Department of Education and Science
Architects and Building Branch

BROADSHEET 25
July 1988

Energy consumption in educational buildings

Introduction

1. For most local education authorities and others concerned with educational building, energy represents one of the largest items of building- related expenditure. It is also an area where significant savings can continue to be achieved. The present publication is one of a series on energy use and conservation aimed at assisting progress in this field.*

2. In 1978 the Department embarked on a four year programme of capital expenditure to promote energy conservation. During this period data on energy consumption were collected from a representative sample of LEAs and data collection was continued beyond the end of the programme to provide information on longer-term trends in energy use.

3. This Broadsheet presents the main findings of the survey in terms of gross energy consumption and expenditure for all LEAs in England over the period 1978/79 to 1985/86. The method of analysis of the data is described in Box 1 below. The results have been corrected for weather conditions during the survey period (as described in Box 2) and adjusted to 1985/86 price levels.

Box 1

Analysis of data

Twenty-one LEAs provided figures for the total annual expenditure and energy units consumed for oil, coal, gas and electricity.

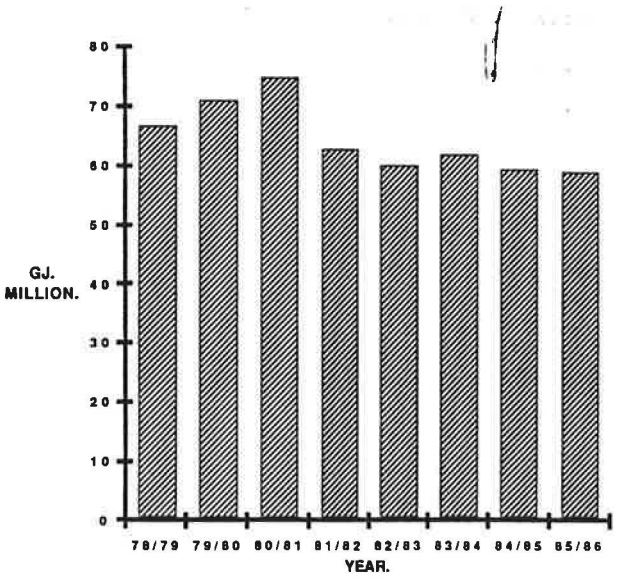
For each year of the survey period, the 21 totals were added to determine gross totals for expenditure and units of energy consumed. The average tariff was calculated for each fuel by dividing the gross expenditure by the gross units of energy. By applying the average tariffs to the gross fuel expenditure for all LEAs in England (derived from RO1 returns), figures have been calculated to represent the gross energy units consumed by all LEAs in England.

Thermal energy consumption

4. Thermal energy (oil, coal and gas) accounts for about 87% of all energy used in educational buildings (with electricity forming the remainder). Thermal energy is used mainly for heating and catering purposes. Since its use can be most easily regulated and controlled, and also because it offers the opportunity for fuel substitution, LEAs have made particular efforts to save thermal energy.

5. Figure 1 records the total thermal energy consumption for the heating seasons 1978/79 to 1985/86: over this period, annual consumption fell by 7.62 million Giga Joules (GJ). This is equivalent to 290 thousand tonnes of coal and represents an annual saving of 11.5%.

Figure 1 Thermal energy consumption



* — Energy conservation in educational buildings: Building Bulletin 55 DES 1981

— Energy conservation in two Oxfordshire schools: Design Note 16 DES 1978

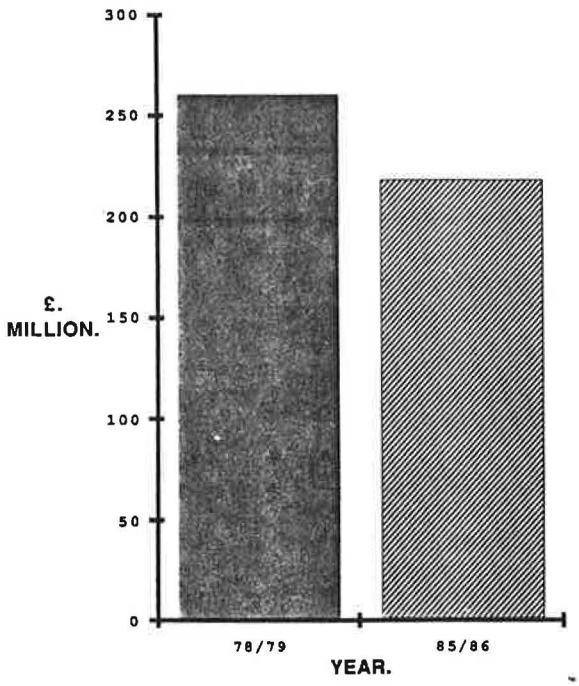
— Guidelines for environmental design and fuel conservation in educational buildings: Design Note 17 DES 1981

— Use of heat pumps in rural schools: Broadsheet 22 DES 1986

— Saving energy in schools: three case studies in Nottinghamshire: Broadsheet 24 DES 1987

