Examination of the Effect of Different Window Types on Energy Use in Turkish Apartment Buildings

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ABSTRACT

In this study, the effect of different window types on energy use in Turkish apartment buildings is investigated. The example building is calibrated and used for analyses according to Turkish Insulation Standard TS 825 for the 5 different climate zones. In this study,, twelve different glazing types are selected for analysis. Also, the frame type changed to a PVC frame which is mostly used frame type in Turkey. As a result, the minimum heating loads are calculated for the W12 glazing type and the minimum cooling loads are calculated for the W1 glazing type. Thus, the U value is not the only value that affects the energy use intensity, solar heat gain coefficient (SHGC), and visible transmission (VLT) values are also important. Finally, the effect of glazing on the amount of CO2 emission is examined.

KEYWORDS

Glazing, SHGC, Apartment Buildings, CO_2 emission, TS 2164, TS 825

OBJECTIVES

The aim of this study is improve the energy efficiency of residential apartment buildings in Turkey.

There are 3 objective for this study;

1- Selecting a representative apartment unit and characterizing it.

2- Conducting a parametric simulation focus on window types

3- Develop design recommendations for different climate zones

AUDIENCE

Building engineers, design makers, architects.

The students who study at the same field.

RESARCH QUESTIONS

What is the reason for selecting window types?

What is the reason for selecting residential apartment buildings?

What are the potential impacts on energy efficiency and consumption?

Assessments of the effect of windows types on building energy efficiency.

Analyse the effectiveness of current Turkish Standard in terms of thermal transmittance, solar heat gain coefficient and visible transmission values. Current standard includes emissivity values

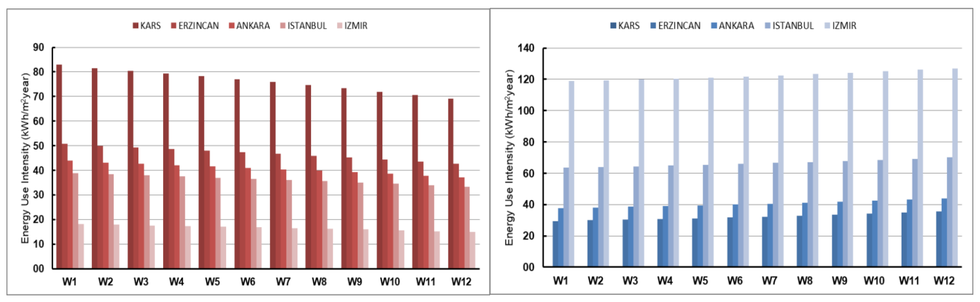
There are so few studies related to this subject published in Turkey.

METHODOLOGY

According to the literature, there are three main approaches to create simulation models and these are theoretical reference models based on statistical data, a reference model based on one specific and monitored building, and ideal reference models based on experts' estimation of input parameters. In this study, we choose an ideal reference model from a previous study to belong to Atmaca, 2015

RESULTS

The maximum yearly energy use intensity for heating was calculated between 69.2 and 83 kWh/m^{2}year for Kars province and the minimum was between 14.9 and 18.2 kWh/m^{2}year for Izmir province. When the glazing type changed, the energy use intensity decreased 16.6% for W12 glazing in Kars. When the results examined for Izmir which is located in the hottest climate zone, energy use intensity is decreased by 18% (Fig 2). According to these results, it can be said that a better U value is better to decrease the heating load of buildings.



When examined the energy use intensity for cooling, it is not affected by glazing due to any need for cooling in Kars. The maximum yearly energy use intensity for cooling was calculated between 118.8 and 127 kWh/m^{2}year for Izmir province and the minimum was between 29.5 and 35.7 kWh/m^{2}year for Erzincan province. When compared to the base scenario (W1), the energy use intensity increased by 7% for Izmir province for W12 (minimum U value). For Erzincan, the W12 glazing type increased the cooling energy consumption by 21% (Fig 3). According to these results, it can be said that the U-value has an adverse effect on cooling loads.

CONCLUSIONS

As known, TS 825 which was renewed in December 2013 takes into consideration only U values of glazings. However, when we examined the simulation results, U values are not the only value that affects the heating and cooling loads of buildings. Also, SHGC and VLT values are important. Thus, these values should be added to the TS 825 If the SGHC values increase, the heat gains increase for the heating season. On the contrary, it has an adverse effect on cooling loads. For Kars which is located in the 5th zone and has no need for cooling, higher SGHC values will be better for heating-dominated provinces. Thus, the cooling and heating loads are not only affected by U values.

Resources

Atmaca, A., Atmaca, N., 2015. Life cycle energy (LCEA) and carbon dioxide emissions (LCCO2A) assessment of two residential buildings in Gaziantep, Turkey. Energy Build. 102, 417–431. https://doi.org/10.1016/j.enbuild.2015.06.008

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TS 825, Building insulation standard, December 2013.

TS 2164 Turk standard, Principles for the preparation of the projects of the central heating systems (2000)

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