Energy efficient refurbishment of hotels and guesthouses

– a guide for proprietors and managers

INTERNATIONAL HOTELS ENVIRONMENT INITIATIVE

BRITISH Hospitality ASSOCIATION

BEST PRACTICE PROGRAMME

ENERGY EFFICIENCY

BEST PRACTICE PROGRAMME

GOOD PRACTICE GUIDE 205

CONTENTS

BRECSU gratefully acknowledges the support and assistance of the British Hospitality Association and the International Hotels Environment Initiative (IHEI) in the preparation of this document.

British Hospitality Association, Queen's House
55-56 Lincoln's Inn Fields, London WC2A 3BH
Telephone 0171 404 7744

IHEI
15-16 Cornwall Terrace, London NW1 4QP
Telephone 0171 467 3620

The cover photographs show 42 The Calls, Leeds before and after refurbishment. The hotel design incorporates energy efficiency principles and some examples are illustrated throughout this Guide. The building received an award for architecture in 1992. The inscription on the plaque reads: In 1887 Wright Bros., corn millers, acquired these late 18th and 19th century mills. They produced large quantities of flour and 'horse corn' for the Leeds district. In 1991 the buildings were splendidly converted to a high quality hotel.

1 INTRODUCTION

Hotels and guesthouses with between 10 and 25 bedrooms represent over half of the UK's hotels. Most are unaffiliated and tend to be owner operated. Three-quarters of these hotels were built before 1920, so there are more opportunities for improving their energy efficiency during refurbishment. Refurbishment is often carried out by the proprietor in these smaller sized businesses.

This Guide is for proprietors and managers of hotels and guesthouses. The Guide provides practical advice on introducing energy efficient measures, and describes different aspects of energy consuming systems. Readers should gain a greater understanding of what to expect from energy efficient equipment and systems, and also be better informed to ask questions of those who supply and install them.

WHY SAVE ENERGY?

Energy efficiency is important for several reasons.

- Attractive and well-controlled conditions for guests increase comfort and encourage their return.
- Reducing fuel bills increases competitiveness and profitability.
- Using less fuel reduces pollution.

Financial implications

Although savings will vary, the main opportunities and benefits are shown in table 1. The additional cost of replacing equipment and systems with more efficient alternatives is marginal when compared with like-for-like replacements. There may even be overall cost savings. For example, eliminating draughts and adding insulation to the building fabric could result in a smaller and less expensive replacement boiler with fewer radiators to achieve the same level of comfort.

USING APPROVED CONTRACTORS

Remember that there are regulations covering the installation and connection to some building services, such as gas and electricity. Make sure your contractor is approved for such work and is, ideally, a member of the appropriate professional body or trade association. If they are not you may not be covered by your insurance in the event of any claims.

Opportunities	Potential annual savings (£)
Replace cast iron sectional boiler with: Modern standard boiler Condensing boiler	 2200 2800 – 4500
Improved heating and hot water controls ie weather compensation, zone temperature control, boiler interlock, hot water time and temperature control	5850
Energy efficient lighting throughout	3000
Increase building fabric insulation	1000

Based on a study of over 300 hotels, the total energy cost for a 25-bedroom hotel in the UK varies between £6750 and £30 250[1]. Assuming a 25-bedroom hotel is very energy inefficient, the likely energy bills are £13 000 for gas and £17 250 for electricity. [1]Energy Consumption Guide 36, see references.

Table 1 Some of the potential savings for this hotel from improved energy efficiency

MANAGING THE REFURBISHMENT PROCESS

A major refurbishment can involve a range of skills and experts, including architects, builders, surveyors and heating and ventilating contractors. They need to be told that energy efficiency is central to your requirements. If the requirements are not mentioned in the brief it is unlikely that they will be incorporated.

Supply copies of relevant energy bills so that potential cost savings can be calculated with some accuracy.

Coordination between specialists is also important. For example, if loft insulation and double glazing are being incorporated, together with a replacement boiler, make sure the heating contractor takes into account the reduced heat loss when sizing the new boiler.

A key principle for incorporating new plant, equipment and controls is 'keep it simple'.

- Ensure that building services are designed to be managed and monitored effectively.
- Quality control during construction will help ensure the potential of the design is achieved.
- At handover, obtain evidence that the building services are fully and correctly commissioned.
- Ensure you are given drawings, operating instructions and maintenance schedules and, where necessary, that you receive training in the use of the newly installed plant and systems.
- Keep a log book to record control settings and get the best from your system.

POINTS TO REMEMBER

- Refurbishment is an opportunity to improve energy efficiency at minimum cost – don't miss the chance.
- Brief your consultants, contractors and suppliers to provide energy efficient designs.
- Ensure systems are simple enough to be used effectively by your staff.

2 INTERNAL LIGHTING

Brightly painted surfaces help to reflect light and reduce the need for artificial lighting

DAYLIGHTING

The cheapest form of lighting is daylight. Careful design of windows and roof lights can provide good, even illumination.

ARTIFICIAL LIGHTING

Tungsten lamps

The tungsten lamp has several drawbacks:

- it is the least efficient light source
- it has a relatively short life
- the heat given off can cause deterioration of plastic lamp-holders and lamp shades, and scorch marks on wall coverings, increasing the need for more frequent decoration.

Compact fluorescent lamps (CFLs)

CFLs are energy efficient, with good colour rendering properties and long life. They can also be dimmed under some circumstances. They can be used effectively in all areas of your hotel. CFLs with integral ballasts are a direct replacement for tungsten lamps. However, CFLs with a separate ballast are cheaper, but you will need dedicated lampholders.

