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Does window-to-wall ratio have a significant effect on the energy consumption of buildings? A parametric analysis in Italian climate conditions

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Abstract

Building envelope structures play a pivotal role in the energy behaviour of edifices. They influence the heat exchanges between indoor and outdoor environment and might allow a proper exploitation of solar energy. Therefore, when properly designed, they can contribute to minimizing the overall energy demand of buildings, allowing achievement of the high energy performance that is the basis of the Nearly Zero Energy Building (NZEB) concept.

In this context, window systems are generally considered as the crucial element to be correctly designed for energy efficiency purposes in view of the role they play in heat exchange processes and solar gain management.

This paper outlines the methodology and the correspondent results of an analysis which aims to search for the optimal size of the window surface, which is the size allowing minimum overall energy consumption, in an office building whose structure and configuration represent a typical reference case for the Italian building stock.

Several configurations were considered, varying the climate, the thermal features of the building envelope and the installed lighting electric power. Furthermore, the influence of a switchable shading device was assessed and the correlated comfort consideration reported.

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