GDF SUEZ

Energy Efficiency Advice

For Industrial and Commercial Customers

CONTENTS

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1. THE ADVANTAGES OF ENERGY EFFICIENCY

There are many excellent reasons why all organisations should take energy-efficiency seriously, from improving the economic health of the organisation to helping to reduce damage to the environment. The key advantages are as follows.

ECONOMIC

Minimising energy waste means saving money through lower energy bills, including lower Climate Change Levy payments. This means improved profits, and can help enable your organisation to price products and services more competitively. Controlling energy costs through energy efficiency now will help to mitigate the impact of increases in energy prices or taxes in the future. Organisations that have not looked seriously at energy efficiency can typically save 20% on their energy consumption, and consequent emissions of greenhouse gases, through no-cost and relatively low-cost measures, yielding significant reductions in their energy bills.

Many industrial companies are now party to Climate Change Agreements with the government. These companies receive an 80% discount on the Climate Change Levy for agreeing to energy efficiency targets. If targets are not met, then the benefit of the discount can be lost. Only particular industrial processes are eligible for inclusion in an agreement - see Section 6, Sources of further information.

ENVIRONMENTAL

Wasting energy not only wastes money, it results in unnecessary pollution, particularly through emissions of the main greenhouse gas, carbon dioxide. Global warming, with the consequent changes to sea levels, patterns of weather and of disease, is widely considered to be the single most important environmental issue facing us all. The UK government's response to the problem is set out in its Climate Change Programme, published in November 2000. This details how the UK plans to deliver its international obligation, as a result of the Kyoto protocol, to cut its greenhouse gas emissions by 12.5%, and move towards its domestic goal to cut carbon dioxide emissions by 20% below 1990 levels by 2010.

By using fuel and electricity more efficiently, your organisation will be reducing its impact on the environment and helping the UK meet its international commitments.

REGULATORY

Increasingly, regulation at both the UK and European level is being applied to drive improvements in energy efficiency. Energy efficiency is not just a matter of operating efficiently; it can also be a factor in operating legally.

- The European Directive on Integrated Pollution, Prevention and Control, implemented through associated regulations in the UK, requires that sites operating specified processes use energy efficiently.
  http://europa.eu.int/scadplus/leg/en/lvb/l28045.htm
- The new Part L2 of the Building Regulations requires more stringent control and monitoring of energy consumption in buildings. New measures now govern the performance of lighting, heating and hot water installations and the air tightness of the building fabric. Most of these measures apply to new buildings, but also apply to the substantial refurbishment of much industrial scale lighting, heating and building fabric projects. For information on the Building regulations visit
  http://www.odpm.gov.uk/stellent/groups/odpm_buildreg/documents/sectionhomepage/odpm_buildreg_page.hcsp
- From the 6th January 2006, EU Legislation will require all new buildings, existing public building, or building under renovation to be certified for energy efficiency. In order to be certified, the buildings must have an energy audit of their premises performed by independent accredited experts. The Energy Certificate will be necessary when buildings are refurbished, let, or sold.
- Many organisations, particularly those in the public sector are facing increasing tough targets for the efficient use of fuel, with new mandatory directives issued for NHS estates, MOD establishments and many local authority premises. This situation is expected to widen to include many other organisations.

QUALITY

Energy efficiency is an important factor in accreditation to environmental management systems such as ISO14001 and EMAS. Many organisations now require their suppliers to operate under such systems; good energy management can help supply chain obligations to be met. In addition, good performance can be publicized, thereby establishing green credentials for the organisation. An image of responsibility for the organisation is increasingly important to customers and shareholders alike.

Many energy efficiency measures can also bring substantial benefits in terms of employee comfort through improved heating, insulation and the avoidance of cold spots. This can reduce staff turnover and improve productivity. Attention to energy efficiency often highlights deficiencies in other areas such as maintenance, process yield and quality, and so can bring significant additional productivity benefits.

2. ENERGY MANAGEMENT

Fundamental to the effective implementation of energy efficiency is good management. Like any resource that an organisation employs, energy will only be used efficiently if it is managed properly. Good energy management saves energy in itself, but is also necessary for getting the most out of technical energy saving measures. Energy management can be broken down into a number of key areas:

- Policy
- Planning and organizing
- Monitoring and control
- People
- Reporting and review

These are described below, and all are necessary for effective energy management. However, the level of detail and the exact approach taken will depend on the nature and size of your organisation. The energy management structures and procedures appropriate to a large energy intensive industrial concern will be much more complex than those suitable for a small office based organisation.
Energy management is highly cost effective and on the whole needs little, if any, capital investment, though does need the investment of time.

POLICY

This should be a formal statement of the organisation's objectives, demonstrating senior management commitment to continuous improvement in the efficient use of energy. It should explain the key approaches that the organisation will take to achieve these objectives. An effective policy provides the foundation for setting the culture within the organisation, and should be clearly communicated throughout the organisation. An effective energy policy should:

- Set out the organisation's objectives for energy management;
- Demonstrate commitment to managing energy in a way that both supports good business performance and takes due regard for environmental effects;
- Commit the organisation, when capital investments are planned, to giving energy efficiency due regard in the selection and configuration of plant, and adopting the most energy efficient equipment available when the marginal cost is justifiable;
- Recognize the need for adequate resources and reporting throughout the company;
- Identify the Director or Senior Manager with overall responsibility for the energy policy and its implementation;
- Commit the company to a regular review of the Policy.