Fluorescent tubes

Fluorescent tubes are also energy efficient, offering a high ratio of light output to power consumption. They are suitable for all back-of-house locations, while in public areas they are usually built into concealed locations such as cornices or pelmets.

Fluorescent lamps are produced in a range of whites. Some are warm to match the colour of tungsten lamps and are suitable for front of house areas, while others are cool to match daylight and are more suited to back-of-house areas.

If large numbers of fluorescents are used in an installation, it is recommended that capacitance is connected to achieve a power factor of 0.9 or greater. Contact your regional electricity company for advice.

Tungsten halogen lamps

The most widely used tungsten halogen lamps are low voltage spot lamps. These offer reasonable efficacy and good colour rendering. Using them to light a whole room is not recommended, but they are an ideal light source for adding sparkle to the décor, focusing attention on displays, or creating pools of light.

Light fittings

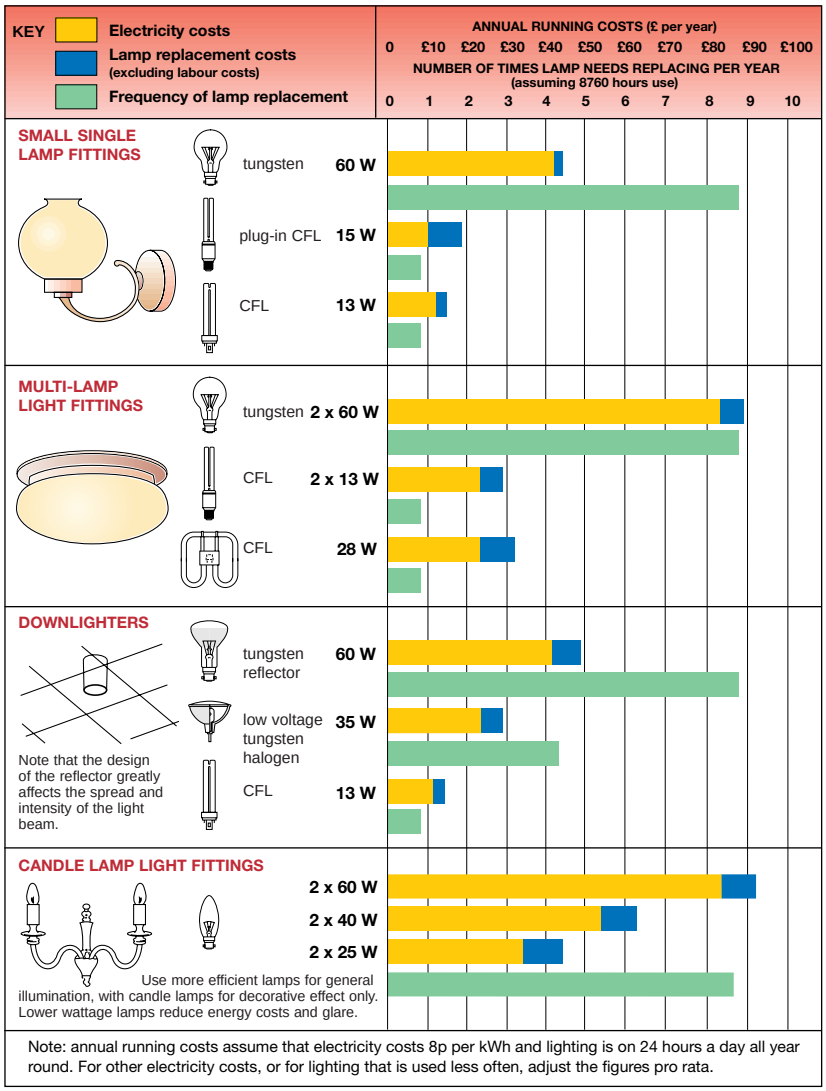
When choosing light fittings make sure that:

- lamp shades are highly translucent
- reflectors direct the light to where it is required.

LIGHTING CONTROLS

Lighting controls should ensure lighting is used only when, where, and to the extent it is required. Careful positioning and labelling of switches will help to encourage staff to switch on only those lights they require and to switch off unwanted circuits. In conference rooms and ballrooms a separate switched circuit for cleaners and furniture arranging is recommended.

Figure 1 Comparison of running costs for different lamp types



Note: annual running costs assume that electricity costs 8p per kWh and lighting is on 24 hours a day all year round. For other electricity costs, or for lighting that is used less often, adjust the figures pro rata.

3 EXTERNAL LIGHTING

Lights can be controlled automatically.

- Daylight-linked controls use photocells which measure either daylight outside or the light in the space. Photo-electric dimming adjusts the artificial lighting to top up daylighting.
- Time-based controls are operated by a building automation system or more simple timing device, and can be used for scene setting at different times of the day or evening. Local override ensures lights can be restored when needed.
- Occupancy-linked controls are more sophisticated than the previous two options, and are described on page 9.

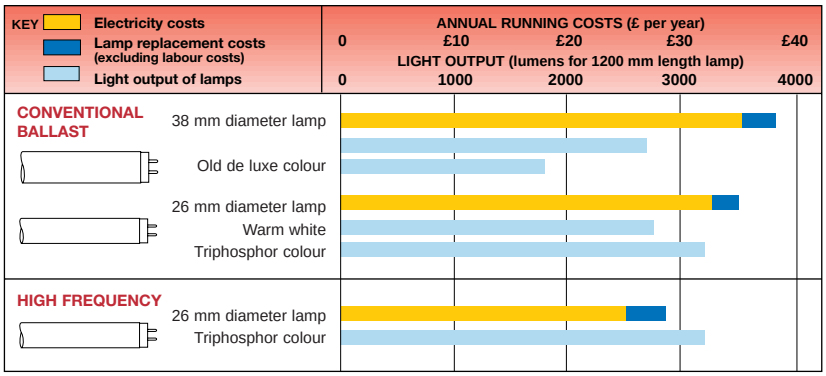
EXTERNAL LIGHTING

A wide range of fittings is available for illuminating hotel entrances as well as car parks, service areas, and paved terraces. For the smaller light fittings designed to take a 60 W or 100 W tungsten lamp, the CFL is the most suitable replacement. Tungsten halogen lamps are commonly used, but though they are cheap to buy, they have high running costs.

