

TAKING ACTION

Advice on making carbon savings in your building

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This booklet will help energy managers,
facilities managers, building managers,
and others interested in the carbon-efficient
operation of buildings to reduce CO₂ emissions.

The financial case for carbon saving in buildings

The reasons for cutting carbon are well known and discussed, however there are additional key issues that make the case for introducing carbon saving measures and technologies not only desirable but a necessity.

The European Energy Performance of Buildings Directive will, in 2008, require that an energy performance certificate (energy label) be made available when buildings are constructed, sold or let. This energy certificate will mean that the energy performance of a building will become a factor that potential investors or tenants can consider when buying or renting a new building.

There are clear indications that low energy commercial property represents a sound investment:

- A poor energy rating could be used as a lever to reduce rental payments representing a potential decrease in revenue;
- The interest in knowing the performance of buildings will become very important in companies where shareholders and customer public images are sensitive.

KEEPING THE LIGHTS SWITCHED ON IN AN EMPTY MEETING ROOM OVERNIGHT CAN WASTE ENOUGH ENERGY TO MAKE 250 CUPS OF TEA.

A STANDARD PHOTOCOPIER USES 1,000 REAMS OF PAPER PER YEAR.

A MONITOR CONSUMES 3 TIMES MORE ENERGY WHEN IT IS SWITCHED ON THAN WHEN IT IS ON STANDBY.

COOLING REQUIREMENTS ACCOUNT FOR 10% OF AN OFFICE'S ENERGY CONSUMPTION.



YOU CAN INVOLVE THE
WHOLE ORGANISATION
IN SWITCHING OFF,
PRINTING LESS,
RECYCLING MORE.

The first step

The first step Facilities, Building or Energy Managers should take in reducing their organisation's CO₂ emissions is to carry out an energy audit, this will enable you to set CO₂ emission targets and get the organisation's senior management to make a clear statement of that commitment.

The energy audit

This is the analysis of energy consumption at a site using fuel invoice records and available site data. An audit helps to determine where, when and how energy is being used, identifying the circumstances where energy is being wasted, and providing the basic information with which the opportunities for energy savings can be reviewed.

To help you carry this out you can use TM22 – Energy Assessment and Reporting Methodology: Office Assessment Method (CIBSE 2006). TM22 describes a method for assessing an office building's energy and building services performance that can be tackled with a spreadsheet approach. The method has been extended to cover bank and agency branches, hotels and mixed use factory-office and industrial buildings.

While primarily directed at finding out about and improving energy performance, the results of an energy audit can have a wide range of uses by building/facilities management, contributing to the circle of good management and satisfied occupants. The energy audit can be used:

- to identify poorly performing buildings and systems;
- to indicate the cause(s) of poor performance;
- to benchmark operating procedures including hours of use, and levels of service provision including lighting levels and system efficiencies.

For example, the energy audit would allow you to identify whether heating consumption is better, equivalent, or worse than standard industry benchmarks. In that case, a detailed investigation should determine the reason why the building has greater heating requirements, e.g. poorly insulated fabric, inefficient boiler, inappropriate control systems, etc. and therefore help to reduce the waste of heating energy.

Following the energy audit the next steps you should take are to:

- **Set targets.** Once the 'baseline CO₂ emissions' have been identified following the energy audit you need to identify how much you want to or can reduce your emissions by.
- **Undertake energy monitoring.** This is the regular recording of energy consumption every year. Included as one of your standard business metrics, annual consumption figures will provide a focus for management activity.

Reducing your energy consumption – how low can you go?

After carrying out your audit and setting targets for carbon saving you need to consider what activity is appropriate for you to carry out. Four general groups of measures can be adopted:

Group 1: Behavioural changes

Employees can help reduce CO₂ by changing their habits (e.g. switch off the lights when they leave a meeting room). These are zero/low cost initiatives that you can involve the whole organisation in: encouraging people to switch off, print less, recycle more.

These measures would generally have no cost and could reduce your carbon emissions by up to 30%

Group 2: Managerial led changes

Management decisions changing the work habits could affect CO₂ emissions. For instance a change in the organisation dress code can affect the cooling requirements (a casual dress code providing more flexibility to adapt to changing weather conditions). Changing the working hours is another example of a decision which could have an impact on the building's CO₂ emissions.

These measures can also have little or no cost but could reduce your carbon emissions by up to 10%.