PLANNING AND ORGANISING

To achieve the aims and objectives of the energy policy, there should be clear and formalized responsibilities, plans and procedures in place. These should include:

- Documented roles and responsibilities;
- Plans which set targets for energy savings, and supporting action plans;
- Appropriate methods for communication, to ensure that policies and procedures are understood and that management commitment to them is visible;
- Training plans, both for energy managers and the workforce as appropriate;
- Procedures for planned and emergency maintenance of equipment, and the procurement of new plant taking due account of opportunities for energy efficiency;
- Procedures for assessing the cost-effectiveness of energy saving measures. These should take a view of savings over the lifetime of the measure.

MONITORING AND CONTROL

Energy waste cannot be effectively controlled without a clear understanding of its use. There are two complementary activities that provide, and help maintain, this understanding:

- The physical energy survey;
- Ongoing monitoring and analysis of energy consumption information.

The **energy survey** is an investigation of the control and flow of energy in, for example, a building, a manufacturing unit, an item of equipment, or a whole site. A survey can range from a simple 'walk-through' to a comprehensive and detailed appraisal. In both cases, the aim of the survey is to gain understanding and identify cost-effective energy saving measures. Whatever their level of sophistication, surveys usually include an examination of energy conversion, distribution and end-use, together with management systems. Surveys typically result in recommendations under the categories of *no-cost*, *low-cost* and *high cost* measures. A simple walk-through survey could be conducted with the aid of the technical measures section of this document, particularly the practical tips. The following tips for carrying out a basic survey will also help

- Identify and draw up a schedule of energy consuming items of equipment and plant
- Speak with colleagues from different parts of your site – they may well be aware of energy wastage in their areas, but have done nothing about it.
- Walk through the site at different times, particularly during 'quiet' periods such as lunch-time, weekends, evenings and early mornings. Are lights, machinery, office equipment, etc. left switched on unnecessarily?
- Walk through the site at different times of the year. Do the heating and/or cooling come on and switch off at appropriate times of the day (listen for boilers and other plant operating)? Do the heating and/or cooling come on when it is unnecessary? Obtain feedback from colleagues as to whether they are too hot or too cold.
- Ask security staff and cleaners whether they have any instructions regarding turning off lights and other items that they might find left on out of hours. If so, do they follow them?
- Make sure that the results of your survey are publicized and that necessary action is taken.
- Don't just carry out a survey once – the exercise should be repeated at regular intervals.

At its very basic, the second activity should consist of an examination of energy bills before they are paid and a comparison with expectations, though expectations should not be limited to *'is the bill much the same as last month?*' Ideally, the activity, often referred to as **Monitoring & Targeting (M&T)**, should be more sophisticated than this, and comprise four main elements:

- **Data collection** from a number of possible sources including energy bills, own meter readings, automatic meter readings, half-hourly data from utilities; plus in-house production information and meteorological data as appropriate. Validation of utility bills as part of this activity frequently yields benefits.
- **Analysis and interpretation** to turn the data into useful information on which to act. Proprietary systems and bureau services are available, or standard PC spreadsheets can be used in-house.
- **Reporting** of appropriate information, such as unexpected excess consumption, at the right time to the individuals with the ability and responsibility to act.
- **Action**, without which there is little, if any benefit. As well as responding to unexpected excess consumption, this should include the setting and reviewing of standards of performance that managers are charged with achieving.

M&T may seem a little complicated at first, but really is very straightforward and is powerful in identifying waste. Like anything, it should be carried out at a level appropriate to your organisation. Further information on energy information and Monitoring & Targeting is available from the Action Energy programme (see Section 5).

PEOPLE

People are crucial to effective energy management. If the person tasked with energy management is working without the support of others in their organisation, their endeavours are likely to be frustrated. Every employee can make a contribution to saving energy, particularly through attention to 'house-keeping' issues, if they have awareness, motivation and empowerment.

Awareness can be raised and maintained through a variety of means, including poster campaigns, communication through in-house magazines or Email bulletins, training sessions and via quality improvement and other business initiatives. For people to do the right thing, such as switching off unnecessary lights, knowing it's the right thing to do is not enough: they also need to be motivated. Motivation comes from commitment to the reasons for saving energy, whether it be improving the organisation's profitability or helping the environment. This requires 'bottom-up' involvement of staff and ensuring they are appropriately empowered to act on their own initiative.

REPORTING AND REVIEW

Organisations should provide management reports on energy use and management (progress against plans, conclusions from regular reviews, etc) in a way appropriate to the size and complexity of the company. In addition, regular reviews close the management system loop. They give the opportunity to stand back, consider whether the energy management system being employed remains appropriate, and to decide whether modifications are needed.

Reporting should include:

- Progress reports as necessary or as required by the appropriate senior management body (e.g. Board) in order to ensure adequate control and review of objectives;
- Frequent reports for operational management control.

Reviews should include:

- Consideration of the policy (its aims and objectives, scope, adequacy);
- Comparison of quantitative performance against targets;
- Comparison with benchmark data (where available);
- A review of the barriers to the implementation of energy efficiency improvements, and proposals for addressing these as far as possible.

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)

3. ENERGY EFFICIENCY – TECHNICAL MEASURES

This section provides practical summaries on the energy efficiency opportunities arising in a number of key areas. For each area key issues and practical tips are described. Against each practical tip an indication is given of the capital cost, cost effectiveness and technical complexity of the measure using the conventions shown in the table. **NOTE THAT THESE ARE GIVEN AS A GENERAL GUIDE ONLY, AND CIRCUMSTANCES CAN GIVE RISE TO EXCEPTIONS.**

CAPITAL COST	COST EFFECTIVENESS	IMPLEMENTATION COMPLEXITY
No cost Zero capital cost.	**Immediate payback** *Measure pays for itself immediately.*	**Simple** *Requires no technical knowledge and is easily done.*
Low cost *A relatively small investment needed.*	**Short payback** *Measure typically pays for itself in under a year.*	**Low complexity** *Requires basic craft skills to implement.*
Medium cost *Some investment needed.*	**Medium payback** *Measure typically pays for itself in less than two years.*	**Medium complexity** *Will require some specialist knowledge and craft skills to implement. Larger organisations may have the skills in-house.*
High cost *Substantial capital investment required.*	**Longer payback** *Measure typically takes greater than two years to pay for itself.*	**Highly complex** *Significant technical experience needed, even larger organisations will probably require the assistance of outside specialists.*

For example:

No cost/immediate payback/simple — the measure will not require any capital investment, will give an immediate financial saving and is simple to implement.

