Energy savings in buildings by combined dynamic thermal simulations and energy management systems 'Energy Saving' - BL/00/C51-52-53

(Geographic) study area : China Guangzhou - Belgium Brussels

Data used: Building design data and energy consumption data

Context and objectives

With a growing urbanization rate, the fast development of the Chinese construction sector and the rapid implementation of more stringent energy efficiency regulations, it is clear that the potential for energy savings in buildings in China is huge. Many building in China, are only performing at very average levels and the instability of energy prices is bound to further heighten the demand for energy performing constructions. The response to this need and potential, however, has so far been rather limited.
Dynamic thermal simulation models of buildings have been used since the 80s to analyze building and installation behaviour in high level research programmes and can be crucial in validating energy concepts at building design phase for optimal energy performance and comfort. Moreover, Building Energy Management Systems (BEMS) for tertiary sector buildings are becoming ever more standard. These systems are intended, once buildings are built, to closely monitor the energy flows and functional parameters of building installations, in order to analyze and improve their operation. The combination of dynamic thermal simulation models and BEMS during building operation has received relatively little attention, although it can provide better insight into building performance by allowing analysis of real energy consumption and comfort levels in light of actual meteorological and occupation data. Effectively combining dynamic simulations and BEMS could enable significant increases in energy savings.
This research project aims to specifically analyse the added value of dynamic thermal simulation models in the operational phase of a building. Its objectives are: final commissioning and operational optimisation of low-energy buildings and improved fault detection and diagnosis in low energy buildings

Methodology

Research for the project is focused on two buildings for which BEMS data is available, one in the South of China and one in Belgium. Tests and analyses on these two locations with very different climatic conditions and building construction standards/practices should provide interesting insight for energy saving strategies.
The methodology is based on the following steps:
- Building selection and detailed energy audits
- Definition of BEMS parameters
- Modellization of the buildings and building systems, with recognized dynamic simulation software (Virtual Environment, TRNSYS)
- Data acquisition, monitoring, and model calibration
- Technical and economical evaluation of the results, analysis of improvement measures
- Monitoring and validation of the calculated savings
- Conclusions and recommendations

Results

Test buildings with sufficient BEMS data have been identified and selected.
The dynamic simulations of the two buildings and the monitoring of relevant operational parameters have started and are providing results for:
- The identification of key parameters for energy efficiency optimization
- The implementation of energy saving regulations for optimal comfort in buildings, with guidelines to users
- An estimate of the order of magnitude of potential savings enabled by the new approach

However, the project is still ongoing and results are still pending. First simulations are yielding highly interesting results with significant potential for savings (which could amount to 30% savings on average). Improvement measures must be implemented and monitored before any energy savings are confirmed.

Products and services

www.3E.eu
www.ugent.be
www.ulg.ac.be
http://www.giec.cas.cn/
Photos of the two selected buildings are in attachment.

Execution

Period:
March 2008 – February 2010

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Discipline

Environment
Energy
Building Energy Management

Perspective / Recommandation for future

The results of the analysis conducted in the project should be used to improve the energy efficiency and to allow for maximised energy savings in buildings. Potential end users are private and public building owners and building management companies.
This studied methodology could be applied to others buildings or others industrial plant/process. Future development could be a continuous dynamic energy management, coupled directly with dynamic simulation.