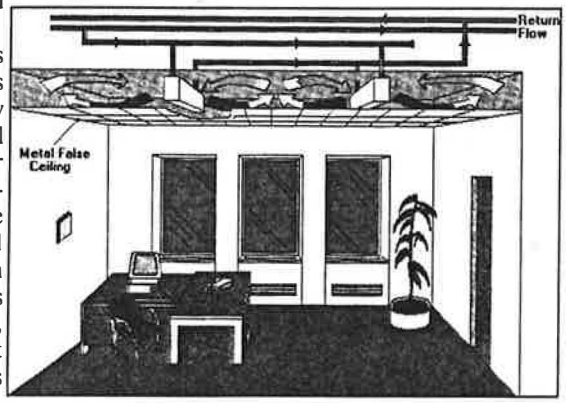
What future for building controls?

Peter Day, engineering consultant with E-Squared Ltd, examines the 'green' buildings of the future and sees a challenging role for tomorrow's building controls

The building services industry appears to be moving into a period of change. For example, recent research conducted by BSRIA and Stanhope Properties plc suggests that heat gain assumptions for small power loads have in the past been set far too high. In consequence, millions of pounds could have been wasted during the last decade both on energy and oversized plant, and all for the want of a little basic research. Meanwhile, refurbishment, maintenance and running costs continue to be high and these in turn are forcing many property owners and tenants to sanction only partial replacement of HVAC rather than full upgrades.

Against this background, the whole requirement for air conditioning and mechanical ventilation is being questioned, including the controls. So called 'green' techniques such as ice storage, heat pumps, heat recovery and natural ventilation are under close scrutiny. The pressure is on for the industry to find ways forward before changes are brought about through proposed Government legislation.

If the building services industry is to move its focus towards low-energy heating and cooling will there still be a role for building management systems? After all, they are complex to design and engineer, and in a green building where there is less mechanical plant, surely the requirement for intelligent control has reduced?



An example of a possible chilled beam cooling system in operation

Or has it? If this view prevails, and its popularity is worrying, the industry will be eschewing the cohesive management of energy and buildings. We will have identified correctly the need for economy cars, but have the steering wheel and instruments been overlooked?

There is a number of technologies currently being examined, and significantly all of these require a high level of control.

For example, take the design of heating systems. The Boiler Efficiency Regulation 1993, and growing awareness of condensing boilers have helped the energy efficiency cause, but a greater emphasis must now be placed on better heating system design.

Other examples, following Scandinavian and German practice, are cooling systems based on chilled beams and chilled ceilings. These are arousing considerable interest at present, due to their claimed energy efficiency, lack of mechanical parts and perceived comfort. The thermal response of these warrants further investigation. Unlike a four-pipe fan coil arrangement which can be controlled to give very fast reaction times, the thermal mass of a chilled beam or chilled ceiling can be high so if the control strategy is not correct, it could take a long time for the building to recover. This calls for controls which can 'optimise' the cooling system to suit the thermal characteristics of each zone. Conditional alarm monitoring is also needed to avoid problems with condensation. Again, distributed control is required.

Much has been said about natural ventilation recently. While this has yet to gain commercial status, a number of demonstration projects have been successfully attempted. More than any of the other techniques being investigated, natural ventilation highlights the control paradox facing the 'green' designer. By eliminating as much mechanical plant as possible and reducing heating and cooling capacity to the minimum, the need for close control may actually increase.

Whereas traditional HVAC systems have the capacity to boost the cooling or increase the ventilation rate when needed, in a naturally ventilated building there is little or no margin for error.

As far as the controls industry is concerned, R&D is needed to develop cost-viable control for concepts such as chilled beam and chilled ceilings. It is also clear that in ventilation systems which are not mechanically driven, more sensitive louvre and damper control is required, particularly near to the fully closed position. Louvre design and air flow modulation will need to be re-examined in terms of pressure drop characteristics, controlling the free area, and even air distribution across the face of the louvres. Dampers will need higher torque drives than existing types as they will need to do more than just shut; they will need to seal.

It is difficult to envisage how the techniques described could be successfully applied using anything other than intelligent control. There is no reason why these should not become standard in green buildings. While green controls are likely to be every bit as intelligent as their present counterparts, they may well be smaller, even perhaps with just one input, one output and a network connection.

What is most likely though, is that mixed solutions will become more common, for economic and practical reasons. We may find some areas in a building with four-pipe fan coils and VAV, while, others have VRV. In some areas, mechanical ventilation may be necessary while in others, natural ventilation will suffice. Intelligent controls will be the most viable means to unite such disparate systems and co-ordinate management. So it looks as though in the green buildings of tomorrow, both intelligent controls and the role of the specialist controls contractor will be assured.