

Unit1_3 Energy Use and climate - IEA and sustainable buildings & communities
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IEA Design for Sustainable Buildings and Communities

The papers presented in this unit focus on the IEA sponsored research activities for sustainable buildings and communities.

The Activities of IEA for Sustainable Buildings and Communities

World-wide, buildings roughly share 30~40 % energy use, 30 % green house gas emission, and contribute to 25~40 % solid waste. The International Energy Agency (IEA) has sponsored 40 research projects involved researchers from 22 different countries. The main objective is to facilitate and accelerate the introduction of energy conservation, related to design decision and regulation, building envelope and systems, as well as technology adoption and deployment. The main research activities of IEA include the analysis of research and development gaps, life-cycle integration and decision, performance of systems, and acceptable limits for occupancy, for example, the research of market penetration of sustainable solar house, and holistic assessment toolkit for energy efficient retrofit measures for government buildings.

IEA Annex 37, Low Exergy Systems for Heating and Cooling of Buildings

Exergy means the quality of energy. A system using low exergy means the heat/cool energy source temperatures of the system are as close as possible to the environment and also close to the comfort temperature for building occupants. The aim of IEA Annex 35 was to promote rational use of energy by using low temperature heating systems and high temperature cooling systems of buildings. Besides energy conservation, low exergy systems can also provide improved thermal comfort. Case research shows that people with low temperature radiant heating systems are very satisfied with their thermal conditions. Another benefit of using low exergy systems is its adaptability to utilize sustainable energy sources in a flexible way. The main product of IEA Annex 37 is the design guidebook that is publicly available.

IEA Annex 35, Hybrid Ventilation

Hybrid ventilation includes combined natural and mechanical ventilation, fan assisted natural ventilation, as well as stack and wind supported mechanical

ventilation. In IEA Annex 35, 13 buildings with different sizes around the world were selected as study cases. The main issues of this annex include ventilation and free cooling, immature technology, and control strategies. For comfort and indoor air quality (IAQ), occupant control is not able to always ensure success, and automatic control with manual override is advisable. Generally, cell offices have good comfort conditions for buildings with hybrid ventilation. But the challenge of hybrid ventilation is the integrated solutions, for the performance of environmental control systems cannot be separated from the performance of buildings.

IEA Annex 40, Commissioning Tool

With many new developed systems and products, these solutions may be more efficient and flexible but can lead to a higher level of complexity. The objective of building commissioning (Cx) is to bridge the gaps between design and operation. The papers address 1) tools to manage the commissioning process, 2) manual commissioning tools, 3) use of building energy management system to assist in building commissioning, and 4) use of models to improve commissioning, such as the Standard Models of Commissioning Plans (SMCP).

IEA Annex 33, Advanced Local Energy Plan (ALEP)

Local energy plan (LEP) has been developed since the 1970s, based on planning for building and energy network. Local energy plan should be the basis for decisions of urban development. Due to the shortcomings of traditional LEP, it is necessary to integrate energy system models into conventional planning tools by providing familiar user interfaces. The use of existing data bases like GIS data is of high importance for model developers to ensure the use of their models in practice. The city of Göteborg in Sweden is one of 5 cases that have achieved success. A guidebook for advanced local energy plan is available for designers and planners.

Discussion

The design for energy efficient buildings requires an integrated system design and there is a requirement to academic institutions for improved education. The goals of existing annex have not been fully accomplished and new annex will come up. Generally there is requirement for good quality design data. Before the design guidebook becomes simple, it has to be valid.

For example, more detailed information is necessary for annex 37 and there is a new follow-up annex to continue with Annex 37. For Annex 33, due to the

practical issues in urban planning, there is requirement for practical and academic research. For Annex 35, there is a requirement for more practical solutions due to the complexity of control in hybrid ventilation.