Developing ventilative cooling for better comfort and energy savings in buildings

This position paper gives a brief overview of opportunities and challenges for ventilative cooling solutions both:

— To contribute to the 2020 objectives of the EU in the building sector with regard to energy savings and greenhouse gas emissions;
— To contain the overheating risk, which is an increasing concern in low-energy buildings.

venticool partners believe policy makers and standard bodies should take steps together with the implementation of the EPBD recast to accelerate the uptake of this technology.

Context and concern for overheating risk in nearly Zero-Energy Buildings

With 40% of the final energy use and 36% of greenhouse gas emissions in the European Union, the building sector deserves specific attention to meet the ambitious 2020 objectives of the EU.

One key concern regards provisions taken in practice to maintain acceptable indoor environmental quality (inc. thermal, visual, acoustical comfort, indoor air quality) while taking measures to reduce buildings' energy use. In general and in particular in nearly Zero-Energy Buildings, there is a very strong tendency to drastically reduce the heating demand. One adverse side effect is that in doing so, it often increases the risk of overheating both in summer and shoulder seasons due to the increased airtightness, insulation levels and solar gains of these high performance building structures.

Ventilative cooling reduces the need for active cooling

Experience shows that active cooling is often considered to address this problem, while other options should be prioritized in the building design, when relevant. Proper building design strategies can overcome this risk of overheating with little or even no use of active cooling. These strategies include in particular ventilative cooling (i.e., use of ventilation to cool indoor spaces), adequate solar control (e.g. dynamic shading) and thermal mass utilisation. They give designers a range of options to address the overheating risk and help avoid energy and aesthetics issues associated with the installation of active cooling units in existing buildings.

There are a number of theoretical and field studies that have shown the energy savings that can be realized with ventilative cooling, using readily available products. Of course, the magnitude of these savings depends highly on climate as well as on building design and usage. This is why the new project of the Energy in Buildings and Communities programme of the International Energy Agency on ventilative cooling (IEA Annex 62) will evaluate and analyse case studies to better characterize the performance of ventilative cooling and give the boundaries of existing solutions and their control strategies.

Ventilative cooling is poorly rewarded in regulations in most EU countries

Energy performance regulations have undoubtedly become key market drivers because of their increasing weight on building design options. Therefore, to grasp the potential of ventilative cooling in practice, this technology must be fairly rewarded in these regulations. However, most energy regulations poorly consider ventilative cooling. The vast majority of energy performance calculation methods in Europe do not include summer comfort criteria for free-running non air-conditioned buildings. In these cases, the substantial summer comfort improvements realized with ventilative cooling are not rewarded by the calculation. In addition, if mechanical or hybrid ventilation is used, the additional fan energy use may be penalized. To the credit of calculation method developers, ventilative cooling strategies indeed require rather mature assessment methods for thermal comfort and ventilation losses to be correctly accounted for.

venticool's involvement

Since its inauguration in 2012, venticool has devoted a lot to bridge the gap between scientific and regulatory approaches in this area. Its support to the AIVC conferences and development phase of the IEA Annex 62 has triggered interest from scientists, standard developers and policy makers around the world.

Exchanges between these communities have pointed out limitations with CEN standards (EN 15242, EN 15241, EN 15251, EN 13779) used in energy performance regulations which are detrimental to ventilative cooling. These include the poor handling of usage profiles and control strategies, in other words, assumptions on by how much and when the airflow rates are increased to meet acceptable thermal comfort conditions.

Nevertheless, studies conducted in several countries—e.g., Austria, Denmark, France—have shown how ventilative cooling could be accounted for in energy performance regulations, with different levels of detail. The methods are partly based on existing standards but use an hourly time-step instead of the commonly-used monthly time-step to simulate the thermal behaviour of the building. The French calculation method now includes such an approach. These developments are promising and should inspire other Member States.

venticool's position

venticool asserts that although ventilative cooling can significantly reduce the need for active cooling in the EU, very few designers implement this strategy in practice because it is poorly rewarded in regulatory energy calculation procedures. To overcome this problem, venticool appeals to standard writers and policy makers to provide fair and easy evaluation of the performance of ventilative cooling systems in standards and regulations. Together with initiatives such as venticool to foster exchanges on this matter and encourage professionals to consider ventilative cooling when appropriate, venticool partners believe this aspect is critical to achieve both significant energy savings and better comfort in the building sector.