On Development of Design Day for Cooling Energy Need Calculations

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1 Introduction

The paper implies that the methods most frequently used for cooling load calculation (simplified dynamic modelling like e.g. admittance procedure) can be also applied when estimating the annual cooling energy use of buildings. Such approach makes good use of well-established and recently improved tools in another area – in energy performance rating of buildings with regard to their sustainability.
The idea is to replace the design day for cooling load calculation by design day for cooling energy need (DEDCEN) while keeping the same calculation procedure. This would enable to introduce the dynamic impact of weather to the calculation of cooling energy use.

2 Methodology

Three different methods were developed and employed in searching for appropriate 12 DEDCENs representing individual months of a year. Two methods were based on statistical analysis of design reference year data. The statistical analyses were developed from TMY2 (M1) and EN ISO 15927-4 (M2) procedure [1] [2].
In the third method (M3) we used known values of the cooling energy need for well-defined building types to select the DEDCENs from all-year data.
Cooling energy need calculated with DEDCENs and admittance procedure should be as similar to known values of the cooling energy need for all of the building types as possible.
The results of the three tested methods were compared to each other and evaluated by the IEA building energy simulation test (BESTEST). Four realistic building configurations (600, 620, 900 and 920) were selected.

3 Results

The results show that the predictions of cooling energy use based on 12 DEDCENs varied from 96 to 108 % of the values obtained from the complete reference year data (Fig.1). The best results were obtained by the method M3, results were within 96 to 103 % of the all-year values. In other words, it was proved that instead of the all-year database representing 365 days (8760 hourly steps) we can use 12 DEDCENs (one for each month of the year) requiring only 288 hourly steps while keeping acceptable accuracy.

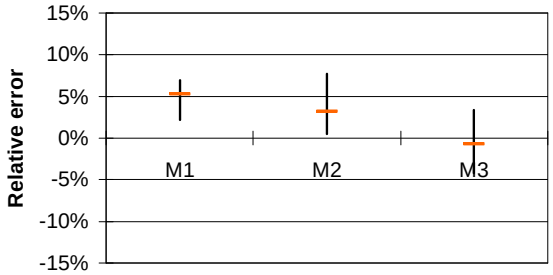

Figure1: Relative errors of cooling energy need calculation using DEDCENs compared to all-year data (set to 100%)

4 Conclusions

The developed methodology has a potential to improve standard procedures for the prediction of cooling energy use of buildings in terms of accuracy and efficiency.

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References

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[2] ISO 15927-4:2005 “Hydrothermal performance of buildings - Calculation and presentation of climatic data - Part 4: Hourly data for assessing the annual energy use for heating and cooling”, European Committee for Standardization 2005