If high-intensity lamps are essential, the four preferred options are listed below.

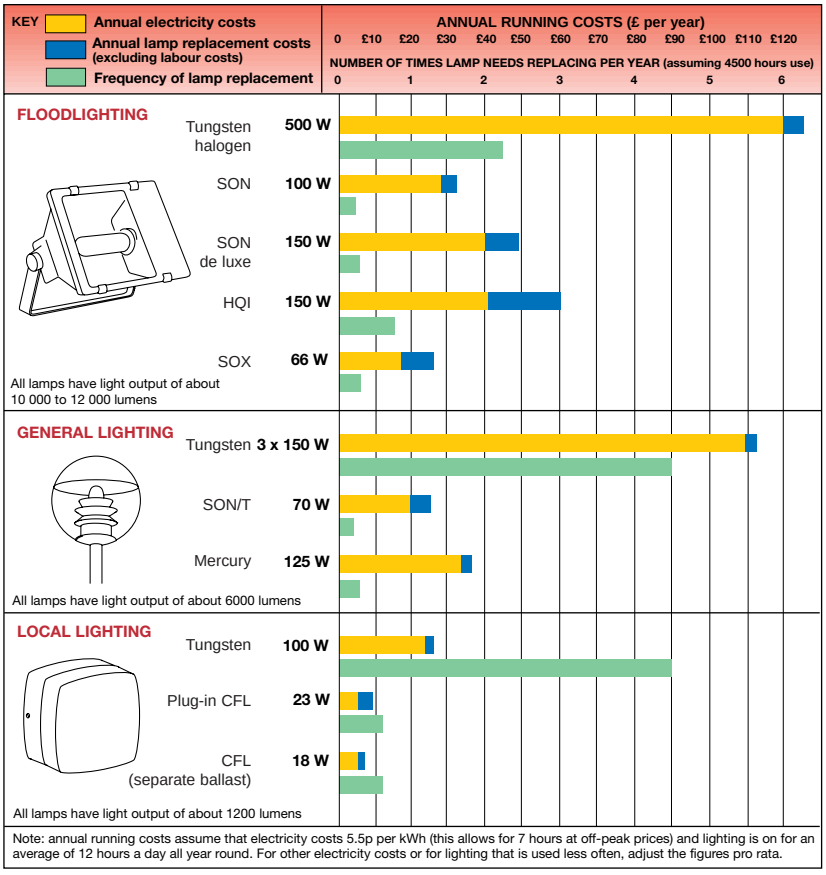
- ***Low pressure sodium*** (SOX) is the most efficient light source available. However it gives a strong yellow light that is unsuitable where good colour rendering is required.
- ***High pressure sodium*** (SON) lamps have a very long lamp life (typically 14 000 to 24 000 hours) and low electrical consumption. However, they give a yellowish light unless the de luxe SON lamps are used.
- ***Metal halide*** (HQI) lamps give excellent crisp white light and have low energy consumption, with a lamp life of about 6000 hours.
- ***Mercury*** lamps have moderate installation and running costs. Colour rendering is poor unless de luxe lamps are used.

All four types need their own control gear and are generally not interchangeable. Where lamps are in difficult-to-reach places their life span is an important consideration. Choose fittings that direct light to where it is needed to minimise light pollution.



Note: figures for 1200 mm length lamp

Figure 2 Comparison of running costs for different fluorescent lamps



Note: annual running costs assume that electricity costs 5.5p per kWh (this allows for 7 hours at off-peak prices) and lighting is on for an average of 12 hours a day all year round. For other electricity costs or for lighting that is used less often, adjust the figures pro rata.

Figure 3 Comparison of running costs for external lamps

POINTS TO REMEMBER

- Use daylight wherever possible.
- Modern replacements for tungsten lamps are very efficient and have good colour rendering.
- Choose fittings that direct light to where it is needed.
- The cheapest lamp is the one you don't use - ensure circuits allow unwanted lights to be switched off easily.
- Consider automatic controls that respond to daylight or occupancy, or incorporate time switches.
- When selecting external lighting, consider running costs, lamp life and accessibility, as well as capital costs.
- All external lighting should be enclosed to prevent moths flying onto the bare lamps, causing cool spots and premature lamp failure.
- For more detailed information on lighting refer to Good Practice Guide 189 (see page 16).

4 HEAT SOURCES

SPACE HEATING

The important first step to take when considering changes to heating plant is to ensure that the heating loads are as low as possible. Simple cost-effective energy saving measures should always be implemented before or during a major heating project, as this will significantly reduce the future demand for heat and hence the size of plant required. Changing your heating system is unlikely to be an overnight decision, and will probably be taken in conjunction with a specialist contractor. The main heating options are set out in table 2, along with their different characteristics.

BOILERS

Modular boilers and sequencing

Conventional boilers operate to maximum efficiency at maximum output. At part-load operating efficiency reduces, so boilers should not be oversized. To help achieve high operating efficiencies, two or three smaller boilers can be linked. Sequencing controls are needed for maximum efficiency. These ensure that each boiler comes on only when there is sufficient load.

