# Energy Management for Hospitality Students - a teaching pack

## Section 1 What is energy?

**Slide 1**

**Energy management for hospitality students**
What is energy?
Energy and the global environment
Energy use in the hospitality industry
Why energy is important
How to manage energy efficiently
Some technologies that can cut energy waste
Water conservation
Waste management

In this lecture I am going to introduce the subject of energy management, together with water and waste management, as they relate to the hospitality industry. The lecture covers:

- What is energy? (section 1: overheads 1-5)
- Energy and the global environment (section 2: overheads 6-14)
- Energy use in the UK (section 3: overhead 15)
- How to manage energy efficiently (section 4: overheads 16-25
- Some technologies that can cut energy waste (section 5: overheads 26-35)
- Renewable energy technologies (section 6: overheads 36-37)
- Water management (section 7: overheads 38-42)
- Waste management (section 8: overheads 43-45)

**Slide 2**

Slide of Greek windmill and setting sun

The scientific definition of energy is the ability of a body to do work, for example to move things, to light things, to heat things. But I am going to focus on the fuel resources - particularly electricity and gas - used in the hospitality sector. When I use the word energy, it is a shorthand for these fuel resources. The first thing you need to remember is that energy is an essential component of the services you offer your customers - a necessary evil if you like. Without energy, our buildings would be quite literally uninhabitable. If you don't believe this, go home and turn off the electricity and gas for a day. Today's lifestyle is utterly dependent on electricity and other fuels.

**Slide 3**

Primary energy:

- natural gas
- coal
- crude oil
- nuclear and hydro electricity

Secondary energy:

- electricity
- petroleum products
- coke

In the UK we rely almost entirely on four main energy sources, known as **primary fuels**. These comprise three **fossil fuels** - natural gas, coal and crude oil - together with what is known as **primary electricity** - generated by nuclear and hydro. (Energy conservation is sometimes known as the 'fifth fuel'.) Primary electricity generated by nuclear and hydro power may be distinguished (theoretically at least) from secondary electricity generated at conventional power stations by burning fossil fuels.

Most of our primary fuel supplies - the three fossil fuels - are not consumed in their original state, instead they are converted into **secondary fuels**. These include petroleum products, coke and of course, electricity. The largest proportion of coal, for example, flows to power stations where it is transformed into electricity. The main reason for the conversion is to produce the fuels needed for specific purposes. For many uses there is no practical alternative to electricity.

**Slide 4**

Delivered energy - to the consumer

Useful energy - for a function (differs from delivered energy owing to conversion losses)

**Delivered energy** is the energy content of the fuel delivered to the consumer. This is the quantity measured by the consumer's meter and for which the consumer pays.

**Useful energy** is the energy required to perform a specific function at the point of application. It differs from delivered energy because of the conversion losses in the appliance. For example, a central heating boiler may have a conversion efficiency of only 60-80%. In such a case only 60-80% of the delivered energy is converted to useful heat, the rest is lost in various ways, like out through the flue.

**Slide 5**

Cartoon from GPG 115 [modified - DELIVERED ENERGY replaced by USEFUL ENERGY]

Power stations lose a considerable proportion of the primary fuel - about 70% - as waste heat. So for every kilowatt-hour (kWh) of electricity delivered to a building, the equivalent of more than 3 kWh of primary fuel has to be burned. You can see this in the diagram, where to obtain 100 kWh of electricity at the building (shown by the blue arrow), 333 kWh of primary energy is used.

On the other hand, to deliver 1 kWh of natural gas to a building takes only about 1.03 kWh of primary fuel (this factor is so small it is not shown in the diagram). Conversion losses in the boiler result in 200 kWh of primary energy producing 160 kWh of useful heat - a boiler efficiency, in this example, of 80%.

On site efficiencies are also different for the different fuels. Broadly speaking to obtain 1kW of useful electricity - for heating or lighting - requires 1kW of delivered electricity. The efficiency of the conversion on site is taken as 100%. But, for gas appliances, to obtain 1 kW of useful energy it is necessary to have something like 1.25 kWh delivered; this is because burning gas in a boiler has a conversion efficiency of only about 80% (in practice it varies between about 60% and 90%).

