Early Stage Design of VC: A standardised approach to improve robustness and avoid vulnerability lock-in at the later design stages

Paul O'Sullivan

1 School of Mechanical, Process & Electrical Engineering, Munster Technological University, Rossa Avenue, Bishopstown, Cork, Ireland
Paul.osullivan@mtu.ie

SUMMARY

The global increase in building cooling demands poses a challenge for designers striving for net zero energy consumption. The prevalent use of mechanical cooling underscores the necessity for designers to consider Ventilative Cooling as a viable alternative in the early stages of building design. Recent research findings suggest that the pre-design stage has the same influence for promoting Ventilative Cooling strategies as the schematic and detailed design stages for practitioners, yet limited impactful decision making occurs at this stage. We present the latest process flow diagram for early stage evaluation of ventilative cooling strategies and discuss its implementation in terms of the iterative nature of design and the role of the proposed ventilative cooling potential method. We also discuss the different needs of architects and engineers at the early design stages of buildings.

KEYWORDS

Calibration, modelling, ventilative cooling potential, early stage design

1 BACKGROUND

Evaluating design choices at the earliest possible time in the design cycle can reduce both the need for 'design churn' at the later detailed design stages as well as the risk of a 'lock-in' effect where poor design choices become difficult to reverse. Practitioners also have diverging needs where Architects prefer informative guidance and qualitative advice on choices whilst specialist consultants and engineers would be more comfortable with an approach that aims to quantify the performance of the particular design choice. Ventilative Cooling as a strategy for addressing occupant thermal comfort in indoor spaces is a low energy strategy that can be resilient to various external performance threats such as power outages. However its potential to meeting the cooling needs of indoor spaces is limited by the available cooling potential in the ambient air. Further, its performance is typically subject to various design choices linked to site design, building morphology, system and component selections and so on, therefore ensuring a successful design solution requires a multi-disciplinary approach involving Architects, Engineers and specialist designers, with an opportunity at the early design stages to have a strong influence over the adopted strategy. There is currently a lack of availability of 'easy to use' early stage design tools for Architects and Engineers that evaluate the potential for ventilative cooling. Further, any tool or method that might be employed at the early stages of design would need to be 'stress-tested' to ascertain its reliability in predicting the likely performance of a given strategy. While there is no requirement for high accuracy at the early stage there would need to be a reasonable level of robust advice so as not to result in a divergent finding when assessing a more complete version of the strategy at the detailed design stage with a tool such as dynamic whole building energy simulation software.

2 EARLY STAGE VENTILATIVE COOLING ASSESMENT

We qualitatively discuss the appropriateness of the VCPM tool as an early stage assessment method. We also present an early stage (or feasibility stage) design process flow diagram which incorporates the VCPM as well as a number of other steps linked to the overall design guidelines within the new European Technical Specification on designing ventilative cooling systems. The

proposed design process incorporates the iterative nature of defining a cooling and ventilation strategy, revising that with the addition of passive interventions (defined under the categories of preventative, modulating and dissipating effects) when the cooling demand prohibits ventilative cooling. It also assists the designers in making choices around supplementary cooling options when read in conjunction with the European Technical Specification document itself. This flow diagram and the corresponding steps shall ensure a coherent way of designing (passive) Ventilative cooling systems in the early design phase before needing to go into more energy consuming systems, such as mechanical cooling systems. The aim of this flow diagram for ventilative cooling design in the CEN/TS is that the designer in Europe will have a platform to actually design ventilative cooling systems, which currently has lacked in European standards and technical specifications.

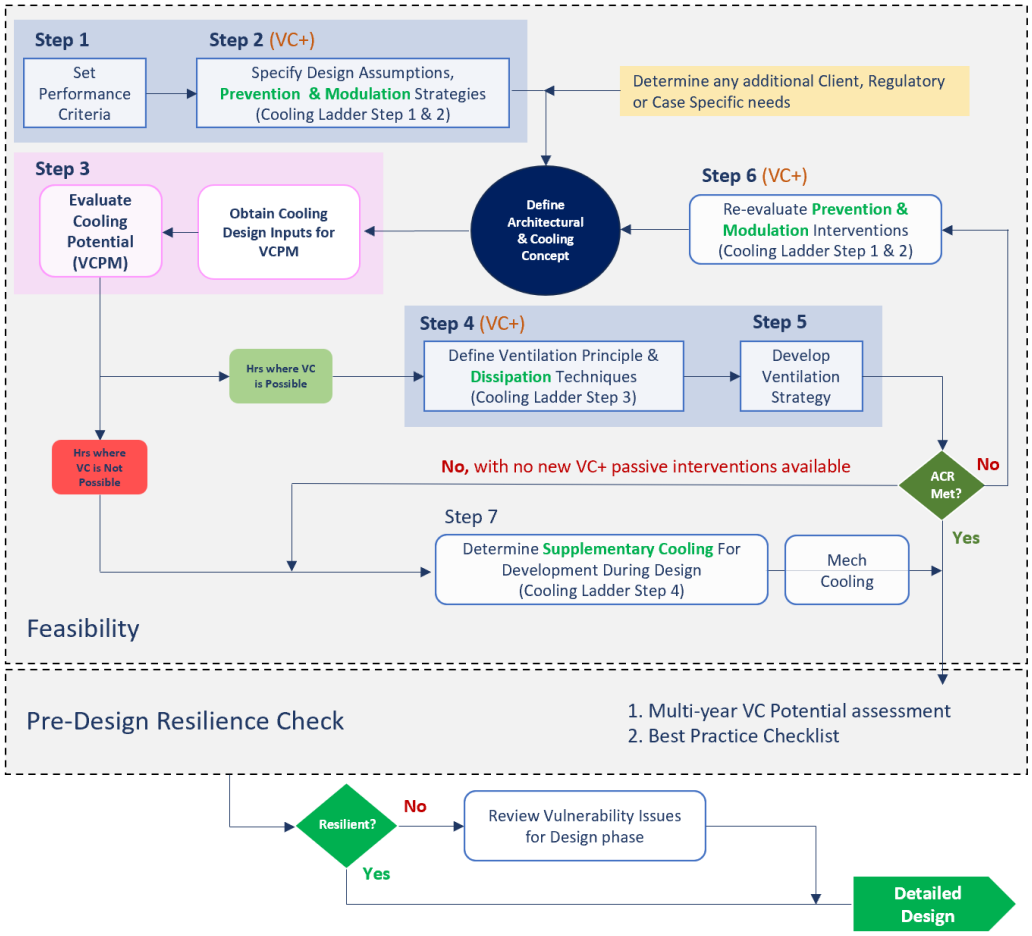

Figure 1: Early stage design process for evaluation of ventilative cooling potential

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