Acceleration of Energy-Saving Measures for Housing and Buildings

MAKATAYAMA Miho(Ph.D. in Engineering), Director, Housing Department

Key words: carbon neutral, Building Energy Conservation Act, energy-saving renovation, existing stock

1. Introduction

The goal of "achieving a carbon neutral, decarbonized society by 2050" was announced by then Prime Minister Suga in October 2020. Subsequently, in March 2021, as the basic measures of the “Basic Plan for Housing”, a guideline for housing policy, initiatives were announced, including expansion of ZEH stock, promotion of the evaluation and dissemination of LCCM housing, and establishment of an obligation to comply with housing energy-saving standards and its performance indication, etc.

In October 2021, the Global Warming Countermeasures Plan and the Basic Energy Plan were revised, requiring new housing and buildings to have the energy-saving performance at the level of the ZEH/ZEB standard (Fig. 1), and existing houses and buildings to have the energy-saving performance at the stock average level of the ZEH/ZEB standard. To achieve these initiatives, in June 2022, the Act amending the "Act on the Improvement of Energy Consumption Performance of Buildings (Building Energy Conservation Act)" was established.

As an initiative aimed at decarbonization, the Housing Department is working on research to promote energy savings focused on divisions of the environment field, as well as research on renovation technologies, etc., for existing housing to reduce damage caused by flood, which is becoming more frequent due to global warming. This paper provides an overview of research currently undertaken to significantly bolster energy-saving measures for housing and buildings.

2. Research required to accelerate energy-saving measures

Table 1 shows the major revisions to the Building Energy Conservation Act and other laws concerning the acceleration of energy-saving measures. Reinforcement of energy-saving measures requires research to support (i) to (iii) of the same table. Regarding (i), since all buildings including new housing will be obligated to comply with the energy-saving standards; it will also require development of methods of evaluation and so on that can be used by designers. It will also require establishment and promotion of evaluation methods of energy-saving performance for high-performance houses that exceed ZEH standards. Regarding (ii), it will be necessary to streamline the evaluation method for phased increase in the level of requirement standards for non-residential structures and development of evaluation methods for various energy-saving technologies that have high energy-saving effects, but have not been properly evaluated in the past, in order to guide them to the ZEB level.

As for (iii), the research is necessary to improve the energy-saving performance of existing housing stock, which has been insufficient compared to new housing. In order to effectively renovate existing stock, it is necessary to properly grasp the energy consumption performance of facilities and equipment, insulation performance, etc., and then renovate housing based on the results of the existing condition diagnosis, which, has not yet been fully developed. Methods diagnosing existing conditions, as well as design and evaluation methods for energy-saving renovation based on diagnosis methods must also be developed.

Note that one of the renewable energy facilities described in (iv) is a technology using photovoltaic power generation and storage batteries. This technology is very effective not only as an energy-saving measure, but also to enable home evacuation after a disaster. The Housing Department also conducts research from this perspective. Please refer to the article in this report for details of the research[1].

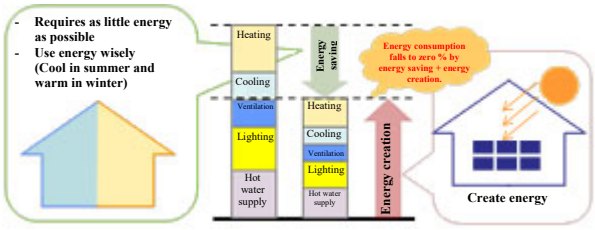

Fig. 1: Concept of ZEH/ZEB

Table 1: Major revisions to the Building Energy Conservation Act and other laws concerning the acceleration of energy-saving measures

(i)	**New housing and small non-housing**
	⇒ Bottom-up energy-saving performance
(ii)	**Medium to large new buildings (non-residential)**
	⇒ Induce higher energy-saving performance
(iii)	**Existing housing and buildings**
	⇒ Improve the energy-saving performance of existing stock
(iv)	**Promotion of the introduction of renewable energy facilities**