## Section 2 Energy use and the global environment

**Slide 6**

Primary:delivered energy ratios and carbon dioxide emissions for various fuels

| Fuel | ratio of primary: delivered energy | carbon dioxide kg/GJ |
|---|---|---|
| Electricity | 3.01 | 188 |
| Nat. gas | 1.03 | 52 |
| Oil | 1.10 | 75 |

The conversion process for turning fossil fuels into electricity is important because of the resulting environmental pollution. The main sources of energy used to generate the nation's electricity are nuclear power (used to generate 36% of our electricity), coal (33%) and gas (29%) (1997 figures). Burning fossil fuels at power stations to generate electricity, or in the boiler room of a building to generate heat, results in the emission to the atmosphere of several gases. Among these is carbon dioxide, a greenhouse gas whose increase in atmospheric concentration may be linked to global warming. You can see from this table that carbon dioxide emission rates for various fuels reflect closely the ratio of primary to delivered energy. The unit costs of various fuels at the point of delivery also bear some relation to their relative carbon dioxide emissions - for example, electricity is about three or four times as expensive per kWh as gas, oil or coal.

**Slide 7**

Atmospheric pollution

Global warming
- carbon dioxide

Acid rain
- sulphur dioxide
- oxides of nitrogen

Holes in the ozone layer
- CFCs, HCFCs

Greenhouse gases are important in the atmosphere as they help the earth to retain heat from the sun. However, carbon dioxide levels in the atmosphere are rising - apparently as a consequence of industrialisation. In turn the rise is thought to causing a gradual increase in the earth's temperature. This has a number of implications for climate and the weather - including rising sea levels, and increased variation in climatic conditions causing droughts, floods and high winds.

Besides carbon dioxide, other gases emitted during the combustion of fossil fuels include carbon monoxide, sulphur dioxide, nitrogen oxides, and unburnt hydrocarbons. Sulphur dioxides (SO2) and oxides of nitrogen (collectively known as NOx) or 'sox and nox' are the main causes of acid rain.

**Slide 8**

Bruntland definition of sustainable development: 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'

Energy has been a concern to us nationally for at least a quarter of a century, although the nature of those concerns has changed during that period. In 1973 the so-called oil crisis made us aware that we could not take for granted abundant supplies of cheap fuel. Government's response was the Save-It campaign focusing on energy conservation. A decade later - after oil had been discovered in the North Sea - the importance of energy conservation was replaced by concerns about its efficient use. This issue is still with us, but it has been supplemented by more global concerns - that our environmental impact on the globe is too great for the earth to absorb it. The World Conference on Economic Development met in 1987 and published what has become known as the Bruntland Report. This coined the much cited definition of sustainable development.

Predictions of global warming from rising levels of greenhouse gases in the atmosphere emerged from the scientific community. And a hole was discovered in the ozone layer over the Antarctic - due to a build up of man-made ozone-depleting chemicals, particularly chlorofluorocarbons (CFCs) we use in refrigeration and air conditioning systems. In September 1987, international agreement to phase out the production of CFCs was achieved remarkably quickly with the signing of the Montreal Protocol. Further agreements were signed in London and Copenhagen. However, not all countries signed these agreements, and CFCs are still be produced legally in some parts of the world.

'Sustainable development means living on the earth's income rather than eroding its capital. It means keeping the consumption of renewable natural resources within the limits of their replenishment. It means handing down to successive generations not only man-made wealth, but also natural wealth, such as clean and adequate water supplies, good arable land, a wealth of wildlife and ample forests.'

**Slide 9**

Britain responded quickly to environmental concerns and, in 1990, government published its white paper *This Common Inheritance: Britain's Environmental Strategy*. This made reference to the challenge of sustainable development, which it defined as:
- living on the earth's income rather than eroding its capital
- keeping the consumption of renewable natural resources within the limits of their replenishment
- and handing down to successive generations not only man-made wealth, but also natural wealth, like clean and adequate water supplies, good arable land, a wealth of wildlife, and ample forests.

**Slide 10**

Diagram of principles that underlie sustainability

In 1992 world leaders met in Rio for the UN Conference on Environment and Development, commonly known as Earth Summit '92. The major achievements of the summit included:

1 Agenda 21 - a comprehensive blueprint for global actions to effect the transition to sustainable development;
2 the Rio Declaration - a series of principles defining the rights and responsiblities of states; a set of guidelines to support the sustainable management of forests worldwide;
3 two conventions - to prevent global climate change and to protect biologically diversity - signed by 150 countries.

This diagram summarises the key principles of sustainability:
**Futurity** refers to protecting the earth to ensure future generations are able to maintain living standards, with an explicit focus on resources and life support systems.
The **Environment** is concerned with ecological integrity, safeguarding biological diversity, keeping within the earth's critical carrying capacity, and using accounting conventions that include environmental impact not just least cost solutions.
**Equity** means equality of access to resources - we may have to share what we have - and equality of living standards (cutting poverty and decreasing disparities in living standards).
**Participation** means providing opportunities for organisations and individuals to be involved in decision making and ensuring they have the information necessary to make good choices.

