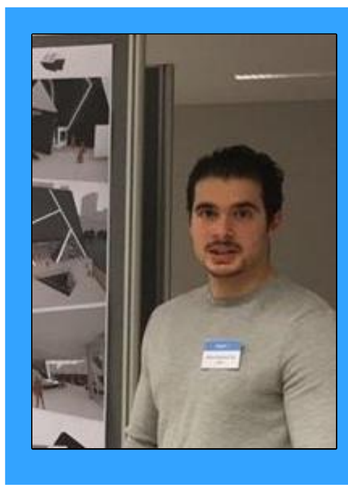


Evaluation of the overheating risk and the potential of ventilative cooling:

A case study in Belgium

Authors: FANI Abdulrahman

E-mail: a.fani@hotmail.com

Address: Building Design Lab (SBD)
Quartier Polytech 1
Allee de la Decouverte 9
4000 Liege, Belgium
www.sbd.ulg.ac.be
Tel: +32 43.66.91.55
Fax: +32 43.66.29.09

ABSTRACT

Current European buildings regulations intend to achieve energy efficient buildings and a decarbonized building stock by 2050, as a result, Member states implement an Energy Performance Certificate (EPC) procedure based on energy performance simulation models. However, with current climate projections the risk of overheating becomes a factor that should be recognized. The study aims to evaluate the degree of accuracy of the overheating risk proposed by the EPC tool and its sensitivity, and assesses the potential of ventilative cooling as a mitigations strategy.

KEYWORDS

Thermal comfort – Residential Buildings – Energy efficiency- Performance indicators – Dynamic simulations – Passive cooling

PROBLEM

- Within the Walloon Region the EPC calculation method is based on a static simulation that uses references days and average temperatures in the calculation.
- The EPC tool also classifies the building based on its current status, without taking into account future climate projections.
- Passive solutions are frequently proposed as solutions to avoid or mitigate the overheating risk, but their efficiency is never quantified.

OBJECTIVES

- Choosing a verified case study in Belgium representing an energy-efficient building typology.
- Creating energy simulation model of the case study in the EPC tool and a state-of-the-art energy performance tool “DesignBuilder” to compare the overheating risk.
- Apply long-term thermal indicators to the simulation results to assess the sensitivity of overheating and the potential of ventilative cooling.

AUDIENCE

- The architects and the administration
- Energy performance engineers

RESEARCH QUESTIONS

- What is the overheating risk degree of accuracy in the EPC ?
- How sensitive are current energy efficient buildings to climate change?
- What is the potential of passive cooling to mitigate overheating?

ORIGINALITY

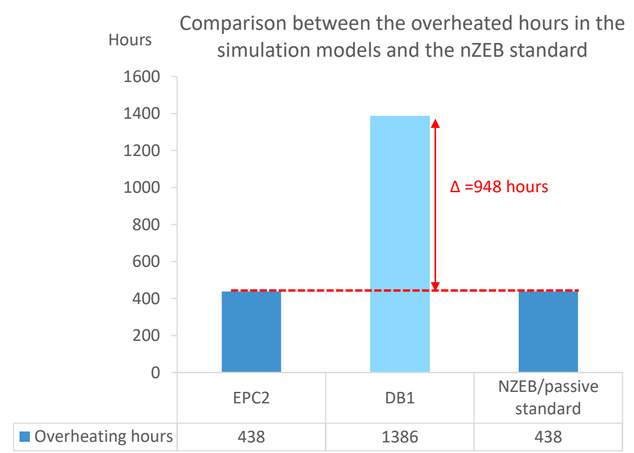
- Assess the degree of accuracy of the overheating risk of the Walloon EPC tool.
- Provide insight on adopting long-term thermal discomfort indicators in the EPC tool to assess the overheating sensitivity .
- Assess the efficiency of ventilative cooling in a quantitative manner and linking it with the overheating sensitivity.

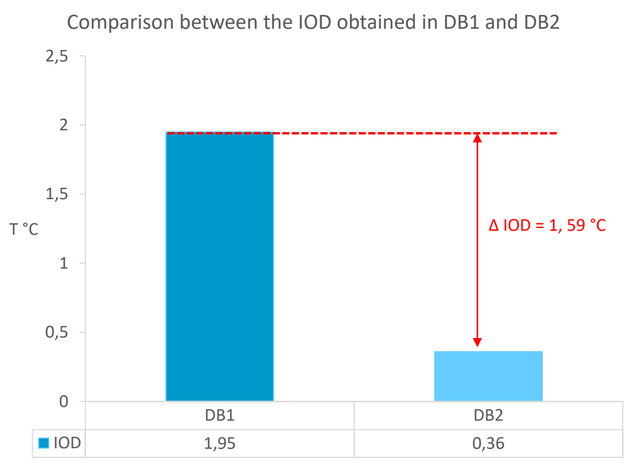
METHODOLOGY

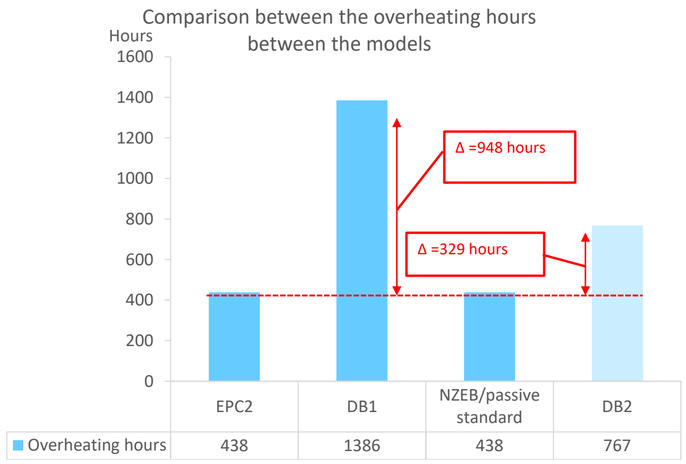
Literature Review	Data processing	Modeling & Simulation	Results & Analysis
• EPBD regulations • EPC context in Wallonia • Problem statement	• Case study in Belgium • Standards • Long-term indicators • Ventilative cooling	• Simulation models in EPC & DesignBuilder • Calibration of models • Applying vent. cooling	• Comparing the overheating risk. • Applying the long-term indicators • Assessing the overheating sensitivity & potential of vent.

RESULTS

- A difference factor of 2,16 in the obtained overheating hours.
- Surpass of the regulations by 14%.
- OEF α_{IOD} = 0,56 → capable of supressing climate change.
- Reduction in the IOD by 1,59°C due to ventilative cooling.
- The effectiveness of ventilative cooling is 82%.
- Reduction in the overheated hours by 65%.







CONCLUSION

- The research clarifies the uncertainty regarding the accuracy of the EPC tool.
- The importance of adopting long-term indicators to take into account future variations.
- The high effectiveness of ventilative cooling that can mitigate the overheating risk.

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