Annex81: Data Driven Smart Buildings

Japan’s Activities and Challenges

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Participation in Annex81

◼ Three main motivations for Japan's participation
  ➢ Urgent issue for **decarbonization** of buildings
  ➢ Importance of **data driven operation** in **existing** buildings
  ➢ Deeply related to the creation of **new value and business** in the field of building services

◼ Domestic committee for Annex 81
  ➢ 13 companies, 1 NPO, 2 universities (20 people)

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<th>Chairperson &amp; Secretaries</th>
<th>Industry/Univ., NPO</th>
<th>Affiliation</th>
<th>Number of People</th>
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Example 1 from Japan #1

In the meetings of Annex81, we provided two examples in Japan on data-driven operations in building systems.

Example 1: Commissioning(Cx) of Kyoto Station Building

- A complex building (station, hotel, department store, theater, etc.) with the total floor of about 23,600m² (built in 1997)
- Fully applied the Cx process to the large-scale water-side system retrofit project (2010-2019)
- First case of business-based Cx implementation with Cx fees in Japan
- The energy saving of 60% targeted in the OPR has been achieved
  - 8% reduction has been achieved using the measured data of EMS in the FPT and operational optimization during the first three years after the completion

Example 1 from Japan #2

For the aspects of simulation and data-driven operation in this example,

- Development of the detailed simulation with automatic controls
- Development of the applications for the optimal control logic of the chillers using the simulation
- These applications and the data of EMS optimize the actual operation, resulting in the additional 8% energy saving.

Simulation originally developed by the Cx provider (Prof Emer. Yoshida, Kyoto Univ.)
Example 2 from Japan #1

Example 2: Automated Fault Detection and Diagnosis (AFDD) in a HVAC water-side system of a semiconductor plant

- Conventional manual FDD and optimization are extremely inefficient, so they are rarely implemented, including in general building systems.
  - Since it is not possible to know in advance which faults are occurring, it is necessary to check all data in the end.
- However, some reports indicate that the FDD and operational optimization can reduce building energy consumption of 10-30%.

Example 2 from Japan #2

- For the aspects of simulation and data-driven operation in this example,
  - Development of the detailed simulation with automatic controls
  - Development of the applications for AFDD using the simulation and machine learning
  - Now, these applications are being demonstrated in the actual system to verify the effectiveness of the AFDD method.
What we learned from the examples/Annex81 for Japan

- **Data and applications** can improve building energy performance in the operation.
- **Various data and applications** need to be utilized in buildings on a plug-and-play basis. It will **upgrade building energy performance** according to the building usage.
- In Japan, there is very little use of such data and applications. The construction industry in Japan is just at the tipping point.
  - An open platform is still not used in most buildings.
  - A Cloud EMS is used in each example, but it does not have mechanism to efficiently manage large amounts of data such as a Graph DB.

- **Important points** for promoting decarbonization of existing buildings
  - Developing data-driven system that can be installed relatively easily during retrofit or normal time,
  - Making building owners and occupants understand the value of installing the technologies with the value of data-driven smartification,
  - Human resources for system integration and application development

Data platform, meta data schema, applications for data-driven operation