**Slide 11**

Indicators of Sustainable Development

1. the economy
2. optimal use of non-renewable resources
3. sustainable use of renewable resources
4. damage to the carrying capacity of the environment

One of the UK's responses to the Rio Declaration was our Strategy for Sustainable Development. This committed the UK to developing a set of indicators to help inform people whether a) development is becoming more sustainable, and b) government objectives are being met. The indicators were published in 1996. There are more than 120 of them covering four main areas: a **healthy economy promoting quality of life** (economy, transport, leisure & tourism, overseas trade), **optimal use of non-renewable resources** (energy, land use); **sustainable use of renewable resources** (water, forests, fish); **damage to the carrying capacity of the environment/human health/protection of biodiversity** (climate change, ozone depletion, acid deposition, air pollution, freshwater quality, marine life, wildlife, landscape, soil, minerals extraction, waste, radioactivity).

**Slide 12**

Graph of global greenhouse gas radiative forcing rate, from Indicators of sustainable development, 1996

The indicators show the UK met its main energy commitment - to stabilise its emissions of carbon dioxide at their 1990 levels. Unfortunately this is not because we are consuming less but largely because of the 'dash to gas' - our power stations are changing from coal to gas as their primary fuel source. This slide combines two of the indicators. The bars show the build up of greenhouse gases and their forcing rate on global warming, the blue line shows temperatures in England relative to the 1951-1980 average. The clear correlation shows the effect - over time - that greenhouse gases have in altering the energy balance of the Earth-atmosphere system.

The UK current target is a 20% reduction on 1990 greenhouse gas emissions by 2010. Europe's target is a more modest 15% reduction on 1990 levels, while the USA is not committed to any reduction at all. International targets and timetables to cut emissions of greenhouse gases are due to be set by the UN Climate Change Convention in Kyoto, Japan in December 1997. A likely long term target is to prevent atmospheric concentrations of greenhouse gases rising to more than twice pre-industrial levels. This would restrict average global warming to 2degC above preindustrial temperatures. Ministers at the UN Climate Change Convention in Geneva in 1996 accepted that eventually global emissions of greenhouse gases would have to be less than 50% of current levels.

**Slide 13**

Benefits of energy efficiency:

Globally - reducing environmental pollution
Nationally - preserving our fuel resources
Business - cut costs and increase profitability
Customers - comfort, repeat business
Staff - commitment to their welfare.

All this international activity by governments at the global scale may seem remote from day to day operating concerns in our industry - where our task is to satisfy the requirements and expectations of our customers for service and hospitality. But, while Parliaments can pass laws and Governments can produce white papers, the environment will only improve if we ourselves have the will to do what lies in our own hands.

The task of protecting the world from environmental pollution and degradation actually falls to us - to you and me. We are the people who use gas and electricity in our buildings, who consume water, who drive to work in our cars, and who generate packaging and other waste. It is we who must make the effort to act responsibly, to use energy efficiently, and to reduce waste, including re-using and recycling wherever we can.

**Slide 14**

‘Energy efficiency is about doing more with less, but this is not the same as doing less, doing worse and doing without’ Amory Lovins

The news isn’t all bad for the hospitality sector, because not only do such actions benefit us globally and nationally, they can also save businesses money and contribute to profitability. If our businesses use less energy they will reduce their fuel bills. Reducing waste also cuts the cost of disposal.

Reference for the quotation: von Weizsacker, E, Lovins, A B, Lovins, L H, Factor Four: doubling wealth, halving resource use, Earthscan Publications, Ltd, London, 1997.

# Section 3 Energy use in the UK

**Slide 15**

Pie chart of national energy consumption

How much energy is used nationally, and how much of it is in the hospitality sector? The following table (illustrated as a pie chart) shows UK delivered energy use in 1994 in Petajoules.

| | |
|---|---|
| Housing | 1,836 |
| Service sector buildings | 778 |
| Building-related industrial | 261 |
| Total buildings | 2,875 |
| | |
| Industrial processes | 1,320 |
| Transport | 2,104 |
| Agriculture | 58 |
| Street lighting | 10 |
| Total other sectors | 3,492 |
| | |
| **Total UK** | **6,367** |

Hotels and catering appear within Service sector buildings and are responsible for some 76 PJ, or 9.8% of the sector’s consumption. It represents about 2.6% of the total energy used in buildings or about 1.2% of our total national consumption. Expenditure in the sector is estimated at £567 million, and carbon dioxide emissions are about 6760 thousand tonnes.

This may not seem much as a fraction of total consumption. But if as a nation we are going to cut our consumption to reduce environmental pollution, it will have to be done on a building-by-building basis, there are no ‘grand technical fixes’ to the problem. In fact as a sub-sector, hotels and catering use energy more intensively that many other parts of the service sector, so there is more potential for saving.

