanced metering infrastructure(AMI) for gas - Part 1: Data model and communication protocol.
- [10] SPS-X KCGA-001-2:2022, Advanced metering infrastructure(AMI) for gas - Part 2: Security requirements.
- [11] SPS-X KCGA-001-3:2022, Advanced metering infrastructure(AMI) for gas - Part 3: Platform integration requirements.
- [12] TTA 2023-0536, Heat Energy Data Platform for Apartment House - Part 1: General Requirements.
- [13] TTA 2023-0537, Heat Energy Data Platform for Apartment House - Part 2: Reference Architecture.
- [14] TTA 2023-0358, Heat Energy Data Platform for Apartment House - Part 3: Data Model and Interface.