Condensing boilers

Condensing boilers extract heat from the flue gases to increase their operating efficiency. They maintain their high efficiency even at part-load. Water return temperatures need to be lower than in conventional boilers, so condensing boilers are well suited to serving underfloor heating, fan convectors, or swimming pools. Water vapour from the flue gas will condense on the surface of a cool heat exchanger and so a drain point is needed in or close to the boiler room.

If you are replacing your conventional boiler, the additional cost of a condensing boiler should have a payback of three to four years.

Combined heat and power (CHP)

CHP units generate useful energy in the form of both electricity and heat, with an overall efficiency of up to 80 or 90%. CHP is usually cost effective if you have an all-year-round demand for heating and hot water of at least 4500 hours per year. Specialist advice is essential.

Heat source	Capital cost (£/kW)	Efficiency %	Environmental impact (CO_2 emissions)	Maintenance requirements
Existing old boiler	–	70 or less	15-30% higher than standard	Spares often unavailable
Modern standard boiler	20-30	80	Standard	Standard
Condensing boiler	25-40	90	About 10% lower	Marginally above standard
Combined heat and power (CHP)	High	High	Much lower	High

Table 2 Boiler systems

5 HEAT DISTRIBUTION

HEAT DISTRIBUTION

The pipework, ducting, radiators, fan convector heaters and so on that transport and emit heat throughout the building make up the distribution system. It is uncommon for the whole system to need replacing unless it is old and costly to maintain, or the building is being refurbished. Table 3 lists the advantages and disadvantages of different distribution systems.

Heat emitters, such as radiators or fan convectors, should be:

- sized according to the heat losses for each space
- positioned to ensure efficiency in achieving required temperatures
- planned into room layouts, so that they are not placed behind curtains or obscured by furniture.

Placing a shelf 15 cm or so above a radiator will help to direct convective air flow from the radiator into the room. Aluminium reflector panels behind radiators on external walls will reflect heat into the room and reduce heat losses through exterior walls.

Thermostatic radiator valves offer a degree of individual room control, with simple instructions for guests if necessary.

Distribution pipework for heating

In low pressure hot water systems where water is heated centrally in a boiler and piped to heat emitters, ensure that distribution pipework is insulated to:

- reduce the risk of freezing in spaces such as lofts
- reduce unwanted heat losses from the pipes in spaces such as floor cavities or store cupboards.

Electric heating systems

If you are considering electricity as your source of heating, remember that electric heating has higher running costs, and causes more environmental pollution than other fuels.

Storage heaters have a lower capital cost than central heating systems, and are easier to install. However there is a delay between charging up and discharging the heat, so storage heaters (with or without supplementary fans) tend to offer a limited degree of control, particularly when the outside temperature is changeable. They also need boosting from an on-peak electrical convector if rooms get too cold during the day.

Radiators are positioned to avoid being obscured by curtains at The Calls, Leeds. These walls are dry-lined with insulation-backed plasterboard

In highly insulated buildings, panel convector heaters provide a rapid warm-up time, and are easier to control. For example, they can be switched on and off from reception.

Type of emitter	Capital cost	Routine maintenance	Heat-up time
Radiator	low	low	moderate
Natural convector	moderate	moderate	moderate
Fan convector	high	high	fast
Underfloor heating	high	low	slow
Ducted warm air	high	high	fast
Radiant panels	high	moderate	fast

Table 3 Distribution system options

POINTS TO REMEMBER

- Avoid replacing like for like - boiler technology has improved substantially.
- Consider feasibility of modern standard and condensing boilers.
- If you have a year-round demand for heat, investigate CHP.
- Plan room layouts in advance to ensure radiators will not be obstructed.
- Ensure distribution pipework is insulated.
- If considering electric heating assess running costs as well as initial capital costs.

6 HEATING AND HOT WATER CONTROLS

Clearly labelled boiler room control panel

HEATING AND HOT WATER CONTROLS

Having minimised heat losses and generated heat efficiently, the next step is to ensure that buildings are heated only when and where necessary to maintain comfortable conditions. This is achieved by good controls. Controls are an essential part of energy efficient heating. It is common practice that expensive controls are the first item that gets cut when budgets are limited. Without them, measures such as insulation and condensing boilers are unlikely to realise their full potential.

Upgrading controls is often the most effective single improvement that you can make. Recommended heating and hot water controls are summarised in table 4 (see Appendix, page 15).

Boiler controls

A wide variety of timers is available to suit daily use pattern, weekend/weekday pattern, or different requirements each day of the week for single and multiple zones.

- Optimum start weather-dependent time switches delay startup of heating to bring the building up to temperature in the morning at the time required. More sophisticated versions have an in-built self-learning capability and calculate optimum time for start up. They can also turn off the boiler earlier towards the end of the day in mild weather.
- Weather compensators control the water temperature in the heating system and adjust it according to the external temperature, ensuring lower temperatures in milder weather. Weather compensation control must be set up to ensure it does not reduce domestic hot water temperature during mild conditions. The system should default to override during the heat-up period at the beginning of the day.

Space temperature controls

Space temperature controls provide the final control for comfort. Room temperature sensors can control the output of the boiler by demanding more or less heat for the space.

- Set-back controls reduce the background temperatures overnight or during unoccupied times. They provide an alternative to switching heating off at night, allowing a minimum temperature to be maintained.
- Zone controls enable different zones to be heated at different times and/or to different temperatures according to factors such as occupancy and solar gains. They are particularly useful where occupancy levels vary. Local time and temperature control can be achieved via programmable thermostats at relatively low cost.

Building energy management systems (BEMS)

These systems use computer technology to control the building services, and are a useful aid to energy management. They allow full automation of the heating controls and can be integrated with other automated services such as fire detection and security. BEMS usually include facilities for monitoring, targeting and analysing performance.

