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Summary of the ventilative cooling track

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Over 160 persons attended the joint 34th AIVC, 3rd TightVent, 1st venticool and 2nd Cool Roofs' Conference held in Athens, Greece on 25-26 September, 2013. The conference focused on research, technologies, policies and market transformation to employ in an optimal way proper mitigation and adaptation techniques with the aim to reduce the energy consumption of buildings and improve the urban microclimate. Furthermore, focus was set on the energy impact of ventilation and air infiltration while ensuring good indoor air quality and thermal comfort, as well as converging work on smart materials to reduce the carbon footprint of the building sector.

Ventilative cooling was one of the major themes since the potential of this technique is more and more considered to reduce the cooling energy demand in summer or mid-season conditions, depending on outdoor climate, building design and internal loads. The ventilative cooling track of the conference consisted of 4 sessions with 27 presentations covering the following topics:

- Ventilation for summer comfort – energy impacts
- Experience with ventilative and passive cooling
- Ventilation and cooling strategies
- Ventilative cooling in standards and regulations – Challenges for Annex 62

Several presentations introduced the **climatic potential of ventilative cooling.** A state of the art review on passive cooling dissipation techniques, found night ventilative cooling to be a very effective method to reduce the needs for cooling and improve thermal comfort regardless the climatic conditions [1]. Similar conclusions were drawn by a comfort analysis of the potential of night ventilative cooling strategies in office buildings in Spain [2]. The study showed that night ventilation is an effective strategy to reduce cooling demand (in buildings with high daily internal gains) improving comfort conditions and flattening peak temperatures in all climate zones. At the same time, it was pointed out that a building typology, which combines a low glazed surface area in the façade and a low shape factor (building compactness), is important for effective night ventilation and to improve comfort conditions significantly.

Predicted scenarios for climate change applied to an energy efficient residential building located in Rhodos island- Greece, showed that although the cooling demand will significantly increase --up to 90% (2050) -- night ventilation strategy remains relevant and can still reduce the cooling load [3]. A similar study for office buildings in Singapore showed that the impact of climate change will increase the indoor air temperature in naturally ventilated offices, but other mitigation measures can compensate [4].

A number of presentations addressed **strategies to offset warm sensation in high temperature conditions.** An investigation on the role of increased air velocities to maintain comfort at high air temperature conditions bore good news. Results showed that it is possible to offset warm sensation within a range of indoor conditions with increased air velocity and that higher air velocities and personal control increase the acceptability of the indoor environment at higher air temperatures and reduce the energy consumption for cooling compared to full air conditioning during summer seasons in warmer countries [5]. Another study on the individual appreciation of air conditioned surroundings concluded that the perception of thermal comfort depends on whether the building is equipped with natural or mechanical ventilation [6].

A discussion on **calculation methods to predict ventilative cooling performance** identified a good correspondence between simulated and measured performance in the case of a zero energy Active House (Maison Air et Lumière) located near Paris, France (Figure 1) [7] and introduced a first order design guide for vent sizing in multistory atrium buildings [8].

Presentations focused on **strategies for ventilative cooling to control comfort and reduce cooling load** outlined ventilative cooling as a first order approach compared to thermal mass and insulation during an effort to understand their individual and synergic effect on thermal comfort [9]. Also, results of the application of an Energy Recovery Ventilator (ERV) with outdoor air cooling mode in a school in Korea, presented a 44 % energy saving potential [10].

Figure 1: Maison Air et Lumière, Paris

Figure 2: Home for Life, Denmark

Part of the presentations also dealt with **solutions to enhance ventilative cooling performance.** It was found that precooling by a closed loop ground heat exchanger (water) can ensure temperatures below 21^{0}C and fulfill the cooling needs in a residence in the Netherlands [11]. Furthermore, a double skin envelope system in Japan using outdoor air resulted in a reduction of both the indoor air temperature by 2-5 ^{0}C and the cooling load by 20-40% [12]. Another example of night ventilation with precooling of air in a lightweight nocturnal roof radiator, in Greece, reduced the temperature in an office room by 2.5 - 4 ^{0}C [13].

Figure Figure 2, Figure 3 and Figure 4 show a number of **case studies** where ventilative cooling was applied. The case studies presented during the conference, demonstrated ventilative cooling solutions in residences and offices and highlighted their role in preventing overheating and maintaining thermal comfort [14] [15] [16]. It was agreed that demonstration projects are very important to clarify what works and what needs to be improved both for the development of best practice guidelines and for "calibrating" design assumptions.

Figure 3: Sunlighthouse, Austria

Figure 4: LichtAktiv Haus, Germany

During a final discussion about ventilative cooling in the regulatory context in Austria and Denmark a number of challenges were revealed. The speakers addressed the need for 1) reliable simplified design tools to be used for residences and small offices 2) guidelines for designers for practical implementation to ensure design assumptions are met and 3) the development of more realistic design assumptions.

To conclude, ventilative cooling can be an attractive and effective solution but has a limited capacity and therefore integrated building design approaches and the reduction of heat loads are crucial. The climatic potential of ventilative cooling is promising as long as we keep in mind that there are many other constraints for applications that need to be met (pollution, noise, etc.). Moreover, using higher velocities is another major challenge if we want to maintain comfort; it brings up 2 questions which need to be answered: '*Is it at all possible to use higher velocities as a design criterion?' and 'Can we in ventilation design ensure certain velocity levels in buildings?'* Furthermore, considering that calculation methods to predict ventilative cooling performance are often overestimating the cooling capacity due to lack of availability of window opening area or lack of availability of thermal mass or occupants' practices, there is a need to move to more practical assumptions in predictions. It is also clear that *s*ince, most solutions to enhance ventilative cooling performance focus on reducing the supply temperature in order to improve the cooling capacity, the need for solutions for cold climates that prevent draught from cold incoming air becomes stronger.