There is a general consensus in the building services industry that the energy efficiency of the existing building stock could be significantly improved. EU figures suggest that cost-effective savings of around 20% of present energy consumption can be achieved in buildings by 2010. The recently published Energy White Paper has set out ambitious targets for improvements in the energy efficiency of the existing stock, to deliver additional reductions of approximately 8 to 12 MtC by 2020. Achievement of these targets will only be possible by significantly improving energy efficiency during building refurbishment, when there is opportunity to implement a number of measures that are unlikely to be considered during normal operation of the building.

Recent changes to the Building Regulations have already brought a number of refurbishment activities within the scope of the regulations, so that they require building control approval (see CIBSE Briefing 1). The White Paper has announced a further review of the Building Regulations covering energy efficiency, promising more revisions in 2005. The recently adopted EU Directive on Energy Performance of Buildings will require certification of energy consumption in all publicly accessible buildings and upgrading of the energy efficiency of buildings over 1000 m² when they are refurbished (see CIBSE Briefing 6). For all these reasons the energy efficiency of refurbishment schemes will be of increasing importance to services engineers and their clients.

Refurbishment provides excellent opportunities for improving energy efficiency, although it can sometimes increase energy consumption where services are enhanced, e.g. by the introduction of air conditioning. Major refurbishment will involve a significant amount of design. For guidance on the energy efficiency aspects of design see sections 2 to 13 of CIBSE Guide F: Energy efficiency in buildings. Action Energy also provides guidance, which is listed below in the ‘Where can I find out more’ section. Minor refurbishment may also present opportunities for introducing specific energy saving measures.

### Minor refurbishment

Minor refurbishment generally involves refitting the interior and making minor alterations to space layout and plant. Energy saving opportunities explored in CIBSE Guide F include:

- changing space layout to enhance daylight, ventilation and zone controls
- improving lighting arrangements, including automatic controls and energy efficient lamps (lighting is often the largest single end use of energy in office buildings)
- improving window performance by adding blinds etc.
- using lighter coloured interior surfaces and furnishings to enhance the lighting efficiency
Wherever possible, refurbishment should incorporate passive energy efficiency measures, such as daylighting and natural ventilation, to improve energy efficiency and reduce running costs. Buildings incorporating passive measures offer potential environmental benefits, including:

- more attractive, daylit interiors
- less dependence upon mechanical cooling systems
- lower energy and maintenance costs and reduced exposure to carbon taxes
- good long term investment with less dependency on supplies of delivered energy
- less overheating, improved comfort and, possibly, a healthier internal environment
- opportunities for better personal control of the local environment, particularly in cellular offices.

Developers and investors have demonstrated concerns about the marketability and financial returns from passive designs, especially for premium properties. Common concerns are:

- lower rental values; at present passive buildings enjoy no rental premium
- risks to thermal comfort, particularly if occupancy and equipment levels are high
- unfamiliar technologies may require changes of habits from management and occupants
- lack of flexibility in accommodating partitioning to suit occupiers’ needs (partitions may block ventilation paths and interfere with control strategies).

These concerns may be reduced by introducing contingency plans to allow extra services to be added. However, it is likely that the regulatory pressures to reduce carbon emissions will lead to greater demand for passive designs in appropriate locations.

It is important for those who operate and occupy passively ventilated buildings to understand how they work. This helps ensure that the building functions correctly in the passive mode. Otherwise, operators may assume that the measures have failed and allow extra services to be installed. Once this has occurred, it is unlikely that the building will revert to its passive mode of operation.

The cost effectiveness of energy efficiency investments can be expressed in several ways. The simple payback period is the initial cost divided by the monthly or annual cost savings. Discounted cash flow methods are usually used in larger organisations and for major investments, although life cycle costing is becoming more common.
The capital cost of energy-saving initiatives taken during refurbishment is often reduced because they are easier to install as part of refurbishment work. In addition, the costs of disruption and interference with normal working practices are minimised.

For measures included during refurbishment, where plant is to be replaced, the true cost of installing energy efficient plant is only the over-cost compared to the minimum required for regulatory compliance, for example, the extra cost of a high efficiency ‘condensing’ boiler compared with a conventional boiler. This approach substantially reduces payback periods and increases the cost-effectiveness of energy efficiency measures.

In some cases, energy efficiency measures can reduce overall capital costs, for example the provision of natural ventilation which avoids the need for air conditioning. Some energy efficiency measures may qualify under the enhanced capital allowances scheme (ECA scheme). This is designed to encourage the installation of energy efficient equipment. For more information see CIBSE Briefing 3.

Measures can also be divided into those which require limited attention, such as insulation, and those which require active management to ensure that they continue to be effective, such as building energy management systems (BMS). For the latter, manageability is as important as the potential for energy savings, and should be carefully considered in the design.

**Energy loans for small businesses**

To help small businesses invest in energy efficiency measures, Action Energy offers small and medium sized enterprises (SMEs), that have been trading for at least 12 months, interest-free energy loans of between £5000 and £50 000 to fund the cost of buying energy equipment. The loans are totally interest-free, and repayable over four years. The loan can cover the project cost, including, for example, installation and commissioning – not just the capital cost of the equipment.

**Where can I find out more?**

- Naturally comfortable offices — a refurbishment project Good Practice Case Study GPCS 308 (Action Energy (0800 585794)) (1997) (available from www.actionenergy.org.uk)

**Website addresses**

- Action Energy: www.actionenergy.org.uk
- Chartered Institution of Building Services Engineers (CIBSE): www.cibse.org

Where can I find out more?