Monitoring and metering systems

Providing submeters to monitor consumption regularly is particularly valuable for energy-intensive facilities such as kitchens, laundries or swimming pools. It will enable you to:

- identify exceptional or unusual patterns of energy consumption
- help diagnose the causes
- decide how to rectify any problems.

SPACE TEMPERATURE CONTROLS

The most cost-effective control is normally achieved by installing thermostatic radiator valves (TRVs) on each radiator. In some circumstances horizontally positioned TRVs can achieve more accurate control of room temperature.

Space temperature can also be controlled by a room thermostat and on/off (zone) valves. These create better sensing locations and more than one emitter can be controlled via the zone valve.

Room thermostats should be located away from any heat sources including direct sunshine, and away from draughts.

In a guesthouse a single thermostat may control all the space heating, but even a small hotel should have local controls such as TRVs.

7 OCCUPANCY-LINKED CONTROLS

OCCUPANCY-LINKED CONTROLS

Occupancy-linked controls are used to disable some or all of the services in guest rooms, such as room lighting or general power outlets (but not those for room refrigerators and mini-bars).

Where the systems are used to control room heating, unoccupied rooms are typically kept at a set-back temperature in the heating season. The set-back temperature is fixed to ensure comfortable conditions can be met in a reasonably short time and condensation problems are avoided.

Occupancy-linked systems can be controlled from either the hotel reception or within each guest room. Each system has a number of options.

Reception-based systems

Reception-based key-fob systems ensure that room heating, lighting and power in each room are controlled automatically from hotel reception. Removing the key-fob from the console at reception controls heating, lights and/or power outlets in that guest room.

Systems that provide links between building services and guest registration ensure that room heating, lighting and power in each room are brought on automatically whenever a guest is registered. Some of these systems use mains signalling for control; this reduces the wiring requirements. Direct electric heating is the most easily controlled, but you can control thermostatic radiator valves remotely.

Room-based systems

Key-fobs are attached to room keys; with key-card systems the credit card-sized key-card opens guest room doors and operates the energy control unit.

Room-based key-card or key-fob systems ensure that when guests leave their rooms, lights and appliances are automatically switched off. Guests must place a key-card or key-fob into an energy control unit near the door in each of the controlled bedrooms to operate some or all of the services, such as heating, cooling, lighting and power.

The control panel for operating guest room heating from reception is positioned next to the room-booking display screen at The Calls, Leeds

Remotely controlled TRVs on guest room radiators

Occupancy sensors

Occupancy detectors in each guest room detect whether it is occupied: they switch off the lighting or set back the heating temperature when the room is unoccupied. These should be selected and designed carefully to ensure they are foolproof in use.

POINTS TO REMEMBER

- Controls are essential to ensure systems operate only when, where and to the extent required.
- Upgrading controls is probably the most effective single improvement you can make to your heating.
- A TRV should not be installed in the same room as the room thermostat.
- Separating heating and hot water generation has operating advantages, particularly in the summer.
- Building energy management systems (BEMS) are a valuable aid to good management.
- Installing sub-meters for different areas or functions will help you understand where energy is used.
- Reducing the average temperature by 1°C can save 8% of your space heating costs.
- Occupancy-linked controls help to ensure guest rooms are heated and lit only when in use.
- Case studies show payback periods of 2 to 3 years, but they can be as low as 0.6 years.
- For more detailed information on controls refer to documents listed on page 16.

8 INSULATION

A layer of glazing has been added to these opening casements - improving their performance while maintaining their external appearance. Sliding secondary glazing has been provided in the window reveals

INSULATION

The Building Regulations prescribe minimum standards of thermal insulation for new buildings and major modifications. These should also form minimum targets for refurbishment of existing hotels. The heat loss through the fabric of a hotel usually accounts for 10–15% of the total energy costs. In refurbishment work, heat loss through the building fabric is reduced by thermal insulation of roofs, walls, floors, windows and doors.

ROOFS

Pitched roofs that provide easy access to lofts should be insulated with 150 mm or 200 mm thick insulation, giving payback periods of two to three years. Remember to insulate pipes above the insulation, have a break in the insulation below water storage tanks, and keep electricity cables above insulation to prevent overheating.

Flat roofs which are in good condition can be insulated by adding a layer of rigid insulation above the weatherproof membrane, with ballast on top to hold it down. This is known as an inverted warm deck construction. Make sure that the existing structure is capable of withstanding the additional weight, particularly of the ballast. When renewing the weatherproof membrane of a flat roof, place insulation either above the new covering to form an inverted warm deck construction, or below it and separated from it by a vapour control layer forming a warm deck sandwich construction.

WALLS

Cavity insulation

Cavity insulation is inexpensive and causes little disruption. The cavity is filled with blown mineral wool, urea formaldehyde foam, polystyrene beads, polyurethane foam, or polyisocyanurate foam. Typically it reduces the heat transmission losses through the walls by two-thirds. Some simple precautions are needed.

- Conduct a survey to identify suitability in accordance with BS 8208: Part 1: 1985.
- Any necessary remedial work must be undertaken prior to installation.
- The cavity should be filled at the top of the wall.
- Ensure sleeving of air bricks and balanced flues.

Polystyrene should not be used if there are any unprotected PVC cables in the cavity, or if there are unprotected PVC cavity trays or damp proof courses.

Internal insulation

This may be feasible where existing plaster is being removed and existing services (such as electric cables, plumbing, or central heating) are being replaced. Typically, walls are dry-lined with plasterboard backed with a vapour control layer and rigid insulation. Plasterboard is fixed by a ribbon of plaster adhesive at skirting and ceiling levels and around openings, plus mechanical fixings for fire safety. Insulation of 50 mm thickness is recommended as a minimum, but note that some insulants - such as phenolic and urethane foams - have higher insulation values than others like polystyrene.

