

Best Practice Guide BPGCS007

ENERGY MANAGEMENT

Introduction:

With rising fuel costs, opening of electricity and gas markets to alternate suppliers and climate change, the requirement to monitor and reduce energy consumption is receiving greater attention than ever before in Irish business.

The process of managing energy is not new or complicated. Energy should be regarded as a business cost similar to other business costs including raw material and labour. The effort required to manage energy effectively will vary between companies and depends on the company size, energy costs and energy intensity (energy costs expressed as a percentage of total company costs). It is not unreasonable for a company starting out in energy management to achieve a 20% reduction or more in their energy bills by simple, good housekeeping measures alone.

Companies utilising quality and/or environmental management systems such as ISO 9000 / 14001 or EMAS will undoubtedly find the implementation of an energy system familiar, as the method and management of the system should follow a similar, structured approach. Ideally, to provide an integrated approach to business sustainability, it is strongly recommended that energy management be incorporated into any pre-existing systems.

When commencing a structured approach to energy management, experience shows there is a clear sequence of events that brings the best result. Any organisation, whether introducing energy management for the first time or upgrading its existing efforts, needs to be aware of this and adapt its activities accordingly.

Understand energy use:

Where possible, an energy manager should be appointed with responsibility for the coordination of energy management activities. Depending on the size of the business, this may or may not be a full-time, dedicated post. In many organisations the facilities, utilities or environmental manager also has responsibility for energy management. The energy manager should set up a system to collect, analyse and report on energy consumption and costs. This can consist of reading meters on a regular basis and the analysis of utility bills i.e. gas, fuel oil and electricity. The energy manager must have the support of senior management, as management are responsible for measuring performance against targets and allocating resources.

Management should set up an energy team consisting of key energy users, representatives from various departments and supported by an energy manager. The

energy team should ensure that the views of all affected by energy decisions are taken into consideration including security, maintenance and operations.

The next step is to assess how, when and why energy is used in the organisation through an energy review or audit. An energy audit establishes energy use patterns, the potential for energy and cost savings, and can include recommendations for actions for improving energy efficiency. The typical energy audit examines the use of the main utilities including electricity, gas, oil and water.

Good Practice Guide 316 “Undertaking an Industrial Energy Survey” <http://www.actionenergy.org.uk/> provides a useful starting point when a company is considering an energy audit. Most of the initial work can be carried out in house as it primarily involves collecting information on current energy use and practices. An external consultant may be required at a later stage to examine a particular area e.g. boiler operation or compressed air in more detail.

Starting with electricity the energy manager should collect the bills for the previous year and build a profile showing monthly energy use. The company should ensure that it is using the most cost effective tariff or charge structure. An electricity tariff usually consists of the following elements: standing charge, PSO (Public Service Obligation), day kWh, night kWh and Wattless charge. The Wattless charge can generally be avoided by installing power factor correction equipment. Your electricity supplier or contractor can advise on this issue.

A similar process should be followed for other energy inputs so that a chart can be created comparing the annual energy use and cost for each type of energy. The energy manager should report regularly on energy use and this information should be used to assess current performance and discuss potential projects to reduce energy costs. Electricity can cost 2 to 3 times as much as gas per unit of usable energy produced (kWh).

The following table (Table 1) contains a breakdown in energy costs by fuel type for a company with an annual energy spend of €370,000. The company has two natural gas fired boilers (gas oil is used as backup) for steam production. Steam is used onsite for space heating and various production processes. Electricity is also used for lighting, air conditioning in the offices and for the motors that are used in the plant. The company can then start to identify the monthly energy use figures to get a better understanding of how and when energy is used. If a company uses a significant proportion of its total energy for space heating then you would expect the natural gas usage to be considerably lower in summer than in winter. The electricity supplier can assist in providing daily energy use profiles. This information can be used to assess whether electrical equipment is operating when not required. For example a company that operates two 8-hour shifts might expect their energy use to drop considerably during the night. Sometimes equipment is left running continuously and this analysis can help to identify this problem. Simple easy to implement measures can be put in place to correct this issue.

Table 1. Annual energy use for manufacturing site					
	Consumption		Cost		Average cost
Energy type	KWh	%	€	%	cent/kWh
Natural Gas	6,000,000	65.2	150,000	40.5	2.5
Gas oil	200,000	2.2	10,000	2.7	5
Electricity	3,000,000	32.6	210,000	56.8	7
Total	9,200,000	100	370,000	100	4