Medium cost/short payback/low complexity — he measure is likely to require a noticeable capital investment, but will pay for itself quickly and be fairly straightforward to implement.

Key sources of further information specific to the area are also provided; Section 5 provides details of more general sources of further information that also cover the specific areas set out in this section.

3.1 Lighting

20% of the electricity generated in the UK is used for lighting. This amounts to nearly 60,000 million kWh and an approximate cost of £3,510 million per annum. 58% of this is used in the service sector (offices, shops, warehouses etc), 13% is used in industry and 29% for domestic use. Considerable savings are therefore to be found in all sectors of use.

KEY ISSUES

- Maximise use of daylight.
- Ensure lighting is appropriate for task.
- Improve lighting controls.
- Improve lighting efficiency.

PRACTICAL TIPS

- Label switches and encourage people to turn lights off after use. Increase staff awareness. **No cost/immediate payback/simple**
- Use time switches to control display lighting. **Low cost/short payback/simple**
- Have lighting levels checked – are they inappropriately high for the task? Local task lighting may reduce glare and energy use. **Low cost/short payback/simple**
- Replace older 38mm (T12) fluorescent tubes with 26mm T8 types that give a better colour light and use 8% less energy. **Low cost/short payback/simple**
- Compact fluorescent lamps use 80% less energy than tungsten GLS lamps and can last 10 times longer, reducing maintenance costs. **Low cost/short payback/simple**
- Consider fitting daylight sensors to areas that receive natural light to turn off lighting and maximise the use of daylight. **Medium cost/medium payback/medium complexity**
- Consider replacing lighting with new high frequency triphosphor fluorescent. These can be dimmed and use around 20% less energy. **Medium cost/medium payback/medium complexity**
- Review the use and control of exterior lighting. Sodium lights are most cost effective for night-time security. Fit automatic photocell switching. **Medium cost/medium payback/medium complexity**

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
Energy Saving Trust & manufacturers' partnership website: www.lightswitch.co.uk
UK Lighting Manufacturers' Trade Association website: www.lif.co.uk

3.2 Office Equipment and Gas Appliances

Electrical appliances such as computers and IT equipment, photocopiers and office machines typically account for 15% of electricity used in UK offices. The growth in IT equipment generally means electricity use is increasing, despite newer appliances being more efficient. Gas appliances may offer lower running costs for heating but should be serviced regularly and require fresh air supply to operate safely.

KEY ISSUES

- Switch off equipment when not in use if possible.
- Configure the energy saving features of IT equipment.
- Select new equipment that is “energy star” compliant or similar.
- Consider fitting time switches to turn off equipment at night.
- Consider energy efficiency in new equipment costing.
- Avoid using supplementary electric heaters.

PRACTICAL TIPS

- Ensure that staff are responsible for switching off their computers and other equipment before leaving the building. Enable the energy management facilities on computers to put monitors and disc drives into low power standby mode when inactive. Most computers allow a specified time delay before power down – choose to suit user convenience. In most cases this will increase equipment life, reduce power consumption by up to 80%, reduce office heat gain and should not affect computer networks. **No cost/immediate payback/simple**
- Photocopiers, laser printers and many hot drink vending machines include heaters to keep the appliance near operating level to save time. An inexpensive time-switch to shut the machines down overnight can save up to 75% energy over the whole year, yet leave the machines ready to use in office hours. Well-insulated water boilers allow exact cupfuls of water to be dispensed offering improved safety and significant energy savings over kettles. Consider removing internal lamps from vending machines. **Low cost/short payback/simple**
- Ask the supplier about energy consumption when leasing or buying new equipment. Although gas heating equipment may require more frequent service, the fuel cost is often significantly less for most daytime heating applications. **Low cost/short payback/simple**
- Gas catering equipment may offer significant fuel cost savings over similar electrical appliances. Similarly, discuss cold areas of the building with staff and upgrade main heating system if needed, to avoid the use of portable electric heaters. Industrial buildings with cold spots may be locally heated with gas fired infra red plaque heaters at low cost. **Low to medium cost/short payback/low complexity**

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
Many electrical retailers display energy labels on equipment showing typical energy consumption in use. Ask manufacturers about power saving or standby facilities.
The Market Transformation Programme contains a database of power consumption for many electrical appliances. See www.mtprog.com

3.3 Heating and Hot Water

Heating includes space heating and the heating of domestic hot water. Consumption in commercial buildings varies greatly from 70kWh/m^2 to 320kWh/ m^2 per annum depending on the building use.

KEY ISSUES

- Avoid overheating space or water - check thermostats and controls.
- Check time switches so heating times match building occupancy.
- Check radiators and heat emitters are free from obstructions.
- Check pipes are insulated, especially in unheated spaces.
- Check the means by which hot water is generated in summer; avoid using large boilers for small loads.

