The development and verification of energy consumption performance prediction tools inducing the energy-saving design of non-residential buildings

MIYATA Masato (Ph.D (Engineering)), Senior Researcher
Environmental and Equipment Standards Division, Building Department

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1. Foreword

Saving energy is an urgent issue as approximately 30% of our nation's energy consumption comes from housing/buildings. In order to attain effective energy saving, it is important that energy consumption performance is predicted/evaluated in the design phase and the most suitable design is induced. At NILIM, the development of a tool (Web program) that precisely predict energy consumption performance during design stages was conducted towards non-residential buildings whose energy use is especially difficult to predict (Figure 1).

2. Developing energy consumption calculation logic

This tool evaluates the performance of the envelope and facilities as an index of the building's primary energy consumption. The logic behind the calculation of primary energy consumption was structured based on factual surveys[1)].

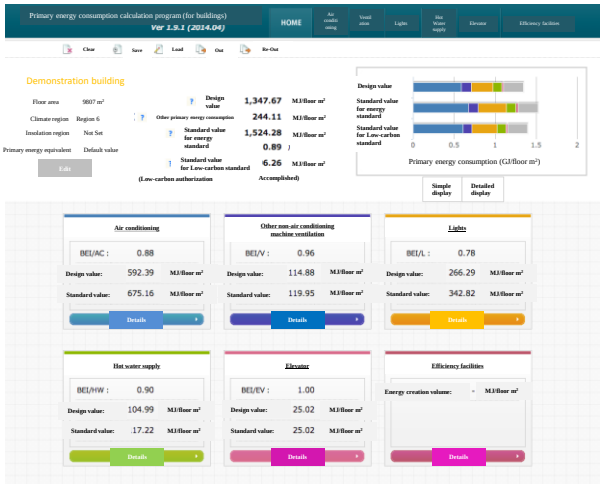

Figure 1: Energy consumption performance

3. Validation of the actual building

Because various energy-saving technologies will be evaluated in line with this tool, its high standards of equity and reliability are also in demand. In order to validate the estimated accuracy of this tool, evaluations were made using this program for multiple actual buildings and a comparison of the actual energy consumption was conducted (Figure 2). Based on these results, improvements were made on the calculation logic and adjustments were conducted on the calculation conditions.

4. Application in actual design processes

Since the information required to execute this tool can be easily created from design documents, evaluations can be easily conducted without much effort. As well, since it can be commonly used to report on various regulations/support/guidance measures like energy-saving reports (the energy-saving standard revised in April 2013) and performance indication system (BELS), appropriate evaluations can be made while reducing the burdens on designers, and promote energy-saving promotions (Figure 3).

(Reference)

1) NILIM reference No.762, 2013 energy-saving standards (promulgated January 2013) etc./related technical references - primary energy consumption calculation program explanation (non-residential buildings issue) -

2) Miyata, others: Evaluations on the validity of the primary energy consumption calculation Web programs based on actual values, Soc. of Heating, Air -Conditioning and Sanitary Engineering meeting scientific lecture papers, vol. 9, p105-108, 2014.9

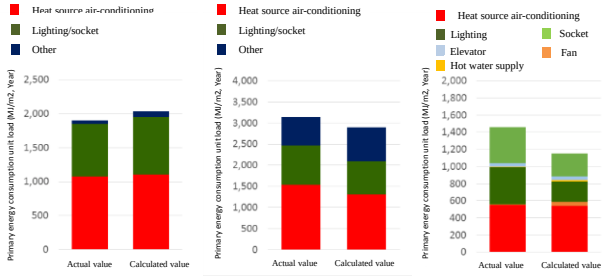

Figure 2: Example of tool verification results
(Left: School A, Middle: Hospital A, Right: Office

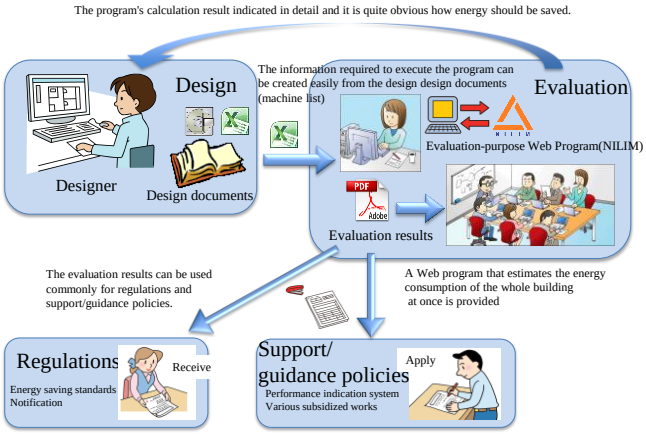

Figure 3: Construction of the design process to promote