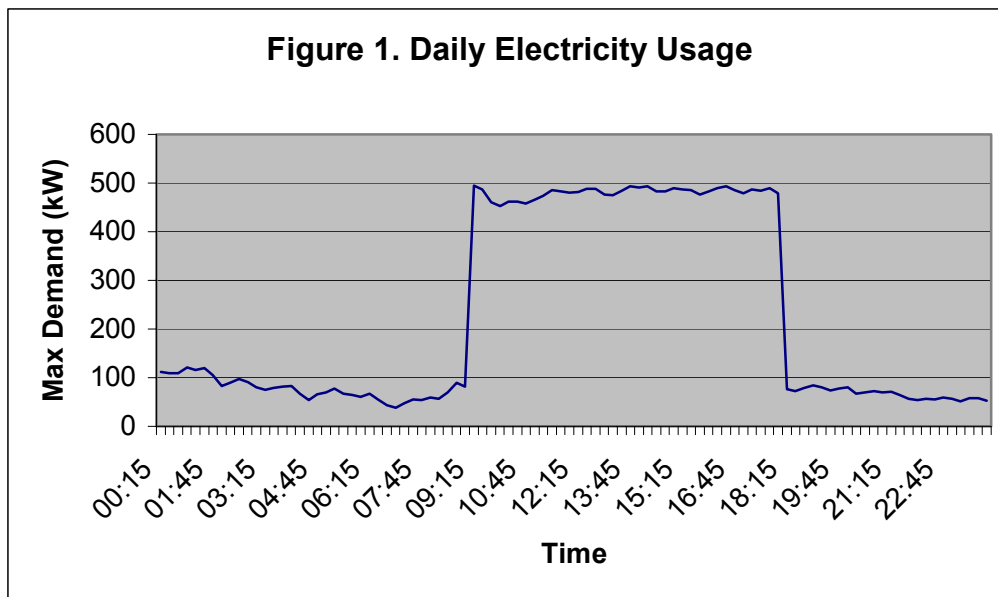
At this point the total energy spend relative to other business costs can be determined. This is referred to as the energy intensity can vary between industries but is usually in the range of 1-2% for small and medium sized companies. The company should initially concentrate efforts on the main energy users as there are often a number of easy to implement no and low cost measures that will show immediate benefit. The successful completion of these actions will encourage further efforts.

Typical no-cost and low cost measures:

- Improve labelling of light switches combined with a staff awareness and motivation campaign
- Annual cleaning of light fittings
- Replace lamps with more efficient equivalents
- Clean or replace clogged filters on mechanical ventilation systems
- Compare consumption and costs against equivalent periods in previous years
- Ensure time switches are set for the correct occupancy pattern
- Repair or upgrade insulation on boilers and associated pipe work
- Review electricity tariff and supplier options

Energy consumption is influenced by a number of factors including: climate, building design, operating hours, work practices and individual behaviour. An energy team can help determine these factors by talking to various people in each department. Portable energy meters, regular reading of existing meters, and electricity usage figures can be used to establish the daily energy use profile. A review of the daily energy use profile taking these factors into consideration can highlight immediate energy saving opportunities.

A company may find that it uses a considerable amount of energy during the night even though it only operates from 9am to 6pm. Heating, lighting and office equipment may continue to operate when they are not required. Figure 1 shows a company that uses electricity at night. This company should investigate whether this equipment is required to operate. The energy manager and team will now have a better understanding of energy use and the reasons behind it. Published energy use data for similar businesses can be useful when trying to determine how efficient an organisation currently is and how much can be saved.



Plan and organise energy management:

The chief executive officer, directors and managers have responsibilities for energy management although it is not their principal function. Other staff including the maintenance manager, utilities engineers, purchasing manager and operatives will have a direct impact on energy use. It is vital that these people are consulted when making any decisions with regard to energy use so that their views can be sought when setting or achieving energy targets.

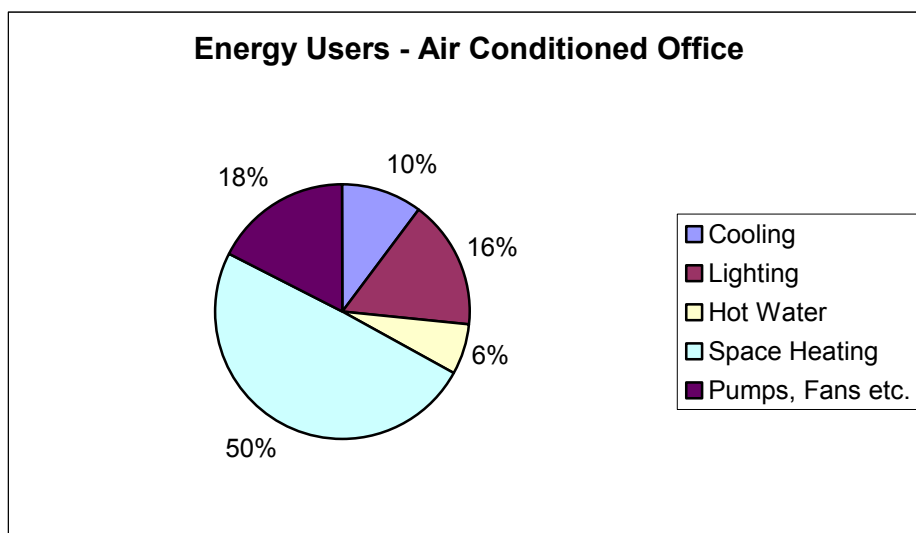
Managers from departments responsible for energy use need to be involved when setting targets to ensure that the targets are realistic. An organisation that is planning to expand production in the coming year may not be able to significantly reduce their overall energy costs. They may however be able to **reduce their energy use per unit output** and hence maintain their energy costs at existing levels. It is important that the targets should be achievable with the level of investment available for energy projects. The approach of a company to energy management should be expressed in an energy or environment policy, which is available to all involved in decisions that affect energy efficiency.