Group 3: Changes/adjustments

Facilities/Energy Managers need to change/adjust the way the building is operated in order to reduce CO₂ emissions (e.g. reduction of the heating set point temperature, switching off cooling at night and when the building is unoccupied).

Generally, these measures would have no capital costs and could reduce your carbon emissions by up to 20%. However, support from senior management is required.

Group 4: Replacement of equipment

Facilities/Energy Managers could reduce CO₂ emissions by replacing inefficient equipment with modern equipment (e.g. inefficient computer screens with flat screens). These measures would require a capital investment. However, their payback could be very short.

These measures could reduce your carbon emissions by up to 50%. Support from senior management is necessary.

This booklet will focus on the third and fourth set of measures, i.e. technical changes/adjustments and replacement of equipment, which are generally under the responsibility of Building/Facilities/Energy Managers but are often the more challenging to implement as they require senior management support and financial backing.

Who does what?

Depending on the size and type of the organisation and the available resources in the Building/Facilities Management team you may want to manage some of your carbon saving initiatives internally and outsource others to gain the expertise of specialists working within the area.

As a first step you might want to consider using a consultant energy expert to carry out the energy audit. They can advise you on the various options available and help you to make an informed choice, in line with the organisation's priorities. This will give you a good base to move forward with and identify the carbon saving initiatives that will be most successful in your organisation.

Generally although you may feel able to instigate the behavioural changes by running a carbon cutting campaign, moving forward from this to uplift your carbon saving further you should consider a specialist to recommend, commission and then supply, install new equipment.

The rest of this booklet will give you specific ideas for areas to cut your carbon emissions, the measures are broken down between 'Changes/Adjustments' which do not generally have capital cost implications and 'Replacement of Equipment'.



YOU CAN INVOLVE THE
WHOLE ORGANISATION
IN: ENCOURAGING
PEOPLE TO SWITCH OFF,
PRINT LESS,
RECYCLE MORE.



01 LIGHTING

Changes/adjustments

- Optimise daylight (optimised office layout, improved daylight penetration).
- Remove any other obstructions from windows and keep them clean.
- Keep luminaires clean.
- Remove excessive luminaires in areas that are sufficiently artificially lit.
- Encourage staff to switch off lights when not required by adding reminder notices.
- Make staff aware of the purpose of the lighting control system, how it works and how they can interact with it.

Replacement of equipment

- Implement energy efficient sources (e.g. replace tungsten filament lamps with fluorescent lamps).
- Promote the use of task lighting rather than high ambient illumination levels.
- Consider dimming.
- Allow lighting to be switched on manually by the occupants and to be switched off automatically according to occupation, daylight or time.
- Allow selective switching for security or cleaning purposes.
- Zone the lighting scheme to provide control to the occupants and allow lights in some areas of the rooms (i.e. near windows or unoccupied) to be switched off.

IN A TYPICAL 2,000M² OPEN-PLAN NATURALLY VENTILATED OFFICE, REPLACING EXISTING INEFFICIENT SOURCES WITH FLUORESCENT LAMPS WOULD SAVE 17 TONNES CO₂ PER YEAR AND REDUCE THE OFFICE CO₂ EMISSIONS BY 12%.



02 STATIONERY

Changes/adjustments

- Set the photocopier default setting to double sided print.
- Keep a pile of good quality A4 scrap paper next to the printer for rough or trial copies. Out of date headed paper is ideal for this purpose.
- Ensure double-sided (duplex) printing is the default setting, and reduce the default margin size to save on paper and energy.
- Where possible replace faxing with electronic fax (e-fax).
- Set all copiers to reset to single copy.

Replacement of equipment

If the organisation has a canteen:

- Avoid serving condiments in individual portion sized packets, consider using a dispenser.
- Use napkins made from 100% recycled material.
- Favour reusable instead of disposable products, i.e. glasses and china cups.
- Recycle packaging – separate glass, metal, plastic, paper – and vegetable oil.
- Ask your suppliers if food can be delivered in fewer, larger reusable crates/cartons.
- Compost food waste.

SETTING THE DOUBLE-SIDED COPYING FEATURE AS DEFAULT ON THE COPIER SETTINGS OF A 10,000M² OFFICE COULD SAVE 60 TONNES OF CO₂.



