Lessons Learned from Irish Schools: Early-stage Insights on Overheating

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SUMMARY

Overheating in school buildings is likely to lead to a negative learning performance experience for occupants in these settings. In Ireland, school buildings are primarily naturally ventilated, given the relative increases in external mean temperatures that are projected to have negative effects on the potential of natural ventilative cooling going forward, it is important to assess what the current overheating status is in these buildings. Existing work has already highlighted the lack of measurement data on overheating in low energy school buildings. Additionally, the literature also supports a difference in comfort between adults and children as well differences between temperature suitable for learning performance assessments and comfort assessments in school settings. In this presentation, early-stage insights on overheating in school buildings in Ireland will be presented with a subset of data from the RESILIENCE project. A series of comfort-based and performance-based metrics will be used to contextualise this data which was gathered in 2022/2023. Additionally, lessons learned from site visits as well as inputs from a calibrated whole building simulation model will be used to determine to what extent is overheating an issue in Irish schools and are they likely to overheat in the future.

KEYWORDS

Overheating, primary and post-primary, natural ventilation, ventilative cooling, overheating

1 INTRODUCTION AND BACKGROUND

1.1 Overheating in naturally ventilated schools

Despite there being evidence in the literature to support that excess heat or overheating can have a negative effect on occupant performance in schools [1], [2], there is scarce data on the overheating performance in schools but particularly new ones [3].

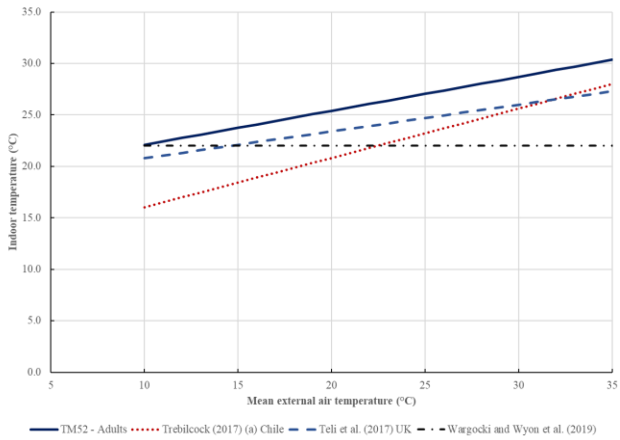

Figure 1: Comparison of adaptive thresholds for adults, children as well as thresholds reflective of relative learning performance

This mirrors the case for non-residential buildings more generally as more data is needed in this area [4]. School buildings have been examined using different metrics in the past be they for comfort [5], [6] or learning performance [2] what is evident is that adaptive standards or thresholds used for adults are not likely to be reflective of what students experience in primary schools and potentially post-primary schools also (See Figure 1).Additionally, it is also evident from the literature that passive cooling systems such as natural ventilation may not be equipped to supress projected excesses in heat in the future [7] and this is when standardised thresholds are used. Therefore, it is important that further research be conducted in school buildings.

1.2 Project RESILIENCE and case studies

The following study is one part of project RESILIENCE, which is research project funded by the Sustainable Energy Authority of Ireland (SEAI). The focus of RESILIENCE is on overheating in naturally ventilated (NV) low energy or nZEB built environments in non-residential or commercial buildings. This research aims to:

"Systematically map and quantify how low or Nearly Zero Energy (i.e. nZEB's) commercial building design, construction and operation in Ireland has affected or will affect indoor thermal environments in buildings that rely exclusively on passive strategies for the supply of fresh air and, more specifically, the removal of heat build-up that would otherwise lead to an unacceptable thermal experience for building occupants."

The project has three overall building types: schools, office/educational, and healthcare. The project has targeted a total of 30 non-residential buildings (with a minimum of 2 to 3 zones per building), where data is being gathered on overheating at half-hour intervals at a minimum. The utilises data from different sources with existing BMS or Wifi-based data logging systems but in some cases standalone data loggers were used. Table 1 indicates the school buildings that were confirmed as of August of 2023. A mixture of retrofit, new built as well as extensions to existing buildings were monitored.

Table 1: List of 12 case study school buildings (as of August 2023) and monitoring systems installed

School Name	Location	Building Type	No of Zones	Monitor Type	Accuracy
PS1	South	New	5	Stand-alone	±0.3°C
PS2	South	New	5	Stand-alone	±0.5°C
PS3	South	New	>5	Wifi-based	±0.1°C
PP1	South-West	Extension	5	Wifi-based	±0.3°C
PP2	Midlands	New	>5	BMS/ Stand-alone	±0.5°C
PS4	Mid-West	Extension/Retrofit	>5	BMS	±0.5°C
PS5	South	New	5	Stand-alone	±0.5°C
PS6	South	Extension/Retrofit	5	Wifi-based	±0.3°C
PS7	North-East	Retrofit	>5	BMS	±0.5°C
PP3	South-East	Retrofit	>5	BMS	±0.5°C
PP4	South-East	Extension	5	Wifi-based	±0.3°C
PS8	West	Existing	>5	BMS	±0.5°C

As part of this presentation, data from a subset of these buildings will be presented along with some lessons learned from site visits in each building or from previous work in the simulated performance of a new NV school building in Ireland [8].

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