# Section 4 How to manage energy efficiently

**Slide 16**

Slide from BRECSU's collection of 'the best of bad practice' showing huge gap around door.

We can all think of ways in which energy is used unnecessarily in buildings that we are familiar with. Lights left on when rooms are empty, hotel bedrooms so hot you have to open the window even in the depths of winter, catering appliances switched on in the morning and left to operate all day, dishwashers run when only half full. Look at the gaps around this outside door! Think of the cost of this waste. And remember - not only is it adding unnecessarily to environmental pollution, but someone is paying for it. If a bottle of whisky went missing behind a bar there would be an enquiry - yet in many buildings far greater energy resources are lost in ways which are untraceable. Energy is, almost literally, invisible.

So what can be done to cut unnecessary energy waste, to ensure it is used efficiently, in short, to manage it effectively and responsibly as a resource? There are two broad strands to the answer - through good management practices and by the effective use of technology.

**Slide 17**

Diagram of energy champion leading staff to better world, taken from illustration inside *Protect the environment - save energy*

To be managed effectively, energy needs someone to be appointed with overall responsibility for it. In most institutions of any size this will be an Environmental or Energy Champion. He or she may well be supported by an Energy or Environmental Group or Task Force which includes representatives from each department.

Because the Champion has to influence people in other departments without being their line manager, it is important that he/she is experienced as a facilitator with good powers of persuasion - someone who can enthuse staff 'to go the extra mile' in saving energy.

**Slide 18**

Environmental Group

Strategic aims:
- raise awareness
- build commitment
- provide support
- recognize and reward effort
- celebrate success

The aims of the Environmental Group should be to:
- raise awareness among staff of the financial cost and environmental implications of wasting energy
- build commitment across the organisation to reduce avoidable waste
- provide support in the form of help and advice, contribute newsletter articles about efficiency and run poster campaigns
- recognize and reward efforts made to improve day to day operating practices
- celebrate success when targets for reducing energy consumption are met.

**Slide 19**

Environmental policy
- management commitment
- short term targets
- long term objectives
- review progress towards targets and objectives

Well-managed organisations are likely to have a comprehensive Environmental and Energy Policy. As a minimum such a policy will contain:
- a clear commitment to managing energy responsibly
- short term aims in respect of good day to day operating practices
- long term objectives to invest in efficient plant and services where it is cost effective to do so
- a process for regular reviews of the policy and of the extent to which its aims and objectives have been met.

**Slide 20**

Operational strategy:
- targeted reductions
- responsibilities and reporting routes
- staff training in responsible use of energy
- monitoring plant and equipment
- capital investment programme
- cost effective energy purchase
- communication to stakeholders

A policy needs to be backed up by an operational strategy which contains the key elements of:
1. targets for cutting the use of fossil fuels - based on consumption per square metre
2. clearly defined responsibilities for energy use, and reporting routes for information about energy consumption and cost
3. staff training in the effective and efficient use of energy
4. regular reviews of technical improvements and, where appropriate, their incorporation into specifications for new developments and refurbishments
5. capital investment in energy efficiency projects that offer significant benefits
6. ensuring that energy is purchased at the most competitive rates
7. communicating objectives and progress to the Board, employees and shareholders.

Key tasks for effective energy management are to:
- assess how well you are currently managing energy
- ensure you purchase fuel at minimum cost
- monitor consumption and check for unexpected levels of energy use
- use present equipment effectively
- identify opportunities for savings.

**Slide 21**

Utility purchasing:
- check terms and conditions of supply
- selection of appropriate tariff: understanding pattern of consumption
- plan when equipment will run
- invest savings to reduce consumption

As with any resource, it is important to check and assess the terms and conditions under which energy is supplied. Price is usually the main consideration in selecting a supplier. Compared with gas purchase, electricity purchase is more complex and there are several tariffs available. Unlike gas, unit charges for electricity may vary between day and night. And, in larger premises in winter, there may be supplementary charges based on the maximum quantity of electricity used in any one hour. Where this is the case it is important to plan (as far as possible) when electricity-consuming equipment will run in order to minimise costs.

A proportion of the financial savings achieved through tariff negotiations should be invested in energy efficiency technologies, so reducing *consumption* - as well as costs.

**Slide 22**

Front cover of Energy Consumption Guide 36

Benchmarking is a process of comparing your consumption with industry norms. Typically, it involves using your utility bills for the past year or two to obtain details of energy consumption and costs, basic premises information (floor area of the building or number of hotel bedrooms) and operating information (number of covers served, number of guest nights) to work out your performance. This can then be compared with figures published in the government's Energy Efficiency Best Practice programme Consumption Guides. This guide, for example, provides benchmarks for three types of hotel - luxury hotels, business hotels and smaller hotels, and describes how to compare consumption with the benchmark figures. Other guides address other sectors.