THE AVERAGE CO₂ EMISSIONS OF A LAPTOP ARE ONLY HALF THAT OF A PC, AND ONLY A SIXTH IF THE PC IS USING A CRT MONITOR

03 OFFICE EQUIPMENT

Changes/adjustments

- Use power saving modes on computers, photocopiers and printers/reduce the time required for these modes.
- Assess whether or not an appliance which produces large amounts of heat can be located in a separate smaller room to enable a smaller space to require air conditioning thus saving energy.
- Send all empty cartridges to be recycled/refilled. Check that the manufacturer completely dismantles the cartridge and replaces the drum with a long-life one. These should produce 30,000 A4 copies compared with 3,000 copies for some original drums.

Replacement of equipment

- Set up an environmental purchasing policy. It can be based on labels such as the European Union Ecolabel or Energy Star. Labelled products have a lighter environmental footprint than similar products performing the same function.
- Purchase office equipment based on their electrical consumption (see below).
- Replace old CRT monitors with new flat LCD screens. Modern flat LCD monitors are much more efficient than older CRTs, take up less desk space and produce less heat which can overburden air-conditioning systems.
- Purchase printers, fax machines and photocopiers which can handle 100% recycled paper.
- Purchase printers that can print double-sided (duplex) sufficiently fast to avoid wasting staff time.

Additional information

The main environmental consideration for purchasers of electrical office equipment should be power consumption. It is important to note that the stated or 'nameplate' rating is normally greater than the actual average power demand of the appliance. It is therefore preferable to compare average power demand data rather than nameplate ratings, as the latter can be misleading. The appliance's power consumption in standby mode should also be taken into consideration. Below are examples of recommended specifications for office equipment.

| | | |
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| <p>COMPUTERS AND MONITORS Energy Consumption: PC only ≤30 W standby Monitor only ≤30 W standby but aim for ≤10 W Normal operation (total system) ≤120 W Standby/Sleep mode ≤40 to 60 W</p> <p>Thermal emissions: System unit heat output ≤160 kcal/h Display heat output ≤130 kcal/h</p> | <p>LASER PRINTERS Energy Consumption: Standby mode ≤100 W Operating mode ≤600W Automatic 'sleep' mode: adjustable between 10 minutes and an hour</p> <p>Potential for recycling: Machine ≥50% by weight Able to use 100% recycled paper</p> | <p>PHOTOCOPIERS Energy Consumption: Standby mode ≤150 W Operating mode ≤850 W</p> <p>Potential for recycling: Machine ≥50% by weight Able to use 100% recycled paper and duplex copy facility.</p> |
|--|--|--|



04 SMALL POWER

Changes/adjustments

- Make sure the fridge is not near to any sources of heat, as this will increase the amount of energy required to keep its contents cool.
- It is worth reviewing power requirements of vending machines and considering whether they can be switched off when the office is empty.
- Ensure routine maintenance of small equipment, i.e. defrosting and cleaning of coils for fridge/freezers.

Replacement of equipment

- Microwaves are not subject to any major efficiency labelling scheme. However, newer and smaller microwaves tend to be more efficient, so it is best to select the smallest appliance that will fulfil the purpose.
- Purchase eco-labelled equipment.

AN OLD FRIDGE
CONSUMES TWICE AS
MUCH ENERGY AS AN
ECO-LABELLED FRIDGE.



THE DIFFERENCE BETWEEN GOOD PRACTICE AND TYPICAL PRACTICE HVAC RELATED CO₂ EMISSIONS IN A 5,000M² STANDARD AIR CONDITIONED OFFICE IS EQUIVALENT TO 200 TONNES CO₂ PER YEAR, I.E. 25% OF THE OFFICE TOTAL CO₂ EMISSIONS.

05 HEATING, COOLING AND VENTILATION

Changes/adjustments

- Establish the required conditions for the spaces being served, including operational times, air change rates, temperatures and relative humidity. It may be found that the current system operation is based on excessive requirements.
- Examine occupancy patterns and ensure that the system is switched off entirely whenever possible, e.g. overnight, at weekends, seasonally.
- Monitor daily hours run by major items of plant to ensure that they are not working during periods when they should be off.
- Consider variable summer set-points in the interests of energy efficiency and comfort (see below).
- Avoid heating/cooling a room when it is not occupied. In particular, avoid permanently heating/cooling rooms that are rarely occupied.
- Allow occupants to have the ability to influence opening a window and/or influence comfort set-points.
- Avoid excess air flow rates (applies to both naturally and mechanically ventilated spaces) by measuring air volume flow rate and comparing them to the actual requirements of occupancy.
- Check that dehumidification is only operated when absolutely necessary, since it involves cooling and subsequent reheating.
- Check boiler performance.
- Exploit opportunities for passive cooling (e.g. night cooling which makes use of lower night-time air temperatures and the thermal capacity of the building).
- Fans, particularly those for toilet ventilation systems, should be switched off when the building is not occupied.
- Set up a schedule for regular maintenance of equipment.

