Zukunft Bau / Summary

Removing of obstacles to the implementation of innovative, future-oriented components and systems integrated into the building envelope

Starting situation

Modern facades are more and more frequently equipped with controllable components, which can positively influence the energy demand for heating and cooling as well as the room comfort. The topic of the research project is the discussion of innovative components in the building envelope and the identification of obstacles that prevent the realization of such systems or which have to be removed.

Subject of the research project

The use of innovative technologies and components created new challenges in the planning and technical design of the buildings. The use of innovative components often means a reorientation of the planning and execution process. As long as it is not possible to profit by empirical values, this usually results in a higher planning and coordination effort, which is rarely rewarded.

Important for removing barriers is the comprehensive provision of information to planners, builders and contractors. Possibilities and potentials of innovative components must be well-known, only in this way decisions can be made in favor of intelligent systems. It is also very important to increase awareness of the potential for savings resulting by the automation of components. Maintenance and operating cost savings can and should be quantified and communicated within amortization calculations.

In the first part of the work, the documentation of a market research is carried out. In the field of sun shading, glare shielding and daylight control, the market offers a variety of options for rigid or movable elements in front of the window or between the window panes. In the field of the elements of building services the motor-driven ventilation flaps or windows and the different ventilation elements should be mentioned. The ventilation elements range from simple window rebate ventilators to integrated air supply ventilators to more complex units with heat recovery. The multifunctional façade elements go one step further, for example, the box-type windows. Here, shading elements and elements for ventilation are combined within a compact façade or window module.

Energy saving effects by controllable components are basically achieved by avoiding an energy demand for cooling of buildings. Significant savings can be obtained for example by an automatic driven shading device or by using natural night-time ventilation. If a building is not cooled actively, the positive effects of automatic shading devices or of automatic ventilation systems can not be quantified energetically, but they can be quantified, for example based on a comfort analysis according to DIN EN 15251.
To quantify these effects, a comprehensive parameter study is carried out using the example of a typical office space. The calculations are done with the program TRNSYS for the location Potsdam. Different shading scenarios as well as electrochromic glazing and box-type windows are considered. Central results of the building simulation are:

- For buildings with cooling systems, automatic driven shading devices lead on average in halving the cooling energy demand compared to manual shading.
- For buildings without cooling systems, automatic driven shading devices lead to at least 50 % reduction in overtemperature degree hours compared to manual shading.

The crucial point for removing obstacles is the availability of sufficient knowledge and information both on the subject of "energy efficient construction and renovation" and the specific features of each product. That is why it is very important to provide general information and product-specific planning and assembly instructions for innovative components. Not all planners like to try out something new. The manufacturers must therefore ensure that their components can be planned, installed and put into operation without problems. Potentially problematic interfaces should be "defused" by detailed instructions, questions of the warranty should be clarified in advance.

A key part in the dissemination of innovative components is the integral planning and a good communication among all involved. The term "integral planning" stands for a holistic approach of the planning of buildings. Within the planner community the early integration of all specialist involved in building planning is basically considered as the right way to sustainably buildings with high comfort and low energy costs.

Conclusion

Especially at the level of the planners, the willingness has to be aroused to deal with new components and the associated challenges. Integral planning is seen as a possible instrument for this, but so far it has rarely been practiced.

Overall, greater efforts should be made to establish the integral planning approach in practice, so innovative components have a good chance of establishing themselves on the market.

Key data

Short titel: Intelligente building envelope

Researchers / Project management:
Dr.-Ing. Stephan Schlitzberger (Project management), Dipl.-Ing. Christiane Schwenk, Dipl.-Ing. Barbara Falkenhof, Dipl.-Ing. Anna Bauer, Dipl.-Ing. Christoph Kempkes

Total cost: 123.940,00 € €

Proportion federal subsidy: 83.940,00 €

Project term: 12 Months

Pictures:

Picture 1: Intelligente_Gebäudehülle_Bild1.jpg
Geometry of the space model based on DIN EN ISO 13791

Picture 2: Intelligente_Gebäudehülle_Bild2.jpg
Operative roomtemperature as a function of the exponentially weighted moving average outdoor temperature for a system with manual shading and increased day-time ventilation for a proportion of window area of 50 %

Picture 3: Intelligente_Gebäudehülle_Bild3.jpg
Energy demand for cooling and overtemperature degree hours for all orientations for variant 0 (basic system without shading device), variant V1 and variant V2

Picture 4: Intelligente_Gebäudehülle_Bild4.jpg
Number of times of exceeding and lower deviation of the comfort zones I - III for systems without increased night-time air change for orientation West

Picture 5: Intelligente_Gebäudehülle_Bild5.jpg
Number of times of exceeding and lower deviation of the comfort zones I - III for systems with increased night-time air change for orientation West