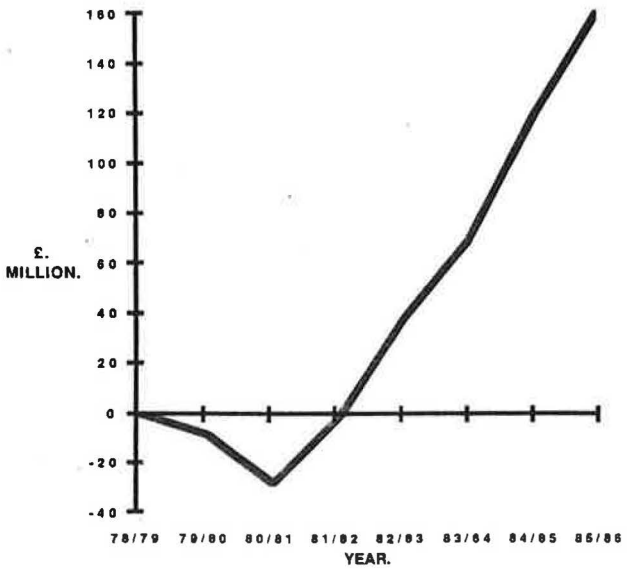
6. The reduction in total expenditure on thermal energy over the survey period amounts to 16%. Figure 2 shows the comparison between the first and final years of the survey. LEAs in England spent £43 million less on thermal energy in 1985/86 than they did in 1978/79.

Figure 2 Thermal energy expenditure comparison



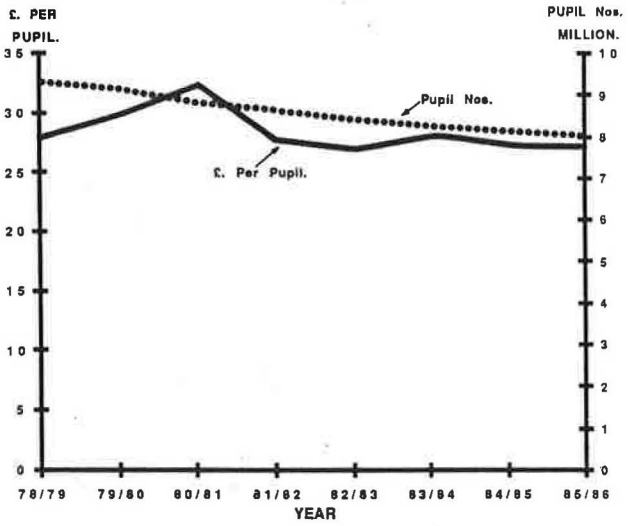
7. Figure 3 shows the accumulated savings over the eight year period. As may be seen, during the first two years of the DES capital programme LEAs' spending on energy continued to increase. This was because it took some authorities time to identify, design and implement energy conservation measures. However, as the benefits of these projects were realised the trend was reversed and since 1980/81, consistent savings have been achieved. By 1986 the accumulated savings had amounted to £160 million. These savings were achieved not only by the introduction of energy conservation measures in existing buildings, but also through more energy efficient design of new buildings in line with recommended energy targets (see Design Note 17).

Figure 3 Accumulated savings



8. Although energy expenditure per pupil also declined over this period, the reduction was not so marked. Total pupil and student (full-time equivalent) numbers decreased by 13.5% during the survey period. In the same period the thermal energy expenditure per pupil dropped by only 2.7%, probably reflecting the fact that school closures lagged behind the decline in pupil numbers. Figure 4 notes this decline, along with the expenditure on thermal energy per pupil in the eight year period. Average thermal energy expenditure per pupil in 1985/86 was £27.25 per annum.

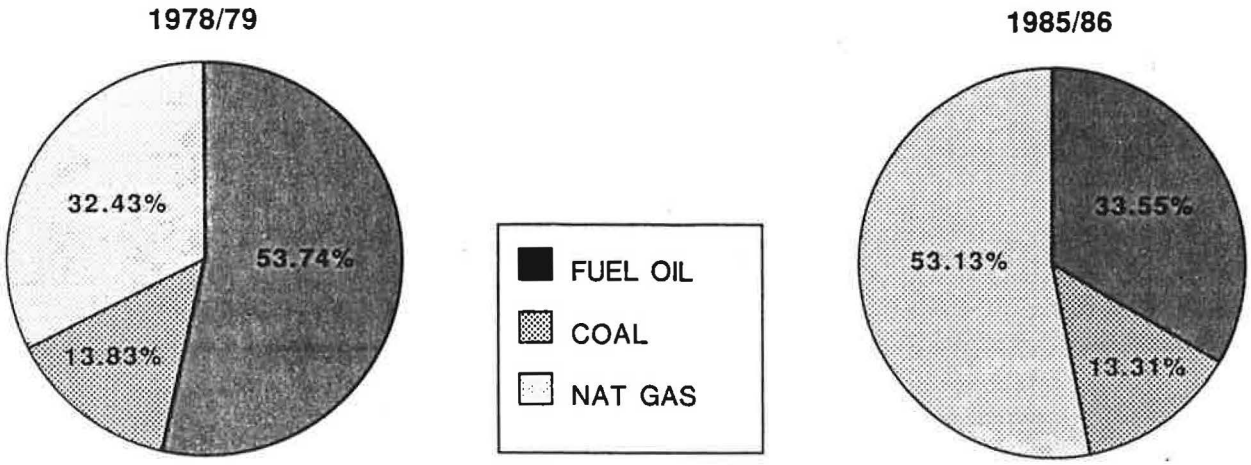
Figure 4 Energy expenditure per pupil and pupil numbers



