Saving energy in schools

Headteachers and governors should agree to an action plan to cut energy consumption, writes Andrew Williams, BRECSU for the EEO

Total energy consumption in schools throughout the UK is in the region of 25,000 million kWh a year and results in a national energy bill of approximately £450 million a year. As a result of this energy consumption, schools produce almost 6 million tonnes of CO_2 a year.

The Building Research Energy Conservation Support Unit (BRECSU) on behalf of the Department of Energy's Energy Efficiency Office has recently released six publications as part of the Best Practice programme in schools. These are Energy Consumption Guides for:

- Headteachers and governors (ECON 15).
- School Energy Managers (ECON 16).
- Local Authority chief officers (ECON 17).

Energy Consumption Guides give data on the way in which energy is currently used in schools and allows users to compare their current energy usage with others in their sector.

Good Practice Guides on:

- Good Housekeeping in Schools (GPG 29).
- Managing Energy in Schools (GPG 39).
- Energy Efficient Refurbishment (GPG 41).

Good Practice Guides promote proven techniques or procedures which are currently available. Many of these techniques or procedures have enabled existing energy users to be more energy efficient.

Most of these publications are aimed directly at the people who run and occupy schools, now that they are locally managed. In addition to the Guides, a series of eight seminars has been organised (see newspage 11).

The publications will be released through the Local Authorities. Each authority has been contacted and sent sample copies of each publication. They have been invited to order from BRECSU the number that they require for schools in their area. To date, the response has been excellent, with well over 50% of authorities requesting copies for their schools. Some of the highlights and issues from the Guides are discussed below.

Where energy is used

Few schools are able to determine exactly how energy is used. The split between heating, lighting, hot water etc will vary markedly from one school to another and will depend upon many factors such as efficiency of plant, insulation levels, occupancy etc. The diagram shows how fuel is used in a typical school. For most schools heating and lighting are responsible for the bulk of the energy costs. Typically electricity accounts for only 15% of the energy used (ie kWh) in schools but results in over 40% of the total energy costs.

Lighting and electrical power

Daytime electricity is expensive, so reducing electricity consumption should have a high priority. Make use of daylight wherever possible. Where lighting is necessary and light switches allow, switch off perimeter lights nearest the windows. Consider replacing tungsten light bulbs with compact fluorescent lamps. The higher purchase price of these lamps is more than offset by the 75% savings on electricity costs and the extended life time – eight times that of tungsten lamps.

Overall running costs are about half those of tungsten lights, but their use should be considered only where pilferage is unlikely. Older 38mm diameter florescent tubes have been superseded by newer high efficiency 26mm diameter tubes. These should be fitted, on failure of the old tubes, in luminaires that utilise a switch starter assembly (small cylinder on the side of the fitting). They cost no more, but use 10% less electricity. Also it is a myth that it is cheaper to leave lights on than to switch them off. Lights in unoccupied rooms should always be switched off unless they are only going to be off for a few minutes.

Most primary schools, secondary schools and colleges are on a Maximum Demand (MD) Tariff. This is a method of charging based on the greatest 'peak' demand for electricity during the winter months. The highest MD charges are in December and January with lower charges being made during November and February.

During these months additional units consumed, say by the use of a portable heater, can, in effect, cost more than 100 times the basic unit charge. The Maximum Demand of electricity is measured and recorded each half hour by the electricity meter. The highest half-hourly figure is recorded during the reading of the meter every month. In addition, a monthly charge is levied based on the peak demand of the previous year so it is advantageous to keep a low MD all year round.