Benchmarking can help:

- to indicate how you compare with your competitors
- to assess potential benefits arising from improvements
- to suggest which fuels to give priority to (it is important to keep electricity and fossil fuels separate because of their different costs and carbon dioxide emissions figures)
- to measure performance over time.

**Slide 23**

Slide of engineer taking meter reading, from Kirklees Sports Centre slide set.

There is an old saying that you cannot manage what you cannot measure. Monitoring involves taking regular meter readings. Entering the figures into a speadsheet will allow you to assess them and prepare graphs and charts. Graphs are helpful to visualise the pattern of consumption against the weather or operating information, and can also be used to illustrate trends to management and staff.

If benchmarking implies there is scope for reducing consumption, it is useful to set a target, for example, 5% reduction on last year's consumption. Targets should be SMART - Specific, Measurable, Achievable, Realistic and Timed.

Monitoring is used to measure whether targets are being met. Monitoring energy consumption regularly is also valuable:

- to check utility invoices and ensure the organisation pays only for what it has used
- to identify unexpected changes in consumption as soon as they occur so corrective actions can be taken
- to provide operational information and set budgets
- to motivate staff by reporting progress.

How often you monitor - daily, weekly, or monthly - depends on the size of the premises and intensity of energy use.

**Slide 24**

Magnifying glass and checklist from front cover of GIR 47

Energy good-housekeeping is essential to avoid wasting energy. In many buildings daily house-tours are carried out to check the condition of facilities. These present a good opportunity to check up on energy use. Alternatively, or additionally, a dedicated energy walk-round can be used. In either case it is valuable to have a checklist of items to inspect. Their purpose should be to assess whether present equipment is being used effectively. Are lights on unnecessarily? Are windows open in winter? Several published checklists are available through the Energy Efficiency Best Practice programme.

After the house-tour, you will be able to identify tasks associated with the required improvements, and who should be responsible. A target date and an actual date will help you to record both what you planned and what you achieved.

**Slide 25**

Illustration of the set of posters accompanying Protect the environment - save energy.

A concerted energy campaign can help:

- to increase staff awareness and understanding of the cost and environmental impact of wasting energy
- to encourage staff action to save energy - particularly by ensuring that the building services (lighting, heating) operate only when, where and to the extent they are needed
- to make staff feel they are part of the solution not part of the problem.

Four actions can be taken to encourage staff involvement and participation in your campaign:

- work with staff and identify opportunities for energy savings and actions that can be taken to cut energy waste
- agree who should be responsible for specific tasks on a day to day basis
- establish with staff clear and achievable targets
- keep staff informed with accurate and timely feedback on progess and achievements towards meeting targets.

Staff may need to be motivated frequently using a regular flow of fresh ideas - new publicity material, posters, stickers, leaflets, competitions, newsletter articles, - if good practices are to continue.

# Section 5 Technical measures

**Slide 26**

GPG 190 illustration of compact fluorescent and thermostat

There are many technical measures that can help to achieve energy efficiency. They fall into two categories - ‘fit and forget’ and ‘fit and manage’. Fit and forget technologies are those which are of themselves more efficient than alternatives - efficient lightbulbs or efficient boilers, for example. Other technologies, like improved controls, need to be managed. A thermostat, boiler programmer or building energy management system will not of themselves lead to increased efficiency but, when used intelligently, will provide better control over the way the services operate. Proper maintenance is also important to ensure your systems are kept in a good state of repair. If building works are proposed, refurbishment is a not-to-be-missed opportunity to upgrade equipment to more energy efficient alternatives - rather than just replacing like for like.

**Slide 27**

Photo of the Forte Crest Hotel, Brighouse from GPCS 243

Technology is important for reducing consumption, and many new and more efficient technologies are available. In terms of lighting, for example, the compact fluorescent lamp, with its far greater ratio of light output to electrical power consumed (‘efficacy’), offers a large reduction in electricity consumption when compared with traditional light bulbs.

At the Forte Crest Hotel at Brighouse in West Yorkshire, for example, energy efficient lamps were installed throughout. They resulted in substantial financial savings, a payback period of less than one year, reductions in lamp storage, and favourable reactions from both guests and management. Remember in some large hotels there is a person whose sole job is to go round checking and replacing light bulbs.

**Slide 28**

Comparison of compact fluorescent lamp and tungsten lamp, from GPG 190

Compact fluorescents use only one-fifth of the electricity for the same effective output, as well as having useful life about eight times as long as conventional bulbs. Although the initial costs of a compact fluorescent lamp is higher than that of its tungsten counterpart, the rated life is around eight times longer. Therefore they are replaced less often, saving in staff time and reducing storage requirements for replacement lamps. They are particularly suitable in bulkheads and other similar fittings found in corridors and WCs. But appropriate fittings which allow them to be used in guest rooms and other front of house locations are also available. The colour rendering of compact fluorescents, once believed to be inferior to tungsten, is continually being improved.

