

Examination of the actual energy conservation performance of buildings using big data

Housing Department

Using a Web program designed to evaluate compliance with energy conservation standards, big data of the energy conservation performance of buildings were gathered on the cloud system and analyzed to identify the actual conditions. This enables the analysis of the relationship between building design specifications and energy conservation performance, which used to be unclear, with conventional investigation methods. It also enables the efficient supply of useful data to be used to propose energy conservation measures.

Social background and issues

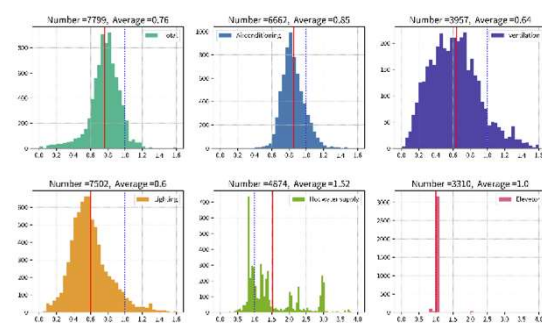
- Improving energy conservation in buildings based on the Paris Agreement is an urgent issue in the effort to mitigate global warming. It is important to identify actual energy conservation performance and to implement proper measures to realize the goal with reasonable effort.
- Competent administrations used to manually tabulate energy conservation standard evaluation results and then report them to the Ministry of Land, Infrastructure and Transport. Starting in FY 2018, this system was changed to the method that used data entered into the Web program to evaluate compliance with the energy conservation standards. (In the new system, the competent authorities report the ID numbers of applicant properties to the Ministry of Land, Infrastructure and Transport, which then uses the ID numbers to download the entered data and the evaluation results.)
- An issue in question is how the Ministry of Land, Infrastructure and Transport would analyze the gathered big data.

Study contents

Analysis of energy conservation performance evaluation result based on big data

About 16,000 cases of data evaluated for the energy conservation standard in FY 2018 through the Web program were analyzed. The distribution of the energy conservation performance of buildings (7,799 cases) submitted as the model building method in six regions of the energy conservation area category (warm areas including Kanto) is shown. The X-axis of the graph is the BEIm (BEI = building energy index) that indicates energy conservation performance. When the BEIm is 1.0 or less, it means that the standard is met.

The average BEIm of all buildings was 0.76, indicating that the buildings satisfy the standards with a relatively large margin. The average BEIm of lighting is 0.60. This is lowering the overall BEI of the building. The BEIm of ventilation and water heating varies greatly among buildings.

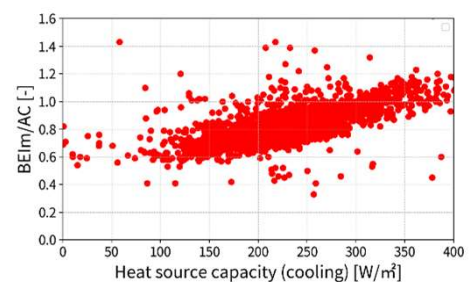


Distribution of energy conservation performance (BEIm) in six regions (warm areas including Kanto) of the energy conservation area category

Example of detailed analysis (analysis of the actual air-conditioning facility designs)

Actual conditions concerning the relationship between the facility design specifications and energy conservation performance were analyzed in detail. As an example, the relationship between the capacity of air-conditioning/heating devices (cooling/heating system) per floor area [W/m^2] and the energy conservation performance of an air conditioner (BEIm/AC) is shown.

This indicates that the capacity of the heating device is small in an energy conservation type building with small BEIm/AC that indicates the energy conservation performance of an air conditioner. This means that selecting a heating device in the proper size (capacity) would lead to energy conservation, and that its effect is reflected in the evaluation of energy conservation performance.



Relationship between the capacity of air-conditioning/heating devices (cooling/heating system) per floor area [W/m^2] and the energy conservation performance of an air conditioner (BEIm/AC)

The proposal of building energy conservation measures based on actual conditions is supported by providing proper information in a timely manner while reducing the workload of the administration.

Relevant articles

- Research on the facade design method to improve energy conservation performance in buildings (p. 101)