Fuel usage

9. There was a marked change in the balance of fuel usage over the period, as many authorities took the opportunity to switch from oil to cheaper gas. This contributed to the saving in overall expenditure. Figure 5 shows the distribution of thermal energy consumption for the heating seasons 1978/79 and 1985/86. Whilst coal usage remained fairly constant, gas consumption, which previously accounted for 32% of all thermal energy, had increased to 53% by 1985/86 and oil consumption decreased accordingly.

Figure 5 Distribution of thermal energy consumption

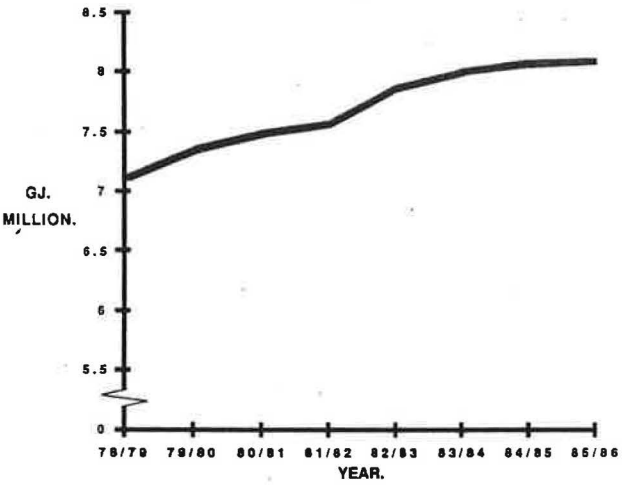


Electricity consumption

10. LEAs' electricity consumption increased by 14% between 1978 and 1985 (see Figure 6). This increase may be explained by the growing use of computers and other electrical equipment and greater curriculum emphasis on subjects such as CDT. The increasing use of schools for community activities, particularly in the evenings, may also have added to the demand for electrical energy. During the period electricity costs per pupil have risen, in real terms, by 32%. Electricity still represents a relatively small proportion of total energy consumption but it is an increasingly significant element in overall energy costs. While curriculum developments are leading to the greater use of electricity for many purposes, there is scope for saving, in particular through:

- tariff management
- reductions in maximum demand
- introduction of lighting controls
- use of low energy light sources

Figure 6 Electrical energy consumption



Conclusions

11. Good progress has already been made in reducing expenditure on energy in educational buildings and also in reducing gross energy consumption. However further savings should still be possible.

12. In terms of capital investment, energy conservation represents excellent value for money. Many energy conservation schemes have already paid for themselves several times over. There are no easy answers as to which options will yield the best savings. Every building must be assessed in terms of its future useful life, type of construction, energy consumption and pattern of use. If continued savings are to be achieved, it will be necessary to harness not only the new technologies such as energy management and lighting control systems, condensing boilers and heat pumps — but also to encourage good energy conserving habits in both staff and pupils alike.

13. In the shorter term, it is suggested that the aim should be for a further 10% reduction in energy consumption and expenditure. Architects and Building Branch would welcome information on new developments, and the progress of existing energy conservation schemes. In turn, it is proposed to continue to monitor overall trends in energy use in educational buildings and to publish the results.

Box 2

Degree days

Degree day data have been used in this analysis to refer the climate for each heating season to a common base, derived from a twenty year average. Degree days are used to compare the severity of winter weather conditions in different parts of the country and from year to year. A degree day is calculated from the difference in °C between the base temperature of 15.5°C and the 24-hour mean outside temperature when it falls below 15.5°C over 24 hours. The Meteorological Office publishes monthly degree day figures for various parts of the country.

Further copies of this publication are available free of charge from:

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This is one of a series of A&B Publications on Energy. The following A&B publications also relate to Energy in Schools:

- Energy conservation in two Oxfordshire schools: Design Note 16 DES 1978

- Energy conservation in educational buildings: Building Bulletin 55 HMSO 1981

- Guidelines for environmental design and fuel conservation in educational buildings: Design Note 17 DES 1981
  Note: A DES computer program is available to perform the calculations detailed in Design Note 17

- Energy performance in three schools: A comparison of design values with measured consumption: Broadsheet 20 DES 1984

- Use of heat pumps in rural schools: Broadsheet 22 DES 1986

- Saving energy in schools: Three case studies in Nottinghamshire: Broadsheet 24 DES 1987

- Energy conservation and maintenance through retrofit measures: Three case studies in coal-fired schools: Research Report 1 DES 1988

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