The efficacy of fluorescent lamps for strip lights has also improved.

Tungsten halogen lamps with good colour rendering are available for decorative interior lighting. For external lighting, energy efficient metal halide and high pressure sodium lights are available.

Finally, the efficiency of light fittings (luminaires) is improving. They provide increased translucency which reduces the quantity of light output absorbed by the fitting, and improved reflectors to direct the light to where it is required.

**Slide 29**

Lighting control systems:

- daylight-linked control
- time-based control
- occupancy-linked control
- localised switching.

Whether or not the premises you are managing have efficient light sources, it is important to ensure lights are controlled effectively. There are four basic strategies, which may be used in combinatin:

**Daylight-linked control:** Photo-electric cells may be used for switching or for dimming. The cells may sense daylight outside or the light available inside the space. Photo-electric switching causes lights to be turned on and off depending on conditions; time delays prevent repeated rapid switching. Photo-electric dimming is less obtrusive and adjusts the artificial lighting to top-up daylighting as required.

**Time-based control:** Here, signals are transmitted to the luminaires from, for example, a building management system or a more simple timing device. Lights are switched on and off at pre-set times. Local over-ride ensures lights can be restored when needed. Time based controls may also be used for changing the atmosphere of spaces for aesthetic purposes during the day.

**Slide 30**

Passive infra-red detector from Case Study 260 including caption

**Occupancy-linked control:** Occupancy linking is achieved using sensors which can detect movement or noise in a space. This passive infra-red one, for example, detects movement. The sensors bring on lighting when occupancy is detected and switch off when they have failed to detect an occupant for a set time.

**Localised switching:** Localised switching is important where only part of a large space needs to be lit artificially, either because other parts are unoccupied or because daylight there is adequate. It is also important to ensure that local switches are clearly labelled so that any unnecessary lighting can be switched off unobtrusively, leaving other lights unaffected.

**Slide 31**

Remotely controlled TRV from GPG 205

The operation of building services is governed by controls. These help to ensure that the plant operates only when, where and to the extent needed by the occupants.The basic controls governing heating and hot water are:

- time switches - bring equipment on and off according to set times (make sure they show the right time!)
- optimum start controllers that calculate when heating needs to come on so comfort temperature is met at the time needed
- weather compensators that control the flow temperature of radiator water according to external temperatures
- zone controls to heat or cool different parts of building at different times according to occupants' needs and solar gains
- room thermostats to regulate temperatures in individual spaces to prevent overheating and wasted energy
- thermostatic radiator valves (TRV) controlling output from each individual emitter
- set back controls that lower temperatures at night or when rooms are unoccupied.

The TRV shown in this illustration can be controlled remotely.

**Slide 32**

BEMS from Kirklees Sports Centre slides set

All these control functions may be incorporated into a building energy management system (BEMS). A computer provides the interface or 'supervisor terminal' between the user and the control functions. BEMS can be set with the times when various spaces within the building - such as conference suites and other function rooms - are needed. They can control the lighting, heating, ventilating and air conditioning systems, to ensure the required comfort conditions are achieved when and where they are required. BEMS may also be used for monitoring faults. They can also be linked to other computerised management systems, such as guest registration to achieve automated control.

**Slide 33**

Photo of console keycard from Case Study 260

In hotels and similar building types, controls that react to occupancy may be used to control room lighting, power outlets serving television and kettles, and heating or cooling. They prevent services being left on unnecessarily when rooms are unoccupied. There are three main kinds:

- room-based key cards or keyfobs. Keyfob systems have an energy control unit near the door in each of the controlled bedrooms, into which the keyfob must be placed to bring on the controlled services. With keycard systems, the credit-card sized keycard is used by guests to open the bedroom door which in turn enables the services.
- occupancy sensors detect whether a room is occupied and if it is not, they switch off the lighting or set back the heating temperature.
- central systems operate from reception when guests register to bring on the heating and enable the room services. Keyfob systems rely on keyfobs being parked in a console at reception when not in use - removing the keyfob at reception enables the services in the room. More sophisticated still are systems which are linked to the guest registration system - when a guest registers, heating in the guest's room is brought up to full comfort temperature automatically.

**Slide 34**

Diagram from bottom of page 2 of GPG 115 modified as before, i.e. repeat showing of slide no. 5

Another technology which can raise energy efficiency in a building involves the generation of heat and electricity on site. This slide was shown earlier to illustrate how a large fraction of the primary fuel that is burned in a conventional power station to generate electricity is lost to the atmosphere as waste heat. Let us imagine that waste heat could be recovered and used - efficiency would rise.