Heating

Energy costs for school heating is normally the largest single part of the energy bill and hence offers the greatest potential for saving. However, up to half the money spent on heating is used to warm incoming fresh air hence one of the most important contributions that can be made towards reducing heating costs is to avoid unnecessary opening of doors and windows during the heating season and to fit and maintain adequate draughtstripping. Significant cost savings of up to 20% can be realised for heating if little attention has been paid to the plant in the past. Subject to the requirement for frost protec-

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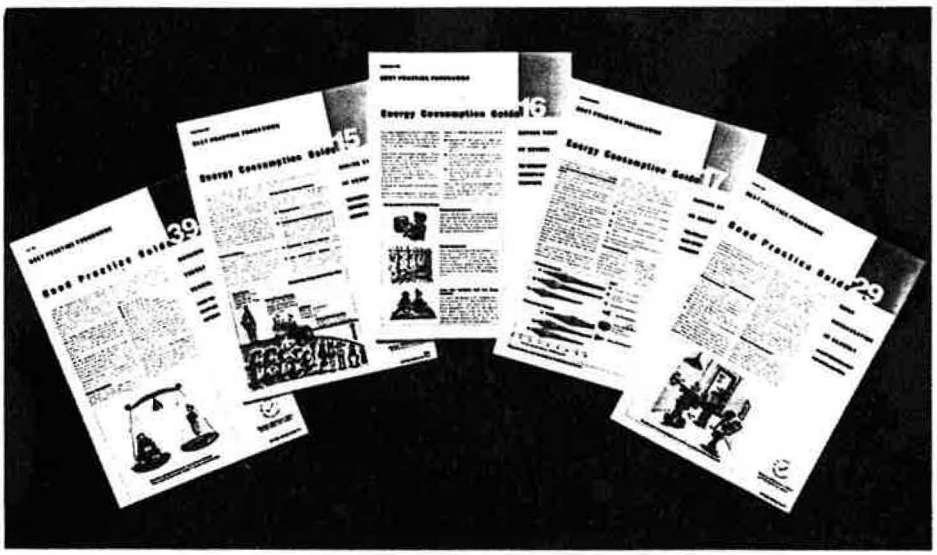
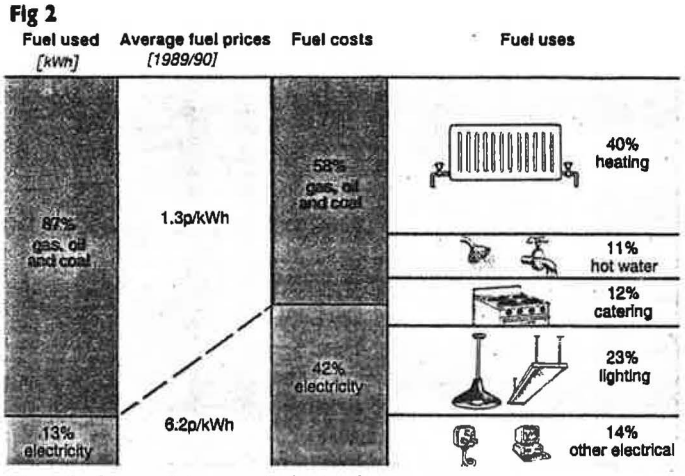


EEO Best Practice programme for schools

Schools should be aware of energy saving technology

Fig 2



How fuel is used in a typical school

tion the heating system should be off when the school is unoccupied. During occupation the room temperatures should be maintained at the level specified by the Department of Education and Science (DES), ie 18°C for classrooms and dining areas. Overheating by one degree increases fuel consumption by 6 to 10%. However, it is not uncommon for rooms to be three or four degrees above the DES guidelines.

Ventilation

Generally, excessive and uncontrolled ventilation is the largest source of avoidable wasted heat in schools and it can account for up to 60% of the total heat loss from a building. Heating systems are usually sized to be able to heat approximately twice the volume of air in a room to the required temperature every hour, ie a ventilation rate of two air changes per hour (ach). Doubling this ventilation rate can increase the heating costs by up to 50%. Although fresh air is essential for a healthy environment excessive and uncontrolled ventilation is to be avoided.

