

# Environmental opportunities for services engineers

**T**he role of building-services engineers in providing healthy and comfortable conditions in buildings, as well as protecting the environment, is a very important one. Billy Manning considers the issues.

Indoor air quality is a major concern for the building-services industry in the United States, just as it is in Europe.

It is estimated that to some extent over half of commercial buildings today have an IAQ problem. A more serious situation called building-related illness, and the litigation that may result, may well make the issue of indoor air quality rival the asbestos issue in terms of its impact on the building owner's bottom line.

## Inadequate ventilation

The US National Institute of Safety & Health has carried out a study of 432 buildings with problems of indoor air quality. The primary cause of the problem in 52% of the cases stemmed from inadequate ventilation.

There are three important aspects of the IAQ issue.

- \* Health.
- \* Comfort.
- \* Productivity.

The health issue is obvious, but it is important to note that a building can meet the health criteria but still not be comfortable. Comfort is important because it relates to productivity.

## Comfort

The ability of HVAC systems in a building to generate comfort is of vital importance to that building's economic viability. This assertion stems from the fact that the cost of people in a building can dwarf the cost of the building itself.

As an example, let us consider a typical office building. We will assume that the average person working in that building costs \$30 000 a year — including salary and fringe benefits. Let us also assume that the average person occupies 14 m<sup>2</sup>. The cost of people in that office building is therefore \$2200 per square metre.

Now let us assume that because of an inadequately

designed HVAC system, the people in the building are not as comfortable as they ought to be.

According to a study by the Building Owners & Managers Association, the impact on productivity can range from 2 to 18%. Taking the most conservative estimate, a 2% impact on productivity due to poor comfort costs \$43 per square metre per year!

When you consider that the installed cost of the entire comfort system was probably \$50 to \$100 per square metre and that another \$5 to \$20 per square metre could have made the difference between a poor comfort system and an excellent one, I am totally baffled why we as an industry have not done a better job of selling our value to the building owner.

Instead, we all seem to have a cost-cutting mentality. Instead of selling a better system with smaller control zones and building automation, we, as an industry, spend our efforts cheapening systems and undercutting one another.

**"Some of the rebates offers by utilities for thermal-storage systems completely pay for the installed first cost"**

The increasing emphasis on indoor air quality provides our industry with an outstanding opportunity to get healthy economically. Owners are getting more involved, because lack of comfort is one of the biggest reasons for tenants moving.

Environmental concerns also have a direct bearing on the work of building-services engineers. There is growing acceptance by world leaders that limitations must be placed on human activity that destroys the environment if the Earth as we know it is to survive.

Two words sum up how environmental awareness can turn an industry upside down — ozone depletion.

The Montreal Protocol and the Copenhagen Accord which strengthened it are



unprecedented examples of international co-operation.

## Responsibility

While the ozone depletion caused by CFCs in our industry accounts for only 2 to 5% of the depletion which is occurring, our industry still has a large responsibility to reduced its contribution to this environmental problem.

New refrigerants such as HCFC 123 and HFC 134a have been developed to replace CFC 11 and CFC 12. These new refrigerants nearly solve the challenge of ozone depletion.

But one thing that must be kept in mind is that the ideal refrigerant must have little or no ozone depletion, must be efficient, and must have low global-warming potential. And, of course, the ideal refrigerant must be non-flammable and non-toxic.

No refrigerant that exists today perfectly meets all the criteria, and the search for the perfect refrigerant will continue through the 1990s.

## Research

ASHRAE will help in this search through its support of research. Its research programme has an annual budget of \$2 million. At a given time, this budget typically supports about 70 projects worth more than \$6 million. Eight research projects related to CFCs are currently supported.

ASHRAE is also promoting the use of

existing alternative refrigerants and the wise use of all refrigerants.

'Guideline 3' tells the industry how to prevent the inadvertent escape of refrigerants through design, installation and service. 'Standard 15' describes precautions that must be in place for the safe use of refrigerants in different types of equipment. And 'Standard 34' classifies refrigerants by toxicity and flammability and standardises the nomenclature for describing them.

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Another area of international concern is energy, a concern that is driven by three factors.

- \* Finite energy resources.
- \* Impact on the environment.
- \* Limitations on the generation and distribution of electricity.

The Earth's resources are not infinite. Decades ago an eminent geologist by the name of King Hubbard graphically expressed the fact of our diminishing resource in what has been called the 'Hubbard Pimple'. He illustrated that we are

using energy resources faster than we are discovering new resources — a situation that cannot be left unchecked if we are to sustain our standard of living.

The second aspect of the energy problem is that *the more hydrocarbons that are burned, the greater the global warming or greenhouse effect.* Not only must we reduce the consumption of our energy resources simply to preserve them, but also to minimise their impact on global warming.

## Electricity

Finally, there is the problem of electrical generation and distribution. The USA is already a new importer of electricity. Our generating capacity cannot keep up with consumption, and we are purchasing an increasing percentage of our power from Canada each year.

The lead time on a fossil-fuel plant is about five years; for a nuclear plant, the lead time is usually 10 to 15 years. Beyond this timescale, the power stations that are currently on the drawing boards will not keep up with our current increasing rate of electrical consumption.

In the USA, power companies have adopted rate structures that encourage efficiency, peak shaving and thermal storage. Some of the rebates-offered by utilities for thermal-storage systems completely pay for the installed first cost.

Our industry has

accepted the challenge, and we can feel proud of what we have done. For instance, the comfort system in a typical US office building today consumes less than half the energy per unit area of the typical office blocks built in 1970. Our industry has achieved this through more efficient equipment, more efficient systems and better building design. In the next century, we will need to do more.

## Energy code

Much of the credit is due to 'Standard 90'. The US National Energy Policy Act of 1992 mandates that each US state must have in place by this October an energy code that meets or exceeds the efficiencies of the current version of 'Standard 90'.

In 1992, ASHRAE was appointed secretariat of a new ISO technical committee (TC 205) responsible for writing ISO standards covering total building environment design.

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It is ASHRAE's objective to incorporate into this standard technologies from around the world which provide the most energy-efficient, comfortable and healthy environments which our industry can offer. We hope to give the industry a worldwide standard for the indoor environment to design for, to build for and to maintain.

Total building design — for energy efficiency, indoor air quality and for comfort — has become the standard by which all buildings are now being measured. This objective will soon have additional impact through the creation of international standards. □

*Bill Manning becomes president of the American Society of Heating, Refrigerating & Air Conditioning Engineers Inc, at the end of this month.*