PRACTICAL TIPS

- Hot water for catering and washing should be heated to 60-65 °C to avoid legionella, but no higher to reduce excessive heat loss. Check the lagging of hot water storage tanks and calorifiers and reset or improve thermostat control. **No to low cost/immediate to short payback/simple**
- Many older hot water storage systems are oversized for their duty; fitting smaller storage or valving off multiple units reduces wastage. Spray taps can reduce water consumption by two thirds. **Low cost/short payback/low complexity**
- Large buildings may have hot water storage heated by the heating mains; in summer great economies are possible using a local heat source such as a small boiler or electric immersion heater. **Medium cost/short payback/low complexity**
- Check space heating controls and temperatures regularly – good practice suggested temperatures are 16°C for warehousing, 16-18°C for light manufacturing and 20°C for offices. Ensure frost thermostats are set to 5°C. **No cost/immediate payback/simple**
- Thermostatic Radiator Valves can be fitted to radiators to enable local temperature control. **Low to medium cost/ medium payback/low complexity**
- Spaces with high ceilings can suffer high temperatures at high level, known as stratification, particularly with warm air heaters. Fitting ceiling fans can help de-stratify the air, reducing roof heat losses and improving comfort. **Medium cost/short payback/low complexity**
- Tall, poorly insulated buildings such as factories and warehouses are often best heated with direct-fired radiant tube heaters. **Medium cost/short to medium payback/high complexity**
- Many radiator circuits are weather compensated - radiator temperature is reduced in mild spring and autumn weather using a mixing valve based on the outside temperature. This reduces overheating, improves occupant comfort and can save significant amounts of fuel. **Medium cost/medium payback/medium complexity**

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
The Heating and Ventilating Contractors' Association provides information on local contractors. Tel 0207 313 4900 or visit www.hvca.org.uk

3.4 Boiler Plant

There are many different types of boiler, but in simple terms they fall into two broad categories: water-circulation boilers, commonly found on space heating systems, and steam boilers, used in industry and larger buildings such as hospitals.

KEY ISSUES

- Modern boilers are significantly more efficient than older designs. If your boiler plant is approaching 20 years old or more, you should seriously be thinking of replacement. When replacing water-circulation boilers, condensing models should be considered. These are more efficient in particular applications.
- Boilers lose energy via the flue gases, the boiler casing and, for steam boilers only, blowdown. The heat distribution system that a boiler serves can also be a significant source of inefficiency.
- Optimum combustion of the boiler fuel is important for both efficiency and safety reasons. It is vital that all air vents are kept clear.

PRACTICAL TIPS

- Plant should be checked regularly for leaks (from pipework, valves, flanges and the boiler itself). If feed and expansion tanks are often filling, then a significant leak is likely. **Low cost/short payback/low-medium complexity**
- Boilers should be professionally serviced at least once a year. This should include cleaning of burners, a check on combustion efficiency and adjustment of air/fuel ratio for optimum efficiency in accordance with the manufacturer's instructions. **Low cost/short payback/medium complexity**
- Check that boilers are adequately insulated. If fitting additional insulation, ensure that this does not interfere with the burner or air supply to the boiler. **Medium cost/medium payback/medium complexity**
- Record flue gas temperature over a few months. A rising temperature indicates boiler fouling.
- In multi-boiler installations, ensure that boilers are not running at part load unnecessarily. Sequencing controls, if not already fitted, should be considered. **Medium cost/medium payback/medium complexity**
- Insulate piping, valves, flanges and other fittings on steam and hot-water distribution systems. Heat loss from these areas reduces efficiency by a typical 10%, and insulating them is one of the most cost-effective measures that can be taken. **Low cost/short payback/low complexity**
- In steam systems, maximising the return of condensate to the boiler saves both energy and water treatment costs. If condensate is unnecessarily going to drain seek specialist help. **Medium cost/medium payback/medium complexity**
- Blowdown boiler only when needed to keep good water quality.
  Low cost/short payback/low-medium complexity
- Work on the boiler design and functionality: Increase the heating surface (keep the boiler tubes cleaned) by implementing a 4 pass heat exchange system or turbulators in the boiler tubes (for a 2 pass system) to increase the heat transfer by changing the previous laminar flow into a more turbulent one.
  Medium cost/medium payback/medium complexity
- Control the excess air coming to the boiler so as not to decrease the efficiency.
  Medium cost/medium payback/medium complexity
- Set a boiler automatic sequence control. **Medium cost/medium payback/medium complexity**
- Ensure that the ambient air does not vary too much. **Low cost/short payback/low-medium complexity**

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
The Combustion Engineering Association: www.cea.org.uk

3.5 Insulation

Effective insulation and draught proofing is essential to reduce heat loss from buildings and there is usually considerable scope for improvement. Good insulation is best fitted during the construction or refurbishment of buildings where it becomes more cost effective and less disruptive.

KEY ISSUES

- Reduce draughts on all windows and doors
- Use automatic door closures
- Consider improving insulation levels with refurbishment
- Loading bays will benefit from air locks
- Ensure pipes and valves are effectively insulated

PRACTICAL TIPS

- Sealing doors and windows using inexpensive self-adhesive draught excluder reduces air infiltration and can reduce around 10 % of heat loss. **Low cost/short payback/simple**
- Entrance doors can add substantially to heat loss. Ensure external doors have automatic closures. At busy doorways, consider fitting a draught lobby or porch. **Low to medium cost/short payback/low complexity**
- Plastic strip curtains reduce heat loss and create a visual security barrier at loading bays and service doors yet still allow easy access. **Medium cost/short payback/low complexity**
- Fitting docking seals to temperature controlled warehouses reduces heat loss and helps combat the ingress of dust, maintaining product quality. **Medium cost/short payback/low complexity**
- Rapid roller shutters reduce loading bay heat loss by automatically opening and shutting using presence detectors, causing little inconvenience to deliveries. **Medium cost/medium payback/medium complexity**
- Fit doubled glazed windows. **Medium cost/medium payback/medium complexity**
- Cavity walls and many roof voids may be insulated cost effectively with little disturbance to commercial activities reducing heat loss by up to 35%. **Medium cost/medium to longer payback/medium complexity**
- Refurbishment offers great potential for upgrading insulation levels of factory roofs and metal clad buildings. Internal linings can drastically reduce heat loss in winter and improve working conditions throughout the year by helping to limit excessive summer temperatures. **Medium to high cost/medium to longer payback/medium complexity**

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
The Council for Energy Efficiency Development includes trade associations for the draught proofing and insulation industries. Tel: 01428 654011 or visit www.ceed.org.uk for local installer information.