External insulation

External thermal insulation composite systems typically are made up of one or more coats of cement render over a layer of insulation. The insulation is fixed to the wall either mechanically, or with adhesive. External insulation systems are unlikely to be cost-effective on energy efficiency grounds alone, but can often be justified where new rendering is required on other grounds - such as general exterior repairs or improved waterproofing.

Insulation of 50 mm thickness is the recommended minimum. Only systems with an Agrément Certificate should be used. Care is needed at junctions of walls and roof, around windows and doors, and external features like balconies.

FLOORS

If there is access beneath suspended timber floors, insulate them from below by adding either mineral fibre insulation between the floor joists, supported by netting stapled to the underside of the joists, or rigid insulation boards supported between the joists. Suspended timber floors and solid ground floors can be insulated by adding a layer of rigid insulation covered by flooring-grade chipboard decking or tongue-and-groove floorboards. This will raise the finished floor level - so bear in mind the effect on doors and staircases.

9 WINDOWS AND DOORS

WINDOWS

Where windows are being replaced, the additional cost of double glazing over single glazing is marginal. Double glazing has four main advantages over single glazing. It:

- reduces heat losses
- reduces condensation
- improves comfort
- lowers external noise, such as traffic.

An air gap of 20 mm between the panes is recommended for both noise and heat loss reasons, but 12 mm provides an acceptable standard.

Improving single glazing

Where windows are being retained for architectural reasons or because of their good state of repair, their thermal performance can be improved by:

- adding secondary double glazing internally
- using a proprietary method to seal a second pane of glass hermetically to the existing pane.

ENTRANCE DOORS

Draughtstripping entrance doors will help to reduce unwanted air infiltration during the winter. Ensure that draughtstripping material conforms to BS 7386. When installing new doors, consider insulated doors. These are typically of glass-fibre (GRP) facings with a core of polyurethane foam. Door sets, where doors are supplied ready hung in draughtstripped frames, are likely to have better performance than those hung on site.

There are preferred alternatives for hotel entrances.

- A revolving door reduces heat loss when people are entering or leaving. It should be draughtstripped (see photograph). An ordinary door nearby is essential for large items of luggage and as a fire exit.
- A draught lobby should be large enough to ensure the outer door closes before the inner one opens. Both doors should be draughtstripped.

Revolving entrance door at The Calls, Leeds. Note the deep brush draughtstrip

POINTS TO REMEMBER

- Insulation improves comfort and reduces heat losses through the building fabric.
- Insulate pitched roofs using 150 mm to 200 mm fibreglass insulation.
- Install cavity insulation in all cavity walls; elsewhere consider internal or external insulation.
- Use double glazing to keep heat in, improve comfort and reduce noise from outside.
- Draughtstrip doors and windows to keep cold air out and improve comfort.
- Consider constructing draught lobbies around frequently opened external doors.
- For more detailed information on insulation refer to documents listed on page 16.

10 DOMESTIC HOT AND COLD WATER

Pipework and tank insulation. Note the labelling of tank and service pipes

POINTS TO REMEMBER

- Avoid piecemeal additions to hot water circuits and simplify them where possible.
- Check and repair insulation to the hot water storage tank(s) and pipework.
- Reduce water usage using flow controls, pressure regulation, showers and low volume cisterns.

DOMESTIC HOT AND COLD WATER

Hot water storage and distribution

Hot water is often supplied from a central storage tank connected to the main boiler. It is then distributed by pipework around the building, often over long distances. To ensure hot water can be drawn off immediately, these circuits can be pumped at periods of demand. Remember that hot water must be stored above 60°C to avoid the risk of legionnaire's disease.

An alternative to pumped circuits is trace heating. A thermostatically controlled heating element fixed to the pipe tops up the temperature of the water inside to ensure that it is hot when it is drawn from the taps. Trace heating has the advantage that it can be taken along pipes almost until they reach the taps, ensuring guests have instant access to hot water.

Localised hot water generation

Where very limited quantities of hot water are needed in locations remote from the central storage tank, consider localised water heaters - either instantaneous or with limited local storage.

Sub-metering

Sub-metering of water supplies to various parts of the hotel, such as the kitchen and guest rooms, will improve your management of water. Sub-metering is essential if you have a swimming pool.

CONSERVING WATER

Measures to avoid waste of hot and cold water can be introduced during refurbishment.

- Detect and repair leaks, both above and below ground. Consider installing leak detection equipment.
- Offer showers (in addition to, or instead of, baths) to reduce water usage where en suite facilities are being provided.
- Lag cold water storage tanks and supply pipework to prevent the risk of burst pipes due to freezing.
- Reduce excessive flow rate with simple flow restrictors, such as sleeves inside pipes (ensure their locations are noted for future reference).
- Pressure regulators to shower heads will reduce water flow.
- Install aerators to mix air with water to taps.
- Install automatic cut-off devices, such as spring loaded taps in kitchens, to prevent continuous unattended drawing of water.

Urinal cistern controls

Urinal cisterns are often set to flush at regular intervals, whether or not they are in use. To minimise waste, fit valves to pipework supplying the urinal cistern. Only when these detect a change in water pressure from hand-washing do they allow water to fill the supply cistern. Alternatively, fit micro-switches to washroom doors that allow flushing only after the washroom area has been entered a pre-set number of times. Both of these options have the minor disadvantage that if washrooms are used for hand washing only, the urinals still flush. Presence detectors allow urinal flushing after a pre-set number of people have been detected. Detectors can operate across a bank of urinals, or individual detectors can control the flushing if each urinal has its own cistern.

