Best Practice for Double Skin Facades
The BESTFACADE Project

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ABSTRACT

Double skin facades have become a major architectural element in office buildings over the last 15 years. A double skin facade can provide a thermal buffer zone, solar preheating of ventilation air, energy savings, sound protection, wind and pollutant protection with open windows and nocturnal cooling. Commercial buildings with integrated double skin facade can be very energy efficient buildings with all the good qualities listed above.
However not all double skin facades built in the last years perform well. The BESTFACADE project is supported by the Intelligent Energy Europe Program of the European Community and will actively promote the concept of double skin facades. A best practice guideline of double skin facades will be created. It will be based on a comprehensive survey of double skin facades in Europe. Information on built examples of double skin facades in European office buildings will be collected, investigated and assessed. Non-technological barriers will be analysed and strategies to overcome them will be presented. A simple calculation method to estimate the energy demand and comfort parameters will be developed.

KEYWORDS

Double skin facade, glazed facade, energy efficiency, design guide.

INTRODUCTION

Innovative facade concepts are today more relevant than ever. The demand for natural ventilation in commercial buildings is increasing due to growing environmental consciousness while at the same time energy consumption for buildings has to be reduced. An advanced facade should allow for a comfortable indoor climate, sound protection and good lighting, thus minimising the demand for auxiliary energy input. Double skin facades (DSF) have become a major architectural element in office buildings over the last 15 years.

The double skin facade can provide:

- a thermal buffer zone
- solar preheating of ventilation air
- energy saving
- sound protection
- wind protection with open windows
- pollutant protection with open windows
- fire protection
- nocturnal cooling

- aesthetics
- site for incorporating PV cells

Commercial buildings with integrated DSF can be very energy efficient buildings with all the good qualities listed above. However not all double skin facades built in the last years perform well. Far from it, in most cases large air conditioning systems have to compensate for summer overheating problems and the energy consumption badly exceeds the intended heating energy savings. Therefore the architectural trend has in many cases unnecessarily resulted in a step backwards regarding energy efficiency and the possible use of passive solar energy.

THE BESTFACADE PROJECT

The BESTFACADE project which receives funding from the Intelligent Energy Europe Program of the European Community will actively promote the concept of double skin facades. A best practice guideline of double skin facades will be created. It will be based on a comprehensive survey of double skin facades in Europe. Information on built examples of double skin facades in European office buildings will be collected, investigated and assessed. Using this guideline designers and investors can avoid application of non relevant concepts of DSF performing worse than traditional facades. The investor's confidence concerning operating performance, investment and maintenance costs shall be increased.

Scope of Work

The project started in January 2005 and runs for 3 years. It is structured into six work packages.

Work package	year	2005				2006				2007			
	quarter	1	2	3	4	5	6	7	8	9	10	11	12
WP1: State of the Art		■	■	■	■								
WP2: Cut-back of non-technological barriers				■	■	■	■	■	■				
WP3: Energy related benchmarks and certification method				■	■	■	■	■	■				
WP4: Simple calculation method				■	■	■	■	■	■				
WP5: Best practice guidelines								■	■	■	■		
WP6: Dissemination		■	■	■	■	■	■	■	■	■	■	■	■

The consortium consists of twelve partners from seven European countries, thus covering different climatic regions with their implications on the performance of double skin facades.

State of the Art

In the first part of the project the State of the Art of double skin facades in different counties and climatic regions was documented. A centralized information system database containing details and performance data collected from a survey of double skin facades built in the European Union was established.

This information system, like all other dissemination material, is available on the website of the project www.bestfacade.com. A coherent typology of double skin facades was developed. Questionnaires covering thermal behaviour, indoor air quality, comfort and user acceptance as well as energy demand and consumptions for heating, ventilation, cooling and lighting were produced. The investment, maintenance and operation costs were investigated. The report on 'State of the Art of Double Skin Facades' also covers non energy related issues like acoustics, aesthetics, fire protection, durability and maintenance. The website also contains sections explaining the basic principles of double skin facades and hyperlinks to sources of information on the internet.