3.6 Air Conditioning

Air conditioning is becoming more common in all sectors of commercial buildings. Refrigeration plant is used to provide cooling and can be very energy intensive. Broadly there are three types of system:

- Centralised air systems, where all cooling is in a central plant room with conditioned air ducted to point of use.
- Partially centralised, where centrally cooled air is further cooled by chilled water in a cooling coil at point of use.
- Local split unit types with external condenser for comfort cooling of hotspots.

KEY ISSUES

- Avoid excess cooling – air conditioning is rarely needed below 24-26°C.
- Reduce internal and solar heat gains to avoid overheating.
- Use free cooling from night ventilation, exposing building fabric etc.
- Check control system and operational hours match occupancy.
- Ensure chilled pipes and ducts are well insulated and undamaged.
- Ensure filters are cleaned regularly and equipment is regularly serviced.
- The efficiency at which air conditioners produce cooling is referred to as a SEER or EER number. SEER stands for Seasonal Energy Efficiency Ratio, and is a ratio of the amount of cooling produced (BTU) divided by the amount of electricity (watts) used. The higher the SEER, the greater the efficiency.

PRACTICAL TIPS

- Minimise internal heat gains by reducing tungsten lighting use and employing energy saving features of office equipment such as computers and photocopiers. **Low cost/short payback/low complexity**
- Improved air movement and ventilation can significantly lower temperatures and improve occupant comfort. Consider switching off air conditioning, and using ceiling fans and opening windows to circulate air and reduce temperatures. **Low to medium cost/short payback/low complexity**
- Have control strategies checked; many systems are poorly controlled to the extent that simultaneous heating and cooling is possible. Widen the dead-band between heating off, say at 20°C, and cooling on, say at 25°C. It may be possible to use free cooling by circulating outside air without running the refrigeration. Some systems have unnecessarily tight control of humidity that significantly increases consumption by chilling to remove humidity then re-heating the air. **Medium cost/short – medium payback/medium complexity**
- Solar gains have a considerable heating effect and can lead to discomfort. Control excessive solar gains using blinds in sunny weather. Consider shading or upgraded insulation to walls subject to solar gains. **Medium cost/ medium to longer payback/low complexity**
- Check condensers, some high maintenance has to be performed
  Medium cost/short – medium payback/medium complexity

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
The Heating and Ventilating Contractors' Association provides information on local contractors. Tel 0207 313 4900 or visit www.hvca.org.uk
The Market Transformation Programme is developing a database that should enable energy consumption of small air conditioners to be compared at www.mtprog.com/nondomestic/index.html

3.7 Motors

Electric motors are major users of electricity in industrial plant and commercial premises. Motive power accounts for almost half the total electrical energy used in the UK and for nearly two-thirds of industrial electricity use.

KEY ISSUES

- The low cost of buying a motor can be deceptive. The electricity bill for a motor for just one-month can be more than its purchase price. Consequently, it is important to consider carefully the options when replacing motors or installing new equipment.
- Higher efficiency motors are now available at little or no cost premium compared with standard motors.
- Just concentrating on the drive itself can mean that significant and often low cost energy saving opportunities in the system that the drive is powering can be missed. Critically examine the efficiency of the system being driven and reduce the load on the motor where possible.
- In pump and fan applications, even a small reduction in speed using a Variable Speed Drive (VSD) can produce substantial savings. Also, speed control is a much more energy efficient method of regulating flow than throttles, dampers or re-circulation systems.

PRACTICAL TIPS

- Consider whether the drive system is still doing a useful job. Changing requirements may have eliminated the need for equipment that is still left running. **No cost/immediate payback/low complexity**
- The simplest way of reducing energy consumption is to switch off the motor when it is not needed. Possible techniques include manual switching off, interlocking, time switches and load sensing. **No to low cost/immediate to short payback/simple to low complexity**
- Minimise motor losses by always specifying higher efficiency motors (HEMs) where feasible. **Low cost/short payback/ low complexity**
- When motors are sent for repair, ensure that proper care and attention is given to the repair process. Otherwise significant reduction in efficiency can result. **Low cost/short payback/simple**
- Ensure all equipment is maintained properly. **Low cost/short payback/low complexity**
- A low cost method of saving energy by reducing speed is to change pulley sizes on belt-driven systems. **Low cost/ short payback/low complexity**
- Make sure the motor size matches the horsepower requirement.
  Low cost/short payback/low complexity
- Ensure a motor usage of between 75-100% of full load.
  Low cost/short payback/low complexity
- Check if there is a proper power supply to the motor.
  Low cost/short payback/low complexity
- Keep a rolling maintenance programme..
  Low cost/short payback/low complexity
- Customize machinery by using heavy copper wire, in order to improve efficiency
  Medium cost/short – medium payback/medium complexity
- Consider Variable Speed Drives **Medium cost/short – medium payback/medium complexity**

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)

3.8 Compressed Air

Compressed air is a convenient and often essential utility, widely used in industry. However, it takes a lot of energy (usually electricity) to generate compressed air and consequently is very expensive. For example, it costs up to ten times more to run air tools than their electric equivalent as 90% of the energy used by a compressor is rejected as waste heat.