WC cisterns

Water bye-laws now require all new WC cisterns to have a capacity of not more than 7.5 litres. Cisterns are available with a capacity as low as 6 litres. In existing cisterns, a plastic dam can retain some of the water lost during flushing. The possibility of using vacuum toilets (1.5 litres/flush) or even waterless urinals could be examined.

11 KITCHENS AND CATERING EQUIPMENT

KITCHENS AND CATERING EQUIPMENT

The main opportunities for energy savings when upgrading or refurbishing catering facilities are:

- improved heating, ventilation and lighting
- improved planning and layout
- selection and use of equipment.

Heating, ventilation and lighting

Ensure the kitchen has adequate and controllable space heating to discourage use of catering appliances for heating the room. Provide local controls or thermostatic radiator valves so that heating is turned off when the kitchen reaches a comfortable level.

Use daylight as far as possible in the kitchen. Installing high-efficiency fluorescent lamps in light fittings with reflecting luminaires maximises illumination levels without giving off too much heat.

Ventilation should be designed to remove steam and waste heat at source. Select cooker hoods or canopies that have controls which allow ventilation to be adjusted to suit demand, and incorporate grease filters that are accessible and easy to maintain.

Planning and layout

Make a detailed assessment of the number and type of meals to be served, including:

- prime cooking - preparing meals from raw
- finish cooking - heating or regenerating precooked meals
- central production systems - producing meals in volume and applying preservative methods such as chilling or freezing.

Then plan the basic catering activities:

- food storage
- food preparation
- cooking
- serving.

Designing the layout to minimise the distances that staff and materials must travel will limit material handling, lessen hazards like spillage, and decrease the time and effort required by staff. If changes are anticipated, choose catering appliances mounted on wheels. These provide some flexibility, and allow for easy cleaning and maintenance.

Selection and use of equipment

In many cases it is cost effective to use fast-acting energy-saving equipment.

- Microwave ovens, with grill if required, are particularly useful for reheating batch-cooked meals.
- Energy efficient fryers with finned heat exchangers offer more effective heat dispersal.
- Fan-assisted ovens have improved distribution and evenness of heat.
- Induction hobs, which produce heat only when a utensil is placed on the cooking surface, need no preheating and lose little heat to the surroundings.

As far as possible, other equipment should be well insulated to reduce heat gains in the room and easy to control, with short warm up times. Equipment should include a visible indication that it is switched on, and have automatic timers where appropriate.

The choice of equipment depends on the service provided, and the variation in workload. This may mean selecting either a large adaptable unit, able to cope with reduced demand, or several smaller units which can be used as required. Ensure you or your staff receive training in the efficient use of the equipment.

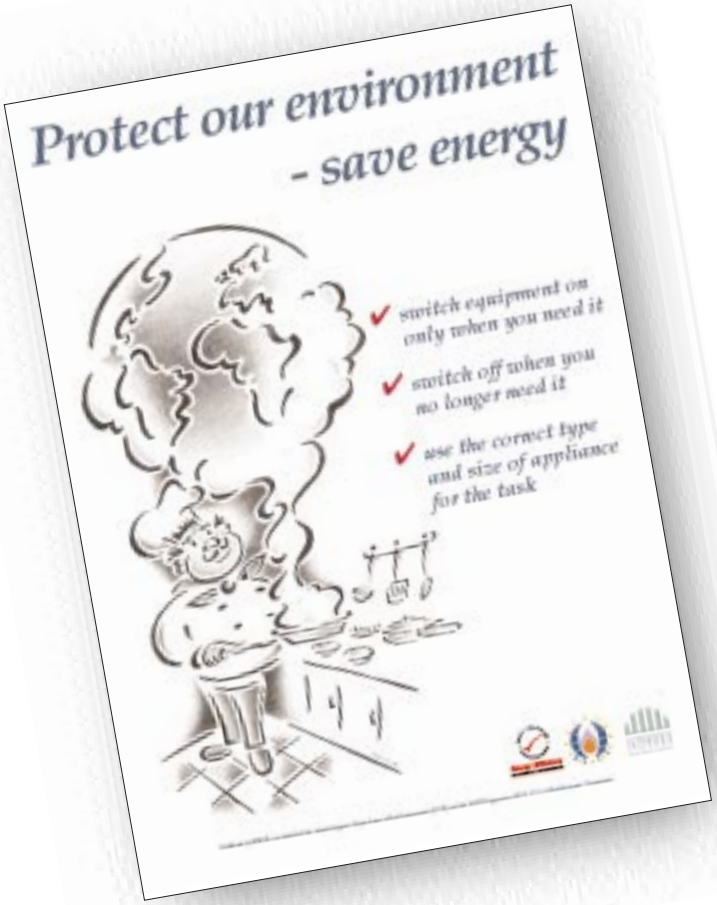
Gas heated catering equipment requires certification of safety, fitness for purpose and energy consumption labelling under European Standard EN203.

Energy is used intensively in kitchens, and there is great potential for savings

HEAT RECOVERY FROM EXTRACT VENTILATION

Large volumes of warm air are exhausted from kitchens in hotels and guesthouses. Some hoteliers have attempted to recover the wasted heat. A key problem is that much of the warm air is contaminated with grease and moisture. Strict requirements for the exhaust duct, including filters to remove the contaminants plus stringent fire safety issues, have usually rendered these attempts impractical or not viable economically. The ventilation system should be controllable so that it operates only when required.