Replacement of equipment

- Improve thermal insulation and airtightness, e.g. seal or draught proof at exterior joints and at service penetrations, add draught lobbies to busy entrances.
- Replace single windows with modern double-glazed or triple-glazed windows.
- Implement appropriate shading devices on glazed areas according to their orientation. Typically:
 - Between North-West and North-East: no shading devices/internal shading devices;
 - Between North-East and South-East: internal or external shading devices required;
 - Between South-East and South-West: external shading devices required (preferably horizontal);
 - Between South-West and North-West: external shading devices required.
- Insulate pipes to reduce distribution losses.
- Identify opportunities for recovering heat from exhaust air, particularly if recirculation is not possible.



Additional information

- Consider variable speed fans and pumps as they can provide significant energy savings. Building services are sized for peak loads and, for most of their working life, operate well below their full output. Variable speed helps to address that issue.
- Consider presence detectors for toilet ventilation systems.
- Install CO₂ sensors to control ventilation in meeting rooms. These sensors would help to control ventilation in meeting rooms according to occupancy, therefore avoiding running the ventilation system on full load.
- Consider weather compensation (i.e. the output of the heating system varies in relation to the outside temperature).
- Consider retrofitting a Building Management System (BMS) to improve monitoring of comfort conditions, plant operation and energy consumption – employ and train staff to operate the BMS.

A 1°C reduction in the setting of the thermostat in winter could reduce energy consumption by as much as 10%, without any significant reduction in comfort. Therefore thermal comfort set-points should be determined with great attention to energy consumption.

In winter an ideal temperature set-point is 20°C, the temperature set-point should be maintained as stable as possible, no lower than 19°C (to ensure comfort) but no greater than 22°C (to avoid overheating and excessive energy consumption).

In the summer, operational summer temperature set-points in the UK are traditionally determined without reference to external conditions. However, recommendations by ASHRAE, German and other national standards allow internal temperature set-points to drift upwards as outside temperatures increase, due to the fact that the perception of comfort in summer relates to the external conditions.

According to this adaptative model, it can be demonstrated that when it is 28°C outside, the ideal comfort temperature inside is not 22°C but 26°C. This means that maintaining a temperature of 22°C under these external conditions would be inefficient in terms of comfort as well as in terms of carbon. Energy Managers and those preparing facilities management contracts could therefore consider variable summer set-points in the interests of comfort and CO₂ savings.

IMPROVING THE EFFICIENCY OF THE COOLING SYSTEM IN A SHOP CAN CUT THE SHOP CO₂ EMISSIONS BY UP TO 30%.

Additional information on Low or Zero Carbon energy sources

Procuring electricity from utility suppliers which guarantee that the electricity is generated from renewable sources (typically wind farms or hydroelectricity) is a way for a business to reduce carbon emissions.

On-site generation by Low or Zero Carbon technologies could also reduce the organisation's CO₂ emissions by displacing natural gas and electricity from the grid and therefore reduce utility costs. They can also improve business environmental credentials, for example a BREEAM environmental assessment rating can potentially provide a visual representation of the company's commitment to protecting the environment.

Low or Zero Carbon technologies include, in descending order of CO₂ emission savings per £100,000 of capital cost:

- Biomass boilers
- Wind turbines
- Solar water heating
- Ground source and water source heat pumps
- Solar photovoltaic modules (PVs)

For large scale projects, Combined Heat and Power (CHP) systems further help to reduce CO₂ emissions as it makes efficient use of primary fuels.

Help is available

Identifying and implementing carbon saving measures in your building can be a daunting process, you may want to plan and run certain elements in house, however identifying when you need professional advice and help can be the key to increasing your carbon savings.

Help and advice are available through the CIBSE register of Low Carbon Consultants.

The Register of Low Carbon Consultants provides a body of professionals whose competence in Low Carbon Design, Building Operation or Simulation (calculation of energy performance) has been tested and registered.

Members of the Register have undertaken examinations to demonstrate their competence to deliver and maintain buildings which exceed minimum standards of energy efficient design and operation. Register members are required to update and enhance their skills continuously to ensure that they keep up with technological developments and the requirements of the regulations.

To find a Low Carbon Consultant, please visit:
www.lowcarbonconsultants.org







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