KEY ISSUES

- Compressed air should only be used where necessary. Frequently it is used because it's convenient, rather than there being no alternative. Compressed air should not be misused, for example for cleaning or cooling.
- Up to 30% savings are possible by some simple good housekeeping measures, often achievable at no or low cost.
- The typical level of leaks on a site is 40%, yet they are often ignored as a source of waste.
- Compressors are frequently left running when not required – even when idling some compressors draw up to 60% of their full load power.
- Poor maintenance is one of the largest causes of poor system performance and wasted energy.
- Producing compressed air at a pressure greater than required, or filtered and dried to unnecessarily high levels is wasteful. Higher pressure means greater losses through leaks and higher power requirement for the same delivered air volume.

PRACTICAL TIPS

- Listen for leaks during quiet periods. Repair leaks – most commonly on connectors, flanges and flexible hoses. **Low cost/short payback/low complexity**
- If the compressors have hours-run meters, read them at intervals through the day to see whether you have more units running than necessary. Compare on-load hours against total run hours for idle running. Reduce unnecessary running by using or installing controls. **Low cost/short payback/low complexity**
- Ensure air inlets to compressors are ducted from the coldest source (usually outside). Reducing air inlet take by 6 °C increases output by 2%. **Low/medium cost/short payback/low complexity**
- Ensure equipment is properly maintained – e.g. filters are changed regularly. **Low cost/short payback/low complexity**
- Use low-pressure blowers for applications such as air knives, air lances, air agitation, blow-guns etc. Never use compressed air for cleaning workbenches and floors. **No to medium cost/short payback/simple to low complexity**
- Fit zone-isolation valves. These can be under time control, or interlocked to the packing/production line served, to enable parts of the site to operate out of hours without air going through the whole works. **Medium cost/short payback/ medium complexity**
- It costs just a few pence to replace an intake filter and could save pounds in energy; blocked filters restrict the air flow into a compressor, increasing the power used by 4% and reducing efficiency..
  Low cost/short payback/low complexity
- Remove any redundant and seldom-used pipework or fit isolation valves.
  Medium cost/short payback/medium complexity
- Compressing more air than you need is very expensive. You can determine your maximum compressed air demand by running all air-powered tools and equipment flat out at the same time and noting the drop in air pressure. **Medium cost/ short payback/medium complexity**
- Determine the minimum system pressure and adjust the compressor accordingly. Ask equipment and tool manufacturers to specify the minimum air pressure that their equipment needs.
  Medium cost/short payback/medium complexity
- Consider installing an automatic pressure controller: this will ensure you always have the most efficient air pressure setting.
  Medium cost/short payback/medium complexity

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
British Compressed Air Society: www.britishcompressedair.co.uk

3.9 Refrigeration Plant

Refrigeration energy consumption costs British industry some £300 million a year. In certain sectors – notably food & drink, chemicals, food supermarkets and cold storage – it accounts for a significant proportion of overall site energy costs. A small percentage reduction in these refrigeration energy costs can represent huge financial savings. Refrigeration equipment can be divided into 'tailor-made' systems and 'plug-in' appliances. Many refrigeration plants can be improved to save up to 20% of their energy consumption, much of which can be done at little or no cost, with paybacks on investment of well under two years being the norm.

KEY ISSUES

- Is cooling really needed?
- Good housekeeping and maintenance helps ensure efficient and reliable operation.
- Evaporators remove the heat from the cooled space - condensers then reject the heat from the plant to the surroundings. For every 1°C fall in evaporator, or 1°C rise in condenser temperature increases running costs by 2 to 4%.
- Refrigerant leaks reduce efficiency. Refrigerants also have a significant environmental impact in themselves – it is illegal to knowingly vent them.
- Factor in efficiency considerations to procurement of plant and maintenance services.

PRACTICAL TIPS

- Do not set controls for a lower temperature than necessary. Too cold will waste energy: 5°C too low will add 10 –20% to the electricity consumption. **No cost/immediate payback/simple**
- Ensure condensers are cleaned regularly. Blocked condensers increase the condensing temperature and cooling capacity drops. **No cost/immediate payback/simple**
- Ensure the medium (air or water) surrounding condensers is as cool as possible. Shade condensers from sunlight if necessary and ensure warm air/water is not re-circulated. Remove obstructions to airflows. Also, check that defrosting is working properly so that evaporators do not become iced up and so less efficient. **No cost/immediate payback/simple**
- Ensure plant is regularly checked for refrigerant leaks – ideally six-monthly. **Low cost/short payback/low complexity**
- On cooled rooms and appliances, keep the doors closed as much as possible. Appliances storing non-perishable goods (e.g. soft drinks, etc.) should be turned off when not needed. **No cost/immediate payback/simple**
- Keep door seals in good condition. **Low cost/short payback/low complexity**
- Cold refrigerant pipes between evaporator and compressor will pick up heat from their surroundings. They should be well insulated and not run through hot areas. **Low cost/short payback/low complexity**
- De-ice evaporators. Ice will build up over time, but excessive ice might indicate that a drain is blocked or that the unit is too close to the thermostat. Get your maintenance contractor to investigate.
  Low cost/short payback/low complexity

Check the oil level. Compressor reliability may be reduced if the oil level is too low or too high. Check the oil level regularly and if a change is noticed, have a qualified service technician investigate. **Low cost/short payback/low complexity**

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
The British Refrigeration Association: www.feta.co.uk
The Institute of Refrigeration: www.ior.co.uk

3.10 Process Plant

Process plant covers a diverse range of equipment, including dryers, furnaces, baking ovens, mixers & blenders, crushers & grinders, tanks & vats, treatment booths, and many others used for specialist jobs in industry.