3. Energy-saving renovation technologies for existing stock

Regarding the research subjects for strengthening energy-saving measures mentioned in 2 above, for new housing and non-housing, an evaluation program

for energy-saving performance is already in operation for building permit examination, and technical standards, etc. are being developed.
On the other hand, initiatives for existing stock have been slow. A study on detached houses was started more than a decade ago; research has been conducted on the evaluation of energy-saving performance for outer shell and facilities/equipment as well as renovation technologies. However, with regard to the existing condition research required for setting energy-saving renovation targets, a unified existing condition research method was not presented. At present, the Building Standards Development and Promotion Project (by the MLIT) is in the process of studying practical energy-saving performance diagnosis and evaluation methods.
The same goes for non-housing buildings such as office buildings, with regard to existing condition research methods. It would not be accurate to say that appropriate research of existing conditions is being conducted prior to energy-saving renovation. At present, the same or equivalent facilities and equipment are simply replaced without evaluating the actual operation of facilities. In addition, in order to implement energy-saving renovation in the large-scale repair of condominiums, it is necessary to properly position it in the large-scale repair plan. However, the effect of energy-saving renovation is not always quantifiable, and it is difficult to build consensus among condominium residents.
Based on these circumstances, we are conducting the following studies:

(1) Renovation design method based on the existing condition diagnosis for energy saving in existing office buildings, etc. (FY2022-2024).

The study includes: (i) development of an existing condition diagnosis method, (ii) a method to design renovation based on the diagnosis results (**Fig. 2**), and (iii) development of a method to predict the cost-effectiveness of renovation.
Output of this study is expected as follows (i) Technical guidelines for designers that summarize diagnostic and design methods, as energy-saving renovation methods, (ii) tools for building owners and designers to calculate the cost-effectiveness of energy-saving renovation, and (iii) a collection of specific examples of energy-saving renovation for local governments and building owners.

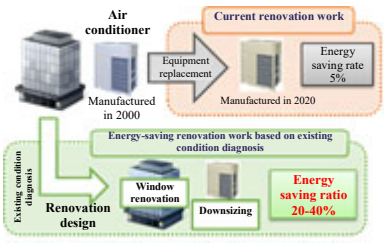

Fig. 2: Current renovation work and retrofitting based on the existing condition diagnosis

(2) Quantification of the effect of renovation to improve energy-saving performance in existing condominiums (FY2023 - 2025)

At present, 60% of the condominium stock was constructed in or before 2000, and many of them have inferior thermal insulation performance, etc. It is therefore essential to promote the renovation of existing condominiums to enhance energy-saving performance, mainly through thermal insulation.
The objectives of this study are to (i) select a renovation menu based on condominium types (**Fig. 3**), (ii) develop a method for estimating the cost of energy-saving renovation and effects, and (iii) develop a method for quantifying cost-effectiveness.
Regarding the results of study, following are expected concerning a method for quantifying the effect of renovation to improve energy-saving performance in existing condominiums: (i) tools for estimating the cost-effectiveness of energy efficiency renovation and (ii) a guide for positioning energy-saving renovation in long-term repair plans, etc.

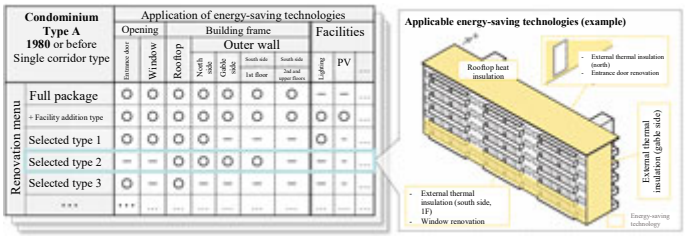

Fig. 3: Renovation menu according to the condominium types (image)

4. Conclusion

Realization of carbon neutrality would require significant enhancement of energy-saving measures for buildings. The Housing Department is working on evaluation standards, methods of diagnosis, renovation technologies, etc. While doing so, it is essential to consider not only the technical aspects of energy-saving performance, but also the realization of a comfortable indoor environment and the health of the people who live and work there. In addition, in order to smoothly implement energy-saving renovation of existing stock, it is equally important to build consensus among residents and users, and to enable them to become aware of energy saving, a quantitative method of presenting the benefits of energy-saving renovation is also needed.
We hope to continue our research so that we can provide not only the technical standards, etc., for engineers, but technical information required for people such as housing residents and building users.

☞See the following for related articles.

1) A study on design goals for self-sustaining energy systems for continued residence after a disaster (p66)