An energy management policy will include general aims and specific energy cost reduction targets, timetables and budgetary limits, the methods to be employed and the organisation of management resources. An energy policy could include the following main points:

- To develop and promote environmental standards throughout the business
- Ensure compliance with standards for noise, air and water quality, waste management, and energy use and to regularly monitor performance.
- To establish an energy management team that meets each month to review energy use

- To set appropriate energy use performance target to minimise energy use per unit of output
- To raise awareness and understanding of the energy use amongst all employees

In some companies it is possible to set up energy account centres e.g. by building, department or production line, which are allocated energy budgets and responsibility for achieving specific targets. This requires the ability to measure the various energy use streams for each centre to accurately track performance. This is really only practical for larger organisations as investment in energy monitoring systems may be required. The investment required should be balanced against potential benefits. Energy use information should only be collected when it will be used to make decisions on energy use.



The roles and responsibilities in energy management vary between organisations and one person can often be assigned to fulfil many of these. The roles in energy management include defining energy policy, capital equipment purchase, setting energy targets, negotiating with energy suppliers, reviewing energy use, collecting and distributing energy use information, boiler house operation and informing employees about energy efficiency. These functions should be reviewed and assigned and ultimately will become part of existing job descriptions.

Implement action plan:

Based on the findings and recommendations of the energy audit, a prioritised action plan should be drawn up. Energy and cost savings and the required investment will be listed for all items in the action plan. Implement the projects in order of priority as set out in the action plan.

Example of an action plan:

- Replace lighting with more energy efficient options
- Provide energy training for staff
- Ensure air handling units are turned off when not required
- Review and upgrade if required insulation
- Substitute high efficiency motors when replacement is required.
- Use ambient air for compressed air system intake.

The progress of individual projects will need to be closely monitored to ensure they stay within budget and achieve the energy target within the specified timeframe. Maintaining support once projects are underway will depend on senior managers receiving regular progress updates. This will remind everyone of the targets and objectives, clearly stating what has been achieved and helping to ensure their ongoing commitment.

Companies should use an energy performance index (EPI) to benchmark their performance over time. The EPI is a measure of a firm's energy consumption per unit of product output, expressed in a suitable way for a company – be it weight, volume or monetary value. The company can then use this EPI to set targets and to monitor progress on a regular basis.

The targets for energy savings need to relate to specific areas of your organisation and the action plan should include a project implementation timeline and state any funding and budgetary requirements. Saving energy requires the contribution from all energy users and not just the energy manager. Users should be provided with regular feedback on energy consumption. The information provided should be at a level that can be easily understood by people who may not have a technical background. A high level of staff awareness is needed for an energy management system to succeed. Many ideas and solutions come from staff, so it is important to provide opportunities for their input. Staff may need training in energy saving practices and use of equipment.

Monitor and control energy use:

The energy improvement program and action plan should be reviewed on a regular basis to ensure targets are being achieved. Adjustments can be made to targets in light of business requirements e.g. a company may decide to make additional products that require a higher energy input. Maintenance should be carried out on all energy related equipment especially where new measures have been implemented to ensure that the company continues to achieve predicted energy savings.

The installation of further energy metering may highlight energy saving opportunities in a plant. Changes in fuel prices, production and investment priorities will affect potential energy projects in the same way that they affect other aspects of an organisation. Therefore ongoing communication between the energy team and senior

management is essential to ensure that energy is available to meet the company's current and future requirements at minimum cost.

Example of an Energy Report: January to December 2002					
Energy source	Units	Quantity	Quantity (kWh)	Cost (€)	CO₂ (Tonnes)
Natural Gas	kWh	6,000,000	6,000,000	150,000	1,186.4
Gas oil	Litres	18,519	200,000	10,000	53.7
Electricity	kWh	3,000,000	3,000,000	210,000	2,327.3
Total			9,200,000	370,000	3,567.4
Plant / Location					
	Utility		Quantity (kWh)	Cost (€)	CO ₂ (Tonnes)
Building 1	Electricity		300,000	21,000	232.7
Building 1	Natural gas		1,500,000	37,500	296.6
Etc.					

The energy team should report results and progress to management and staff on a regular basis. An energy management plan or strategy will be more effective if its results are reviewed annually and the action plan revised. The review should at least detail actions undertaken during the year and projects and implementation plans for the next 12 months.

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