**Slide 35**

Diagram from bottom of page 3 of GPG 115 [modified to read useful energy not delivered]

During the last 15 years the technology to do this has been developed and introduced into buildings. It involves generating electricity in a building and making use of the waste heat from the process. In this way optimum use is made of the primary fuel. The technology is know as Combined Heat and Power (CHP). As you can see from the illustration, the primary energy is turned into both electricity and heat. Losses are lower than at power stations and to obtain 160 kWh of heat and 100 kWh of electricity requires only 325 kWh of primary energy - compared with 533 kWh in the previous slide. Carbon dioxide emissions are similarly reduced.

Conventional electricity generation provides electrical power to the point of use - the building - at an efficiency of only around 30%, the remaining 70% of the calorific value of the primary fuel being lost. But Combined Heat and Power (CHP) systems typically convert between 80% and 90% of the energy in the fuel into electrical power and useful heat.

CHP is expensive to install, so it is economically feasible only in buildings with a year-round demand for the waste heat as well as the electricity. And because it will not meet all heating and electricity demands (as these vary from season to season) a conventional boiler and electricity supply must also be provided.

# Section 6 Renewable energy technologies

Renewable energy technologies:

- wind power
- wave power
- small scale hydro
- solar energy
- biofuels
- waste incineration

**Slide 36**

Renewable energy technologies are so-called because they exploit the ambient environment - sun, daylight, and wind. They represent alternatives to fossil fuels. Large scale hydro electric power is already an established technology responsible for 2% of our power generation and is a renewable technology, although conventionally it is excluded from being classified as one. But small scale water power is being encouraged. Other renewable technologies include wind power, wave power, solar energy and geothermal energy (hot water from underground sources). ‘Biofuels’ include methane from landfill sites, burning waste, and biofuel crop planting (where wood is grown specifically for burning). In future the importance of some non-fossil alternatives may increase through improved technology.

**Slide 37**

Renewable energy in buildings

Passive systems:
- daylight
- solar energy
- natural ventilation

Active systems:
- solar panels - to pre-heat water
- photovoltaics - turn light into electricity
- geothermal energy (underground hot springs)

Renewable energy can be exploited in an individual building. Indeed almost all buildings use daylight, solar gains and natural ventilation to some extent. Increasing the exploitation of renewables can be done in two ways:
- ‘passive systems’, in which the fabric of the building is designed to benefit from sunshine and natural lighting (with care taken to cut the risk of overheating or glare or excessive winter heat loss), and natural ventilation. Daylighting depends on the position and size of windows and rooflights, avoiding unnecessary curtains and blinds, and choosing pale colour decor to benefit from reflected internal light
- active systems, in which mechanical devices are used to capture the ambient energy - such as solar heating panels, photovoltaic panels or wind generators.

Most renewable energy sources are intermittent in their power generation and almost all premises which attempt to exploit them on an individual-building basis still need to be connected to conventional supplies.

# Section 7 Energy and catering

**Slide 38**

Poster of the chef from Protect the Environment

Commercial catering is a diverse activity ranging from small snack catering, via institutional catering, to high class catering in exclusive restaurants and luxury hotels. The cost of energy per meal is relatively small in comparison to the price of the meal paid by the customer, and it would be a mistake to inconvenience customers to save a few pence in energy costs. But catering is a profligate user of energy - hotel catering in particular is very energy intensive, responsible for 4% of the meals produced annually, but 16% of the energy consumption associated with catering.

Energy is used in all stages:
- storage, preparation, cooking and serving of food
- dishwashing and cleaning
- environmental services - lighting, heating, ventilation.

Inefficient practices include switching everything on early in the morning and leaving it on ‘just in case’ until last thing at night; over-estimating warm up times; cooking food too far in advance of need and then keeping it hot; using oversized equipment part-full rather than choosing correctly-sized equipment; leaving equipment at high settings; over-riding automatic controls; and leaving taps running. These costly and wasteful practices can become habits. Overcoming them requires good house-keeping, energy monitoring, and well-designed premises and equipment.

Illustration from forthcoming Best Practice guide on energy efficient catering

**Slide 39**

Although catering is complicated because of the varying daily demands and sporadic nature of many activities, there are four broad areas where efficiency can be improved:
1. kitchen managers should review catering activities - for example, menu selection and equipment usage - to ensure efficient use of equipment
2. staff should receive training in the proper use of equipment
3. equipment should be chosen that is efficient, easily controlled, has automatic timers where possible, and uses indicators to show when it is switched on
4. the kitchen should have adequate lighting and heating, and ventilation that removes steam and smells at source.