KEY ISSUES

- Process plant is often overlooked with regard to energy efficiency because it is seen as too specialist. Also product quality comes first and there is often a great reluctance to change anything in case the product is affected.
- Specialist help may well be needed, but frequently savings can be made through switching off plant when it is not doing anything or altering production schedules to better utilise plant when it is operating.
- Consider and build in energy efficiency opportunities when procuring and installing new process plant.

PRACTICAL TIPS

- Endeavour to use plant as fully as possible. Under-utilised plant can often be significantly less efficient than plant running at full output. **No cost/immediate payback/low complexity**
- Monitor the energy performance of significant processes separately so that any deterioration can be detected early and the impact of savings measures quantified. **Low cost/low complexity**
- Question whether processing regimes are optimised between quality and cost of operation. Process times for example may be unnecessarily long because 'that's the way we've always done it'. **No cost/immediate payback**
- Ensure equipment is properly maintained. **Low to medium cost/short payback/low-medium complexity**
- Consider options for improved controls for existing processes. **Cost, payback and complexity very application specific**
- Where heat is rejected from processes, consider opportunities for heat recovery and its use elsewhere, such as for space heating. **Medium to high cost/medium to longer payback/medium to high complexity**

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)

3.11 CHP Plant

Combined Heat and Power (CHP) is the simultaneous generation of heat and power, usually electricity, in a single process. Compared with the centralised generation of electricity, where the waste heat produced from the generation process is generally discarded, CHP systems can be significantly more efficient and yield substantial financial savings for the user. CHP is a key technology in reducing carbon dioxide emissions, and the government has set a target of 10,000 MegaWatts of Good Quality CHP electrical capacity by 2010.

KEY ISSUES

- Fuel inputs to and electricity outputs from Good Quality CHP are exempt from the Climate Change levy.
- CHP plant are available in a wide range of sizes, and so can be tailored to many applications.
- Where a site has simultaneous demands for heat and electricity for more than 4,500 hours per year, it is worth considering the CHP option. The grade of heat required is an important consideration. A cooling demand may also be served through the use of absorption chillers, which are driven by heat, rather than electricity.
- Most CHP plants run on natural gas, and the economics of a scheme are sensitive to the relative difference between gas and electricity prices.
- CHP plant is capital intensive, but in the right circumstances energy services arrangements are available whereby a third party will finance the plant.
- When examining the economics of a prospective CHP system, it is important not to overlook the costs of maintenance, additional gas supply and connection to the electricity network.
- Consider the connection to a CHP or even the implementation of a micro CHP for small businesses.
- Make sure plants do not overheat and that there is adequate combustion air.
- Set acoustic attenuation measures.
- Test the CHP under a range of loads in line with recommendations and regulations.
- Monitor both the post implementation of the CHP and the system performance.
- Provide frequent maintenance operations to the CHP

High cost/longer payback/highly complex

FURTHER INFORMATION

The Carbon Trust: www.thecarbontrust.co.uk (see Section 6)
Combined Heat & Power Association: www.chpa.co.uk
Combined Heat & Power Club: www.chpclub.com

4. FUNDING ENERGY EFFICIENCY

For many energy efficiency improvements it should be possible to obtain internal funding given the significant benefits available, frequently at no or low cost. However, energy efficiency will always be competing with other potential investments; this section summarises some of the opportunities available to improve the financial case for an energy efficiency investment.

GRANTS AND LOW-COST LOANS

Grants, generally from public funds, are sometimes available to assist with the capital costs of an energy efficiency investment. Low-cost or interest free loans for energy efficiency investments also are sometimes available, particularly for SMEs.
The nature of grants and low cost loans sometimes apply only to a specific region. For information on current schemes available visit the web-sites of the Carbon Trust and the Energy Saving Trust (see Section 6).

THE ENHANCED CAPITAL ALLOWANCE SCHEME

The Enhanced Capital Allowance (ECA) scheme offers tax incentives to businesses that invest in energy saving equipment and enables them to claim 100% first year capital allowances on investments in approved energy saving equipment.
Businesses are now able to write off the whole cost of their investment against their taxable profits for the period during which they make the investment.
Qualifying equipment includes boilers, lighting, motors, drives, combined heat and power, thermal screens, insulation and re-frigeration.
Further information on the ECA scheme and The Energy Technology Product List of supported products can be found on the scheme's web-site: www.eca.gov.uk

ENERGY SERVICES

The term Energy Services, also known as Contract Energy Management, CEM, describes arrangements by which an organisation may contract out some, or all, of its energy management functions. These agreements allow an organisation to transfer some or all the responsibility for ensuring cost-effective procurement of fuel, security of supply, and the efficient use of energy. Depending on the type of contract, the Energy Service can include the finance and provision of energy plant e.g. light-ing, boilers or CHP, its ongoing maintenance and operation, and fuel purchase.
Further information on Energy Services companies can be found in the 'specialist groups' section of the Energy Systems Trade Association's web-site (see Section 5). The Energy Saving Trust and Carbon Trust web-sites also provide relevant information.

