

Perspectives on IEQ control and HVAC sector in relation to the COVID-19 emergency



The point of view of Professor
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How has the perception of the need for high indoor environmental quality changed during the COVID-19 emergency?

— My guess is that there have been very few changes, at least in Italy. Unfortunately, the attitude of the World Health Organization (WHO), which has denied for more than one year the airborne transmission of the virus (despite all the appeals from scientists worldwide and the efforts of REHVA and ASHRAE), has led to insufficient attention to the issue of Indoor Air Quality (IAQ). Nowadays, as WHO has accepted that the virus is airborne, IAQ has come to the fore. In any case, in my country, still very little has been said about the other aspects of IAQ, except in the context of researchers.

What are the key trends for the technological innovation in the field of indoor environmental quality control? What are the sectors in which you think there will be a greater push towards this technological transition?

— The COVID-19 pandemic emergency has brutally highlighted the need to equip air conditioning plants with abatement systems able to reduce the risk of infection from viruses and bacteria. In Italy, most of existing buildings is not equipped with ventilation or air conditioning systems; moreover, the existing

structures are such that it may be not possible to install new systems. This is a serious problem, especially in schools and in many public offices, where only specific actions are possible; some companies are already investing in this sense, proposing easy-to-install solutions, mainly for school buildings. Nowadays, a challenge for existing buildings is to realize systems for “non-typical” situations, characterised by low energy consumptions and costs comparable to those of standard systems.

In the field of indoor environmental quality (IEQ) control, two key pillars are filtration and recirculation, which are closely linked to each other if we consider that filtering recirculated air can reduce energy consumptions and guarantee good IAQ levels, as well as can reduce the risk of infection. In this context, given the sensitivity of the situation, the filtration and recirculation effectiveness of the existing systems must be checked (even though few of such systems are currently present in Italy).

It is worth mentioning that the concept of IEQ also concerns thermal, visual, and acoustic comfort. Companies should invest in products able to guarantee a good IEQ, and mainly an excellent IAQ, with minimum energy consumptions and to be easily installable in existing buildings, where several architectural constraints (e.g., inter-floor height) can exist. It

is also important to consider the interaction between thermal comfort and visual comfort, which, if properly applied, can bring to energy consumptions reductions.

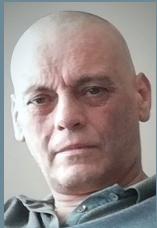
Finally, another important topic is decarbonisation, which comes through the realisation of Nearly Zero Energy Buildings (NZEBS), the energy renovation of existing buildings (with great attention to historic ones) and the use of renewable electricity. For the scope of pushing towards the decarbonisation of the building sector and the improvement of the air quality of the indoor spaces, it is important to also cite the field of management and control systems, which is in great expansion in recent years.

So, to sum up, several actions can be implemented by researchers and industrial partners, to take forward to guarantee to future generations a better world than the one we are offering today.

Nowadays, there is a strong attention towards the topic of global comfort, also in relation to the occupants' expectations; in your opinion, which will be the main research trajectories be?

— As an ergonomist, I can only express my full satisfaction concerning the diffusion of an anthropocentric perspective for the research on the field of indoor environmental quality. However, I should point out that very often it is not possible to compare the diverse published results, because unfortunately researchers use protocols that differ from the international standards in force.

Anyway, as far as the subjective aspects of acoustic, thermal, and visual comfort are concerned, besides the widespread research, which is traditionally carried out using specific questionnaires, I think that it would be important to continue the path of virtual reality (no immediate for IAQ studies). ■



**The point of view of Professor
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How has the perception of the need for high indoor environmental quality changed during the COVID-19 emergency?

— No doubt, it changed really a lot. Nowadays, very much on account of the discussions that were carried out about the role of the different transmission modes on the contagious of COVID-19, most of people is well aware about the importance of indoor environmental quality, with a particular emphasis on indoor air quality. The role of the scientific community in the area of Indoor Air Quality and of the HVAC technical associations should be highlighted by the enormous contribution that was made to the clarification of public opinion worldwide and to the change in the recommendations of the World Health Organization, which started to consider in a different way the aerosol transmission mode. On account of that, the importance of aspects like the performance

of ventilation systems, air cleaning and filtering, air distribution, became like a topic of discussion of everybody.

