Thermal control through a unique coloured solar curtain wall solution

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Summary

This paper presents an innovative approach to generating thermal energy to control the climate of large buildings through a unique aesthetic coloured solar solution for curtain wall architecture. The paper concentrates on the practical execution of this integrated approach. It describes the different project phases for the execution of the first building project where the energy needed to power the water heating system of the building is entirely generated from the building envelop. The curtain wall's spandrel panels consist of thermal solar collectors of a novel design, offering the aesthetic appearance of colored glass panes, opaque to the eye while being able to capture as much solar energy as a commercial solar thermal collector closed by a transparent glass pane. It allows for the first time architects to integrate renewable energy generation in the envelop of the building, offering new design perspectives without compromising the aesthetics of their architecture.

Keywords: Renewable energies, curtain-wall, solar energy, solar thermal panels, thermal control, building aesthetics, architectural glass, solar power.

1. Introduction

About forty percent of the total energy consumption of the world is utilized in buildings, the largest proportion of it being used for thermal control of large buildings with up to seventy percent of it consumed for air conditioning. There is thus a crying need to supplement or even better, to replace, the use of fossil energy by renewable energies to generate the power needed to control the temperature of public or commercial buildings such as shopping centers, sports arenas, office buildings, large housing complexes, public buildings, educational institutions or hospitals.

The solution of choice is the use of solar energy to generate the power for cooling or heating of buildings, as it is renewable and free.

Thermal solar collectors, typically equipped with black, optical selective absorbers sheets, exhibit in general good energy conversion efficiencies. However, until now, the black colour, and sometimes the visibility of tubes and corrugations of the metal sheets, have limited their acceptance as integrated elements of the curtain wall of new or remodelled buildings.

Due to the unpleasing visual aspect of commercially available solar thermal collectors, their use in thermal control has been mostly limited to roof applications, where the solar captor is normally out of sight and hence, its appearance is not important. As a consequence, the surface available to collect solar energy is very limited in most cases, and far from sufficient to obtain the entire power supply for the thermal control of the building.

Increasing the sun collection area by architectural integration of aesthetical solar thermal collectors within the external envelop of buildings is one of the solutions to solve this issue. This is the original and novel approach, applied to a new construction in western Switzerland, that SwissINSO, in tight partnership with EPFL-LESO [1], have chosen to present in this paper.

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