5. ENERGY EFFICIENCY INFORMATION LINE

If you would like to discuss the information provided within this guide please contact us at:-

GDF SUEZ ENERGY UK
1 City Walk
Leeds
LS11 9DX
Tel: 0113 306 2000
Fax: 0113 245 1515
Email: enquiries@gdfsuezuk.com
Web: www.gdfsuezuk.com

6. SOURCES OF FURTHER INFORMATION

This document aims to provide a practical introduction to energy efficiency. There are a number of extensive sources of further information.

THE CARBON TRUST has been established by the government to provide a range of programmes and initiatives to help businesses exploit the commercial opportunities available to them in moving towards a low carbon economy. These include Action Energy and the Enhanced Capital Allowance Scheme (see Section 6). The Carbon Trust will also run the Low Carbon Innovation Programme (LCIP). This programme offers funding for many developmental energy efficiency and low carbon projects.

ENVIRONMENT AND ENERGY HELPLINE on 0800 58 57 94

The following services available through the helpline.

- Free information and advice from basic to technical queries,
- Professional, independent and objective advice about energy-efficient and environmentally conscious building design,
- Free on-site energy surveys, conducted by a professional energy consultant, to assess your overall energy use and draw up a savings plan,
- The helpline may also be able to offer funding for energy efficiency improvements.

The Carbon Trust
9th Floor
3 Clement's Inn
London
WC2A 2AZ
Tel: 020 7170 7000
Fax: 020 7170 7020
Email: info@thecarbontrust.co.uk
Web: www.thecarbontrust.co.uk

THE ENERGY SAVING TRUST is the UK's leading organisation working towards the sustainable and efficient use of energy by households and small organisations. The EST runs a network of local Energy Efficiency Advice Centres (EEACs) providing free, impartial and bespoke advice to small businesses and householders across the UK. As part of Action Energy, the EST provides practical assistance and advises of potential sources of grants to help SMEs realise the cost and environmental benefits available from the adoption of energy saving measures. The EST also runs Government's Transport Action programme, which promotes and offers grants for clean fuel vehicles running on LPG, natural gas and electricity and works to encourage the fitting of emissions reduction equipment to larger diesel vehicles and taxis. The EST is a non-profit organisation funded by government and the private sector.

Energy Saving Trust
21 Dartmouth Street
London
SW1H 9BP
Tel: 020 7222 0101
Fax: 020 7654 2444
Web: www.est.org.uk

Further information on the **Climate Change Levy** and **Climate Change Agreements** can be found on the Department for the Environment, Food and Rural Affairs (DEFRA) and HM Customs and Excise websites:

www.defra.gov.uk/environment/climatechange/index.htm
www.hmce.gov.uk/business/othertaxes/ccl.htm

THE ENERGY SYSTEMS TRADE ASSOCIATION (ESTA) is an energy management trade association, focusing on demand side energy efficiency of buildings, building services and process services in the non-domestic sector. ESTA represents over 100 suppliers of products and services covering the energy efficient monitoring, control, operation and management of buildings, building services and process services.

ESTA
PO Box 77
Benfleet
Essex
SS7 5EX
Tel: 07041 49 20 49
Fax: 07041 49 20 50
Email: info@esta.org.uk
Web: www.esta.org.uk

THE CHARTERED INSTITUTION OF BUILDING SERVICES ENGINEERS (CIBSE) produces a range of publications on energy efficiency issues related to buildings. CIBSE also offers professional training, education and membership services.
The Chartered Institution of Building Services Engineers

222 Balham High Road
London
SW12 9BS
Tel: 020 8675 5211
Fax: 020 8675 5449
Web: www.cibse.org

THE ENERGY EFFICIENCY ACCREDITATION SCHEME provides independent verification of the achievements of organisations implementing energy efficiency and management measures. The accrediting body for the Scheme is the Institute of Energy and it is administered by the National Energy Foundation.

The National Energy Foundation
The National Energy Centre
Davy Avenue
Knowlhill
Milton Keynes
MK5 8NG
Tel: 01908-665555,
Email eeas@natenergy.org.uk
Web: www.natenergy.org.uk

7. ENQUIRIES AND COMPLAINTS

You should contact **GDF SUEZ ENERGY UK** if you have a problem. However, if we are unable to resolve the problem or you want independent advice, you should contact **ENERGYWATCH**. Energywatch is an independent consumer organisation set up by Parliament to protect the interests of all domestic, commercial or industrial energy consumers. They offer free impartial advice and support about the purchase of gas and electricity. Their contact details, including regional offices are as follows. Consumer Helpline: 08459 06 07 08 Email: enquiries@energywatch.org.uk Fax: 020 7799 8341 Textphone for deaf or hearing impaired consumers: 0845 7581 401

Energywatch Head Office
4th Floor, Artillery House
Artillery Row
London
SW1P 1RT

Energywatch Scotland
Delta House
50 West Nile Street
Glasgow
G1 2NP

Energywatch North West
Boulton House
Chorlton Street
Manchester
M1 3HY

Energywatch North East
7th Floor, Pearl Assurance House
7 New Bridge Street
Newcastle on Tyne
NE1 8AQ

Energywatch Central
Civic House
156 Great Charles Street
Birmingham
B3 3HN

Energywatch Wales
5th Floor (West Wing)
St. David's House
Wood Street
Cardiff CF10 1ER

Energywatch South
5th Floor
Heron House
8-10 Christchurch Road
Bournemouth
Dorset BH1 3NA

Energywatch South East
3rd Floor
Artillery House
Artillery Row
London
SW1P 1RT

In certain circumstances, Energywatch may refer your complaint to **OFGEM** (the Office of Gas and Electricity Markets) which is the regulatory body covering the electricity and gas industry. Their contact details are as follows.

Ofgem
9 Millbank
London
SW1P 3GE
Tel: 020 7901 7000
Web: www.ofgem.gov.uk