What are the key trends for the technological innovation in the field of indoor environmental quality control? What are the sectors in which you think there will be a greater push towards this technological transition?

— This one is always a difficult question to answer in a complete way because the reality of scientific and technological evolution often exceeds our predictions, and the emergence of innovative methods and technologies allows the exploration of completely new and disruptive solutions.

We can say that there has been a certain revolution in the way of defining the performance requirements

of HVAC systems, which, before the pandemic crisis, was mainly dominated by chemical pollutants. I think that, once we may have more exact and precise answers in aspects such as the emissions of contaminants by infected people, the conditions of persistence of bio contaminants in ambient air, the effectiveness of protective devices and the infectiousness thresholds of the population, refinements will emerge in the current models of forecasting the risk of contagion.

We began to notice an increasing use of the indoor CO₂ concentration as an indicator of indoor air quality, which is justified by the difficulty in having, in an easy and economical way, a real-time indication of the viral load in the air. I think there will be a great effort to develop methods that will allow this type of monitoring of the viral load itself in the near future.

The market will certainly be more receptive to innovative air purification, cleaning and filtration products and the effectiveness of ventilation systems in removing contaminants will be very much taken into account in the equipment specification phases.

We can have different understandings of the word “sectors” that appears in the question. If we consider that these are different types of buildings intended for human occupation, one of the lessons we have learned from the pandemic crisis is that it is really very important to put into practice the spirit of the European Standard EN 16798-1 regarding the categorization that is proposed for the indoor environment in buildings in the various aspects in which it is evaluated (thermal, acoustic, and visual environments and air quality). It is defined in this standard that environments occupied by more susceptible people must provide a better indoor environmental quality in order to guarantee health conditions for people for whom the risk of disease is greater. If this spirit were really followed in its fullness in the European space, probably the high mortality rates that occurred in nursing homes would not have happened. Another sector that should also deserve special attention is that of school buildings because their particular characteristics, with high occupancy rates per unit of volume and surface, mean that the risk of transmitting an infectious disease is higher.

Deconstructing in some way the answer given so far, it is important to have the notion that what is critical in risk assessment, more than a given space being considered as belonging to sector A or sector B, are the particular circumstances of each case in terms of a set

of variables related, for example, to the intensity of polluting sources, the efficiency of the ventilation system and the flow of fresh air in the space. In summary, we can say that, contrary to what is often reported in the media, there are no sectors that can be considered safe and in relation to which there will be no significant need for improvement.

Nowadays, there is a strong attention towards the topic of global comfort, also in relation to the occupants' expectations; in your opinion, which will be the main research trajectories be?

— I think that control systems based on the collection of information on the perception of occupants, whether with subjective or objective data, collected in practically real time and processed in order to be integrated into decision support models, will deserve particular attention. Also, the refinement of the human behaviour models will be an area with special relevance.

Thus, I expect a stronger integration of the internet of things, artificial intelligence and machine learning in monitoring and management of global comfort. However, an aspect that will be very important for the success of the new solutions is multidisciplinary, because we will always have a better perception of the object of our study if we have more points of view on it, and this is an area where there are many advantages in having greater interaction between the exact sciences and the social sciences.

Would you like to add anything else?

— Yes, a reminder of the need for a greater investment to be able to have a correct diagnosis of what the indoor environmental conditions really are in the park of buildings built in different sectors in different countries. There is a certain tendency to simplify this type of assessment by recurring to what is defined in the requirements published in the national regulations in force in the various countries. However, in many cases, when a new recommendation is published, its effects will be felt mainly in future buildings and other indoor spaces and has little influence on existing ones. In addition, what is built or installed does not always correspond completely to what was specified in the project and also, over time, a degradation of the performance of HVAC systems may occur, mainly due to maintenance and commissioning deficiencies. Thus, so that political decisions can be taken in a conscious and informed way, this effort has to be made to know what really exists on the ground. ■