Ventilative Cooling – Time for large scale implementation?

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1 INTRODUCTION

The current development in building energy efficiency towards nearly-zero energy buildings (nZEB) represents a number of new challenges to design and construction. One of the major new challenges is the increased need for cooling arising in these highly insulated and airtight buildings. The cooling demand depends less on the outdoor temperature, and more on solar radiation and internal heat gains. This naturally gives better potential for the use of ventilative cooling technologies, because the cooling need is not only in summer, but actually all year round.

For **residential buildings**, the design process is much more simplified than for commercial buildings and is to a very large extent based on experiences and rules of thumb and the need for cooling is underestimated or might not even take it into account. Therefore, developed solutions to address cooling issues available for residential applications are very limited, often too simplified and might not be well adapted for practical application. Finally, homeowners of might not know how to effectively reduce the overheating in their building and their behaviour might instead actually increase the problem.

For **offices and other non-residential buildings**, the challenges are different and mainly related to the development of new approaches towards reduction of the existing energy use for cooling. However, due to thermal comfort issues and the risk of draught limited temperature differences between supply air and room can be utilized making heat recovery or air preheating necessary. As a result, the energy and cost advantage of utilising the free cooling potential of the outdoor air in a mechanical ventilation system compared to a mechanical cooling solution might become very limited. These limitations do not apply to the same extent when the outdoor air cooling potential is applied to a free-running building (naturally ventilated building).

2 LESSONS LEARNED FROM RESEARCH CASE STUDIES

Well documented case studies using ventilative cooling from across the world were collected in IEA EBC Annex 62 and a number of key lessons learned were reported.

Detailed building simulation is important when simulating VC strategies. Most case studies analysed highlighted the need for reliable building simulations in the design phase of a VC system. This was considered most important when designing for hybrid ventilation strategies where multiple mechanical systems need harmonization. Some studies also said that simulating the window opening in detail was important. Customisation may be an important factor in designing a VC system. In order to ventilate certain buildings, it may be necessary to design custom components. Some case studies highlighted the need to have custom design systems that were specific to country regulations and the use of a building or space.

VC systems were considered a cost-effective and energy efficient in design by most case studies, but particularly with naturally ventilated systems. It was indicated that designing with the integration of manual operation and control was important, particularly in a domestic setting. All case studies emphasized that monitoring a buildings performance post occupancy is important if not essential in building performance optimization and correct maintenance and calibration of the systems is integral to maintaining performance. Some case studies highlighted the need to exploit the outside air more with lower external air control limits during typical and night-time operation. However, it was noted that care must be taken particularly in cold climates which observed more incidences of overcooling than overheating.

The conclusions from the case studies was that the best contemporary designs combine natural ventilation with conventional mechanical cooling.

3 NEXT STEP – LARGE SCALE IMPLEMENTATION?

Despite the many promising outcomes of recent research activities, the progress in implementation of ventilative cooling solutions seems still to be limited. We have not been able to effectively to remove the many obstacles and stumble stones designers experience.

Progress is being made in international standardisation, but there is still a long way for changes in national regulations and compliance tools. The use of detailed simulation tools for simulation and design of ventilative cooling is not realistic for residential buildings and small offices. Design guidelines for application of ventilative cooling in such cases is needed and must be developed for specific climates and context. The use of customized solutions needs to be reduced and on-the-shelve" solutions developed for application in typical buildings including solutions for monitoring and control.

Research has proved the potential and the capability of ventilative cooling, but industrial development of tools and technical solutions is required before a large scale implementation can be achieved.

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