



## HI-SMART: HIGHER EDUCATION PACKAGE FOR NEARLY ZERO ENERGY AND SMART BUILDING DESIGN

# MODULE #1

### CHAPTER 4: MONITORING AND DATA ASSESSMENT

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In many European countries, continuous management of energy performance in existing buildings is supported on a national level by running a mandatory building energy performance certification system.

The energy performance of buildings can be assessed either by calculating their physical performance based on drawings or by benchmarking an energy consumption level (*Wang et al. 2012*).

Since existing buildings have differences and limited data acquisition levels, the assessment methodology has been developed depending on the situation in each country.

Building data monitoring can provide performance feedback for operational optimization of existing facilities and improve future designs. It can support energy and performance contracting, smart load balancing, and model-predictive building systems control (*Mahdavi & Taheri 2016*).

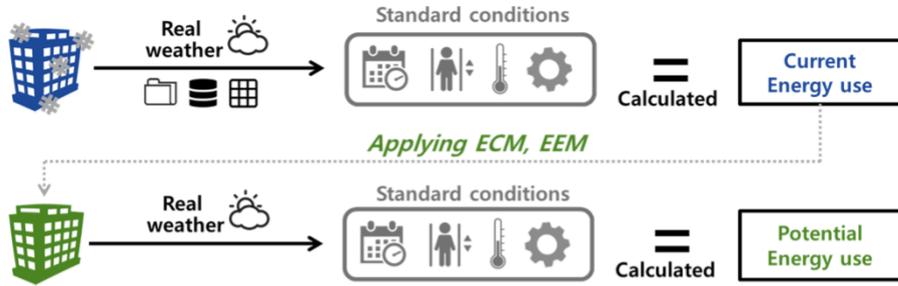
Monitoring and data assessment of buildings focus on different data categories:

- indoor environmental conditions
- external environmental conditions
- control systems and devices
- equipment
- energy flows
- etc.

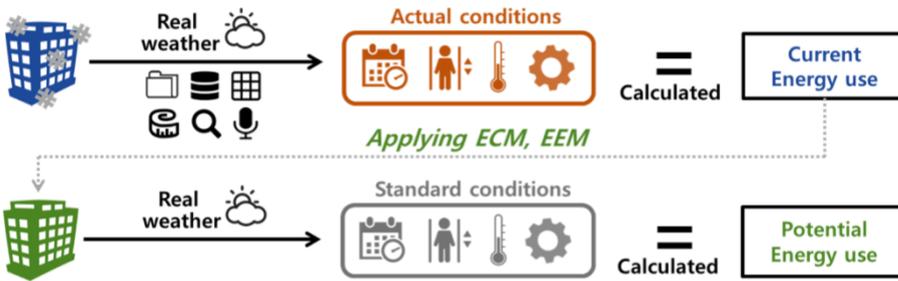
These categories show us both a current status and also the changes (related to devices or energy flows) over time in a building. The data can be used for planning or monitoring the impact of an investment (such as energy renovation).

*Figure 1.4.1* shows an example for data assessment of a building under standard conditions: data collection methods, analysing current conditions and potential energy use.

Type 1. Assess the target building based on technical documents and literature sources under standard conditions.



Type 2. Additionally include on-site audit and consider actual conditions for the assessment.



Type 3. Utilize the measured energy data on assessment to estimate uncollected input data.

