

Natural ventilation in class is up in the air

Growing pressure on school budgets means more are looking towards natural ventilation as a way to meet indoor air quality targets without driving up energy costs. However, ventilation experts warn that the desire for low energy solutions may compromise classroom conditions and so impair learning.

ACCORDING TO THE Partnership for Schools (Pfs), schools are responsible for around 2% of England's total green house gas emissions – 9.4m tonnes of CO₂. Pfs is spending £9.3billion during the next three years on the Building Schools for the Future (BSF) programme to refurbish every secondary school in the country. Dramatically reducing energy consumption is a priority.

Building bulletin 101, the design guidance issued by the Department for Education and Skills (DfES), specifies that pupils and teachers should enjoy 8l/s of fresh air with a minimum average of 5l/s per person per day. It does not specify how building services designers should set about achieving that target.

Legal

In terms of regulations, schools are only required to achieve a legal minimum of 3l/s for "the maximum number of persons the area will accommodate" under the terms of the School Premises Regulations (SPR).

However, legal limits are not a good basis for establishing a ventilation strategy designed to provide teachers and pupils with the most highly productive atmosphere. So design engineers tend to use the amount of CO₂ in the air as a measurement for establishing "freshness". The legislation states that this should not exceed 5,000 ppm during the teaching day but in reality anything above 1,500 ppm will create a stuffy atmosphere.

Schools present a far more complex design challenge for ventilation system designers than offices or homes because of their wider range of uses. Also, many existing school buildings were designed for natural ventilation so are largely narrow-plan with windows which open. The principles of cross and stack ventilation have had some measure of success in making the teaching spaces in these buildings habitable. However, as the main control technique is physically opening or

closing windows, pupils and teachers will regularly complain of draughts, noise and stuffiness.

The new school buildings emerging from the BSF programme will also have to be more air tight to meet energy efficiency standards. This means the design engineers have to at least consider controllable ventilation, particularly as they now also have to manage increased heat loads from IT equipment etc.

If they are not able to rely on passive designs, how can school designers meet fresh-air standards without leaving head teachers with an expensive energy legacy?

"The answer has to be energy recovery ventilation," says Ted Berry, managing director of Samsung distributor Gallant Air Conditioning. "Energy recovery technologies can give schools the best of both worlds with fresh air delivered in a controlled way, but without the potentially high energy penalty.

"No matter how efficient the heating and cooling equipment is, if heat energy is simply expelled from the building through ventilation extraction; the design is fundamentally flawed," says Berry. He adds that the contra flow of the supply and extract air streams through a heat exchanger will deliver excellent results.

"Combine this with low energy consumption, brushless DC inverter fan motors, and integrated control options, and for a relatively low power input, energy recovery ventilation becomes a financially attractive, and sustainable, answer," explains Berry. He also suggests engineers should consider designing night-time cooling for the summer months.

However, commissioning becomes crucial if an energy recovery ventilation solution is going to work properly, according to the HVCA's Ductwork Group.

"While the technology required for this solution is not particularly complex, it depends on the system being properly integrated and bal-

anced so that the ventilation, heating and cooling cycles work in harmony," says group chairman Kevin Talbot. "Systems should also be largely automatic and able to adjust continuously to supply appropriate ventilation rates depending on the occupancy patterns. We must get away from the school ventilation strategies of the past where teachers and pupils had to open windows or doors to get the necessary air flows."

Many experts favour some kind of hybrid approach that involves using as much natural ventilation as possible, but supplemented where necessary and given a measure of mechanical control that is still not present in most schools. Also, designers must be careful they do not to fall into the product traps set by the planning process, according to Berry.

"Much emphasis is placed on the efficiency ratings of the systems you use. However, energy recovery in the ventilation cycle is often not given credit when planners are doing their tick box exercises. Good engineering means it is possible to come up with a fully controlled mechanical ventilation strategy that can match a passive design for energy performance, but deliver far better indoor air quality."

However, others see a need for designers to take a closer look at how air is introduced into the occupied space. "It is not simply a question of how much air, but how it is distributed," says David Fitzpatrick, sales and marketing director of Air Diffusion, part of the Ruskin Air Management group. "In far too many cases, sophisticated air conditioning and ventilation systems are being specified but they are not delivering the results intended. This is often down to corner cutting when the grilles and diffusers are specified. The physics of air distribution is often overlooked amid all the hype about energy efficiency of particular air movement technologies.

"The industry needs to find a



Ted Berry: energy recovery ventilation is the answer



David Fitzpatrick: We must use terminals of the highest quality



Kevin Talbot: systems should be largely automatic

way of getting back into these rooms after they have been handed over to measure airflows and find out what is happening in reality," adds Fitzpatrick. "A lot of research is being carried out into the effect of air distribution on humans and why in many buildings people in different parts of the same occupied area experience completely different comfort conditions. In a number of classrooms some children experience stuffy conditions while others complain of draughts. We owe it to them and their teachers to ensure that we deliver far more consistent results in terms of even air distribution," he says. "That means modelling airflows in a room properly and taking more care over the position and orientation of diffusers and grilles."

So, the need for improved classroom ventilation is not in doubt. How the industry can best achieve it against a background of rising energy efficiency targets and the performance criteria imposed by the huge BSF programme remains the subject of much debate.