KITCHENS AND CATERING EQUIPMENT



Good Practice Guide 'A Guide to managing energy in hotels' available from BRECSU (see back page), contains a series of comprehensive checklists for managing energy efficiency in hotels, and a set of posters aimed at hotel staff

Refrigerators and freezers

Compared with the high ratings of cooking equipment, these appliances have only about 2% to 3% of the installed load, but as they are in continuous use they represent a significant energy cost. Position them outside the kitchen, preferably in unheated, well-ventilated areas. You will need a refrigerator in the kitchen for chilled and frozen foods required for the day's service.

External indicator lights on walk-in cold storage rooms help to ensure the internal light is not left on.

Freezer and compressor motor controllers

Freezer and refrigerator compressor motors are under full load for only short periods at start up, and mostly run at 50% to 60% of their full load. Electronic motor controllers are available to increase the part-load efficiency. These typically save up to £10 per year for a chest freezer in a small catering establishment.

Dishwashers

Dishwashers should be selected to minimise water and electricity consumption. Where possible they should use hot water fill, otherwise electric heating boosters may add substantially to maximum demand charges for electricity. Other energy saving features include recycling of rinse water to a tank for pre-washing the next load, heat recovery from hot water to preheat incoming rinse, or wash water and optional economy programmes at low temperatures.

POINTS TO REMEMBER

- Ensure the kitchen is heated so that appliances are not used for space heating.
- Ventilation should be controllable.
- Modern catering equipment typically operates for over 10 years so choose equipment which is efficient and easy to control.
- Locate refrigerators outside the kitchen, preferably in unheated, well-ventilated areas.
- Use electronic motor controllers to increase efficiency of refrigerators and freezers under part-load.
- Choose dishwashers which minimise water and electricity consumption.
- Put bottle coolers on time switches, so that they are not running unnecessarily overnight.

APPENDIX

SPACE HEATING					HOT WATER	
Boiler output	**Time control**	**Temperature control**	**Boiler system**	**Zone controls**	**Temperature control**	**Time control**
< 25 kW	Time switch	Room thermostat	Fully pumped system with motorised valves in place of gravity system	TRVs to radiator	Water temperature thermostat	Separate time switch from space heating
25 to 100 kW	Time switch and optimum start if heating is switched off at night Night set-back if heating used continuously	If single zone, use space temperature control (eg room thermostat) plus weather compensator; if constant occupancy, use night set-back	Boiler interlock to prevent boiler cycling Sequence control if modular boilers	TRVs to radiators If multiple zones use time switches and space temperature controls for each zone	Water temperature thermostat	Separate time switch from space heating Separate hot water generation preferred
100 to 200 kW	Time switch and optimum start if heating is switched off at night Night set-back if heating used continuously	If single zone, space temperature control (eg room thermostat) plus weather compensator, if constant occupancy, use night set-back	Sequence control for modular boiler	TRVs to radiators. Multiple zones preferred, with zone time switches, space temperature controls, and weather compensator for each zone	Water temperature thermostat	Separate time switch from space heating Separate hot water generation preferred
>200 kW	Requires specialist advice on controls					
NB This table is meant as a guide only, and any changes to your system should be discussed with your heating specialist.						

Table 4 Recommended heating and hot water controls

FURTHER READING

DOE ENERGY EFFICIENCY BEST PRACTICE PROGRAMME DOCUMENTS

The following Best Practice programme publications are available from BRECSU Enquiries Bureau (see below for details).

Good Practice Case Studies

41 Energy efficiency in hotels: condensing gas boilers
243 Energy efficiency in hotels – energy efficient lighting
244 Energy efficient refurbishment of a medium sized hotel
260 Energy efficiency in hotels – occupancy linked controls

Energy Consumption Guide

36 Energy efficiency in hotels – a guide for owners and managers

Good Practice Guides

132 Heating controls in small commercial and multi-residential buildings
143 Upgrading controls in domestic wet central heating systems – a guide for installers
150 Energy efficient refurbishment of public houses – building fabric
176 Small-scale combined heat and power for buildings
182 Heating system option appraisal – a manager's guide
187 Heating system option appraisal – an engineer's guide
189 Energy efficiency in hotels – a guide to cost-effective lighting

Introduction to energy efficiency in hotels

Protect our environment – save energy. A guide to managing energy in hotels

A free video, 'Managing Energy in Hotels', is available from the Department of the Environment Publications Despatch Centre Blackhorse Road, London SE99 6TT. Telephone hotline 0181 691 9191. Quote reference V7 EEOI

The Government's Energy Efficiency Best Practice programme provides impartial, authoritative information on energy efficiency techniques and technologies in industry and buildings. This information is disseminated through publications, videos and software, together with seminars, workshops and other events. Publications within the Best Practice programme are shown opposite.

Visit the website at **www.energy-efficiency.gov.uk**
Call the Environment and Energy Helpline on **0800 585794**

For further specific information on:

Buildings-related projects contact:
Enquiries Bureau
BRECSU
BRE
Garston, Watford WD25 9XX
Tel 01923 664258
Fax 01923 664787
E-mail brecsuenq@bre.co.uk

Industrial projects contact:
Energy Efficiency Enquiries Bureau
ETSU
Harwell, Oxfordshire
OX11 0RA
Tel 01235 436747
Fax 01235 433066
E-mail etsuenq@aeat.co.uk

Energy Consumption Guides: compare energy use in specific processes, operations, plant and building types.

Good Practice: promotes proven energy-efficient techniques through Guides and Case Studies.

New Practice: monitors first commercial applications of new energy efficiency measures.

Future Practice: reports on joint R&D ventures into new energy efficiency measures.

General Information: describes concepts and approaches yet to be fully established as good practice.

Fuel Efficiency Booklets: give detailed information on specific technologies and techniques.

Introduction to Energy Efficiency: helps new energy managers understand the use and costs of heating, lighting, etc.