How to identify avoidable energy wastage

It is very beneficial to undertake a regular 'energy walkround' to look for obvious waste. The walkround should be used to identify items needing repair or maintenance, as well as unnecessary waste and future investment opportunities. This should be done by the team of people responsible for managing the premises; eg the headteacher, a school governor, the school energy manager and the caretaker. Also, if your Local Authority has an Energy Conservation Unit it will be advantageous to involve a representative from this unit.

Once a preliminary understanding of what needs to be done has been gained it may be necessary to conduct a full energy audit and survey. This should be performed by a suitably qualified and experienced person. Again this service may be provided by the Local Authority or it may be necessary to commission independent consultants.

Reducing energy costs – The energy action plan

The first step to help reduce energy consumption is for the headteacher and governors to agree an Energy Action Plan and then nominate a School Energy Team. Schools with a successful Energy Action Plan usually have:

- The support of the headteacher and governors. This is essential if the full potential for savings is to be realised in practice.
- A 'School Energy Manager'. The best person to be a School Energy Manager will vary from school to school. It could be a teacher, caretaker, governor or interested parent.
- Conducted an energy walk round.
- Identified good housekeeping measures.
- Monitored energy consumption.
- The co-operation of the care taking staff.
- Pupils acting as energy monitors in each class.
- The involvement of the whole school, eg project work, theatre groups, posters.

Monitor fuel consumption

The starting point for all energy management is to know how much is being spent on fuel and to assess what each fuel is being used for. This is accomplished by taking regular meter readings (every week/month) and using these readings to diagnose where and how efficiently energy is being used. Once this has been performed and some experience and understanding has been gained on how energy is consumed it may be necessary to perform an energy walk round or audit to further understand energy use.

Improve energy awareness

'Good housekeeping' practices, eg switching off lights, turning off taps etc, can typically reduce energy consumption in schools by approximately 10%. Because it requires no capital investment good housekeeping should be the first stage in saving energy. Also it can:

- Result in immediate savings.
- Produce savings even in the best run schools.

However, identifying good housekeeping measures is only the first stage. Encouraging staff and pupils to adopt energy saving habits can prove more difficult. Improving energy awareness can be achieved in many ways by:

- Running competitions for posters etc.
- Appointing class energy monitors.
- Staging energy plays.
- Relating energy issues in the curriculum to practical measures around the school.
- Training and incentives for key staff.

Operating heating systems

Keeping the boilers well maintained and operating at optimum efficiency is obviously key to reducing energy consumption. However, energy surveys carried out on a number of schools have shown that the operation of heating controls is equally important when reducing energy consumption. Some items to be considered or checked before the start of each heating season are:

- Heating on only during occupancy (excluding pre-heating frost and condensation protection).
- Optimisers set correctly.
- Thermostats set correctly.
- Filters clean in fan convectors.
- Draughtstripping to door and windows.
- Operation of door closers.
- No leaks in pipework or dripping taps.
- Windows and rooflights clean.
- Luminaires are clean.

The list will vary from establishment to establishment and the energy manager should gradually build up a list of items relevant to his/her establishment.

Fig 3

Simple good housekeeping can cut 10% or more off your energy bill

Identifying investment opportunities

There is a large number of measures that can improve the energy performance of a school. However, any energy efficiency measure must be assessed in terms of its:

- Technical feasibility.
- Cost effectiveness.
- Compatibility with other measures.

Compatibility with other measures is vital if a programme of energy efficiency measures is to yield the best results. The building must be considered as a system. For example if the building envelope is insulated, the heating plant would ideally be able to accommodate any reduction in demand for energy without loss in boiler efficiency due to its being oversized. Clearly, in this case, if new heating boiler plant is planned it should be sized in accordance with any fabric improvements otherwise possible capital and energy saving opportunities may be missed.