Non-technological Barriers

Another aim of the project is the cutback of non-technological barriers to double skin facades. These non-technological barriers are more difficult to overcome than technological barriers as they are not objective and differ from country to country. In the first phase non-technological barriers will be identified, solutions to overcome them will be presented and the results will be incorporated in the dissemination strategy. The analyses will comprise the following non-technological barriers: legal, financial, institutional, standardization, cultural, social and educational. This will be partly achieved with workshops and round table discussion with members of the advisory group. Additionally a SWOT analysis (SWOT - strength, weaknesses, opportunities, threads) will be carried out. In the second phase strategies to overcome these barriers will be developed. One educational barrier is the lack of information within the target group. This project will overcome this barrier with a best practice guideline and best practice examples already built. A broad dissemination of the project results within the target group and beyond is necessary to overcome this barrier. The work on legal barriers will include the assessment of emissions and planning regulations. Bureaucratic time-consuming and expensive procedures for obtaining construction permissions are also relevant to this barrier category.

Benchmarks and Certification

Using the results form the questionnaires from the 'State of the Art' work package a benchmark system will be made available on the webpage of the project. This benchmark will allow the users and the operators of buildings with double skin facades to compare their energy consumption levels with others in the same group, set future targets and identify measures to reduce energy consumption.

Simple Calculation Method

Presently the assessment of the thermal behaviour and the energy-efficiency of naturally ventilated double skin facades is only possible by using complex simulation tools, which allow interconnections between fluid dynamics, energy balances and optical transport mechanisms. The performance assessment of mechanically ventilated double skin facades is slightly easier but still requires simulation tools. Because of the interaction of separate calculation results, extensive iterations are often necessary. This makes it impossible to have reliable predictions on energy efficiency and impacts on comfort in the early planning phase.

Therefore an assessment method will be developed, which on the one hand can be integrated in the assessment methods of the EPBD and on the other hand offers sufficient accuracy of the thermal behaviour and the energy performance of the system. Similar to the standardised approach for the winter gardens, trombe walls and the ventilated building envelope parts of the ISO 13790, annex F, a monthly balanced calculation procedure will be developed and evaluated based on sensitivity studies. With this method the thermal and visual behavior and the energy performance of the facade can be calculated with adequate accuracy for assessments of potentials. A prediction of the efficiency of the facade technology can be derived. By that the energy efficiency and quality of the facade could be European-wide certified where required. This calculation procedure should harmonise with the currently developed CEN-Standards for the implementation of the EPBD. The main work consists of the approximation of the airflow in the facade interspace and the adaptation of the utilisation factor of the solar gains to the different facade systems. The results of the developed method will be compared to results from other simulations.

Best Practice Guidelines

A design guide including best practice examples will be compiled, providing the target group with a common basic scientific, technical and economic knowledge on double skin facades. The design guide will allow the target group to design, choose, manage, use and maintain double skin facades. Case studies, good examples of technical solutions and buildings, potential advantages and disadvantages with double skin facades, situations where double skin facades can be appropriate, microscopic and macroscopic impacts of double skin facades will be published. The energy demand and consumption for heating, ventilation, cooling and lighting of different facade types will be compared and appropriate control strategies will be included. Non energy related issues like acoustics, aesthetics, fire protection, moisture, corrosion, durability, maintenance and repair will be discussed. Also a review of available simulation tools and their ability to model the complex system of a double skin facade will be presented.

Dissemination

The project results will be disseminated by different strategies, like website, CD-ROMs, national workshops and presentation at conferences. The multilingual project website www.bestfacade.com will serve as main source of information.

CONCLUSIONS

The BESTFACADE project will actively promote the concept of double skin facades. Studies showed that the energy consumption of buildings with double skin facades vary extremely. The project will offer information supporting the design of energy efficient and healthy office buildings equipped with double skin facades. The purpose is to provide the targeted audience with common basic scientific, technical and economic knowledge on double skin facades. Apart from this fundamental knowledge detailed practical information in order to design, choose, manage, use and maintain double skin facades will be published. Using these information and guidelines designers can avoid the application of not well functioning concepts of double skin facades resulting in increased energy consumption and bad indoor climate. With the best practice guidelines the knowledge and confidence concerning performance, investment, operation and maintenance of double skin facades shall be increased.

ACKNOWLEDGEMENT

With the support of Intelligent Energy Europe **EIE/04/135/S07.38652**

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