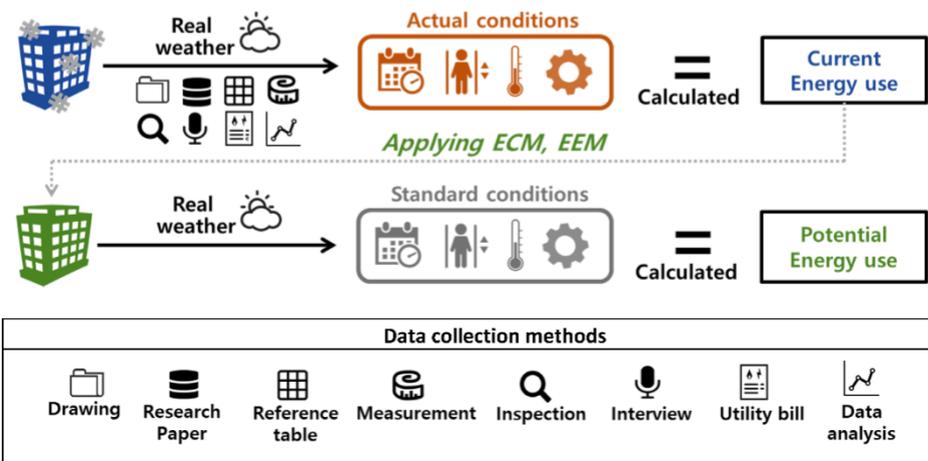


Figure 1.4.1: Assessment of a building under standard conditions (Cho and Kim 2019)

Following an energy investigation, energy conservation or efficiency measures (ECMs or EEMs) are recommended to save or reduce utility costs. Measures consist of potential replacements of, or upgrades to, existing systems that enhance energy efficiency in a cost-effective manner. Usually, a wide range of potential data sources and collection methods are available, such as:

- research papers from the field of building energy consumption and renovation,
- actual or long-term measurement of the examined building,
- interviews with operators, owners, users,
- utility bills of the examined building,

The more information gathered, the better and more precise results can be provided.

We can analyse various data assessment methods on the same target buildings. For example, in their research, Cho and Kim classified the methods into three prototypes according to the required level of data acquisition (see Figure 1.4.2). Type 1 assessed the target building based on literature sources. Type 2 conducted on-site audit and assessed the target building based on additional collected data. Type 3 assessed the target building by further estimating the building properties through analysis of the measured energy data.

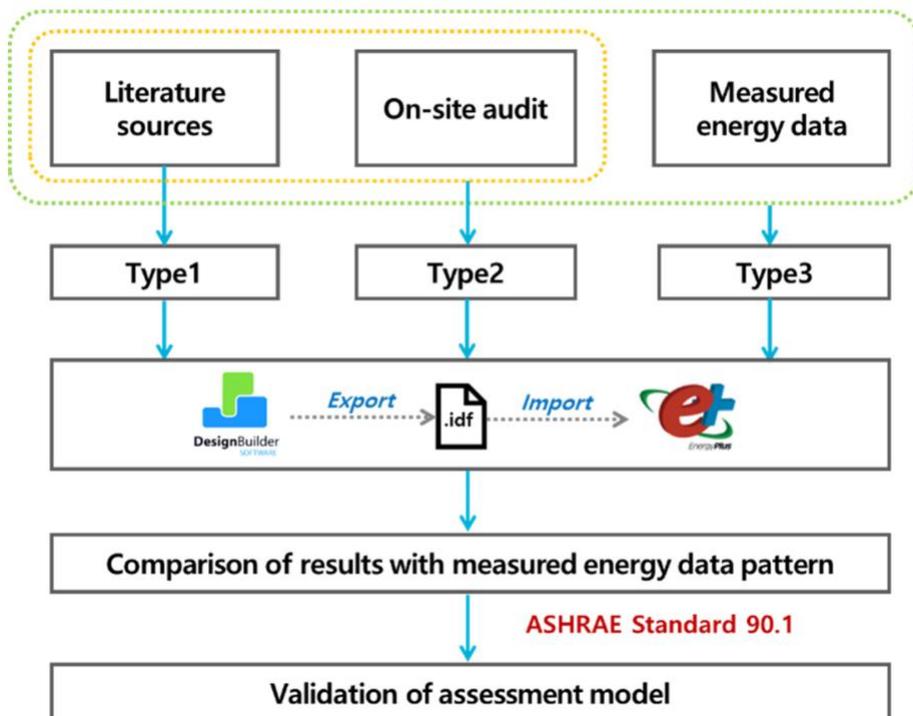


Figure 1.4.2: Assessment methods according to data acquisition level (Cho and Kim 2019)



## References

*Ardeshir Mahdavi, Mahnameh Taheri (2016): An ontology for building monitoring.*

*Kyung Hwa Cho, Sun Sook Kim: Energy Performance Assessment According to Data Acquisition Levels of Existing Buildings*

*Wang, S.; Yan, C.; Xiao, F. Quantitative energy performance assessment methods for existing buildings. Energy Build. 2012, 55, 873–888*

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