To monitor consumption, utility sub-meters should be installed and read on a regular basis so that energy use per meal can be assessed. Periodic checks of week-end versus week-day, and day-time versus night-time consumption may reveal unnecessary energy use.

# Section 8 Water management

**Slide 40**

Dripping tap

I would like to devote just a couple of overheads to water conservation. Although much of the globe is covered in water, fresh water for human consumption is a natural resource in short supply. The hospitality sector is a high consumer of water, and its purchase and disposal often represents a significant cost. In fact water is paid for twice - first buying it, then disposing of it.

**Slide 41**

Strategic water management:
- monitor consumption
- look for sources of water wastage
- ‘good housekeeping’ practices
- low cost options
- capital cost measures

A strategic water management programme will include:
- monitoring consumption - especially to check for leaks - and setting targets to reduce consumption
- inspecting the premises for sources of waste arising through faulty taps, showers etc, and through inefficient practices (excessive water for cleaning or in catering)
- promoting good practices - such as running dishwashers and washing machines less often and with full loads
- using simple technologies to reduce excessive water use, such as dams to reduce the water flushed in WC cisterns
- installing flow restrictors to cut excessive flows from taps and showers and low-volume WC cisterns, and controlling urinal cistern flushing with presence detectors.

**Slide 42**

Guests and water use

‘In order to save valuable natural resources such as energy and water, and to prevent pollution by using detergents, our hotel prefers to launder bedlinen every three days for those guests who stay for multiple nights. However, if you would like your bedlinen changed more frequently, please hand this card on the inside of your bedroom door.’

In hotels it has become increasingly common to change towels and bedlinen only on request - for example, by asking guests to leave towels on the floor when they want them changed.

Using swimming pool covers at night not only cuts water evaporation from the surface, and also reduces the need to ventilate the pool hall at night.

More advanced options for water conservation include:
- water recovery systems, for example re-using rinsing water from laundry or dishwashing for the first wash cycle
- storing rainwater so it can be used for watering gardens and plants - as opposed to putting it to drain
- treating waste water so it can be put to secondary uses.

Detailed checklists for water conservation can be found in Water Management for Hotels, published by Green Globe.

# Section 8 Waste management

**Slide 43**

The three Rs of waste management:
- Reduce (avoid disposable and overpackaged goods, suppliers to collect packaging)
- Reuse (select suppliers who reuse packaging, e.g. glass bottles)
- Recycle (separation, recovery and collection)

Finally we come to the subject of waste and waste management. The hospitality industry is an intensive producer of waste from packaging and containers, and has much to gain from both waste minimisation and waste management. The three main principles are well known:
- reduce
- re-use
- recycle.

Reducing waste in the first place may be achieved by:
- avoiding disposable and overpackaged goods, and encouraging suppliers to re-use and/or take back packaging
- buy in bulk and reusing items such as refillable bottles, containers and dispensers.

Where packaging is essential, biodegradable packaging materials should be demanded.

Re-using is the next best alternative to reducing. It is undertaken by selecting suppliers committed to recollecting containers for re-use. Glass bottles are a prime example where suppliers have shown themselves willing to do this. Bottles need to be sorted and stored for a bottle collection service to work effectively.

Recycling involves:
- separation at source according to the basic raw material, for example, paper, glass, metal, plastic, organic waste
- a recovery system that retains the separated waste and transfers it to a collection point
- negotiation with private collectors of waste materials and/or local authorities to have the waste collected.

Derwentwater hotel ‘Growing Greener’ one-page statement

**Slide 44**

The potential for recycling can be enhanced by selecting materials that lend themselves to re-use, such as natural cottons and linens instead of artificially made alternatives. Similarly the choice of natural rather than artificial materials wheneve possible will help to ensure that those items that end up in landfill sites are biodegradable and do the minimum environmental damage.

At the Derwentwater Hotel in Cumbria a comprehensive environmental management programme has been adopted, that includes commitment to reducing, reusing and recycling. This illustration (which you may not be able to read in detail) sets out their Growing Greener policies and practices and is given to staff and guests alike.

**Slide 45**

Globe from *Protect the environment*

That concludes this lecture, in which I have covered some of the main environmental impacts arising in premises operated in the hospitality sector. I have tried to summarise the various ways in which these impacts can be lessened - through improved management practices and a wide variety of current and near-market technologies. The managerial approaches are fairly well established, while technologies are always evolving. But I can assure you there are no technical fixes that will solve our environmental problems overnight. It is up to each and everyone of us as managers, producers, and consumers, to act responsibly to protect our environment. It’s the only one we have, and if we damage it beyond repair we put at risk our life on earth.