Guide to energy efficient refurbishment

Refurbishment provides an ideal 'one off' opportunity for energy efficient measures to be incorporated, at minimal extra cost, into existing school buildings. The Department of Education and Science in collaboration with the Energy Efficiency Office and the Building Research Energy Conservation Support Unit has published a new guide, Building Bulletin 73, highlighting the potential for incorporating energy efficiency into school refurbishment.

Fig 4

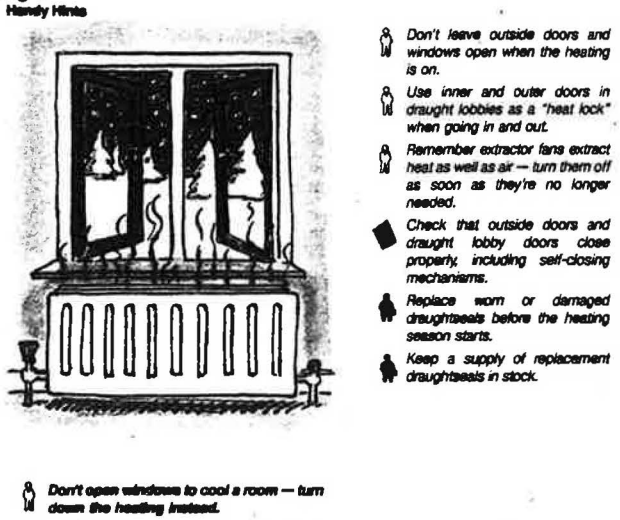


Fig 5

Energy management can cut costs by regular inspection and maintenance, weekly monitoring (see Fig 5 above)

The Building Bulletin, 'A Guide to Energy Efficient Refurbishment', provides comprehensive and independent guidance on proven energy saving technologies and procedures drawn from the experience of a wide range of Local Authorities.

The future

The appropriate application of energy saving measures in schools will provide benefits to the school and Local Authority alike with reductions in energy costs and improved pupil and staff comfort. It is important, therefore, that those responsible for schools are aware of energy saving techniques and how these affect present and future costs.

The current Best Practice publications cover practical guidance and motivational aspects of energy efficiency in schools. Further documents are in preparation, including a series of Case Studies, and detailed Good Practice Guides for School Energy Managers and caretakers.

FOR MORE INFORMATION

BRECSU circle 64

Energy efficiency in burners

Regenerative ceramic burners can significantly reduce furnace energy consumption, writes Jamil Ahmad, ETSU for the EEO

Every year, UK industry uses over £1.4 billion worth of energy in the operation of furnaces. There is an urgent need to reduce this consumption in the interests of both the manufacturer and consumer. Inefficient utilisation of fuel not only results in greater costs but also draws on indigenous resources and increases pollutant emissions.

A major reduction in total furnace energy consumption will not be achieved by one single action alone, due partially to the different requirements of various sectors of industry. This article looks at one technology that can improve energy efficiency – regenerative ceramic burners. Their use in high temperature furnaces and the energy saving achieved by their installation is discussed.

Regenerative ceramic burners

The regenerative ceramic burner unit comprises at least two burners, two generators and a flow reversal system (Fig 1). The regenerators consist of a chamber containing a packed bed of small ceramic spheres. While one burner is firing, (Mode 1), the quarl of the other serves as a waste gas port, and heat is transferred to its regenerator bed from the exhaust gases.

When the regenerator is sufficiently charged, predetermined by a time interval or a preset waste gas temperature, the reversal valve operates to reverse the flow through the system and the stored heat is released to the incoming combustion air, (Mode 2).

Firing with regenerative burners, (Fig 1)

Regenerative burners offer potential for significant improvements in thermal efficiencies in gas-fired furnaces by recovering energy from the waste gases to preheat the combustion air to a temperature approaching within 100°C of the waste gases. The regenerative burner systems can be useful on both reheating and heat treatment furnaces where very good temperature uniformity is required. With an effectiveness of 85 to 90%, the capital investment can be very quickly recovered through energy savings of up to 65% over cold air burners.

Furthermore, even with furnace tempera-

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