Impact of façade window design on energy, daylighting and thermal comfort in nearly zero-energy houses

Appropriate window solutions are decisive for the design of 'nearly zero-energy' buildings with healthy and comfortable indoor environment. This paper focuses on the relationship between size, orientation and glazing properties of façade windows for different side-lit room geometries in Danish 'nearly zero-energy' houses. The effect of these parameters on space heating demand, daylighting and thermal environment is evaluated by means of EnergyPlus and DAYSIM and presented in charts illustrating how combinations of design parameters with minimum space heating demand can be selected within a solution space defined by targets for daylighting and thermal comfort. In contrast with existing guidelines, the results show an upper limit for energy savings and utilisation of solar gains in south-oriented rooms. Instead, low U-values are needed in both north- and south oriented rooms before large window areas lead to reductions in space heating demand. Furthermore, windows in south-oriented rooms have to be carefully designed to prevent overheating. Design options for prevention of overheating, however, correspond well with options for low space heating demand. Glazings with solar control coating are therefore obvious alternatives to dynamic solar shadings. Regarding room geometry, deep or narrow south-oriented rooms show difficulties in reaching sufficient daylight levels without overheating.
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