unchanged. The objective of this second trial was to compare the benefits of a condensing boiler system with a modern, standard heating system.

Further monitoring of the two buildings showed additional savings on space heating costs in Holly Court through the use of condensing boilers, see fig.2. Holly Court used about 20% less gas than St Clement's Court. The condensing boiler system is operating at an annual efficiency of over 87%, the non-condensing boilers in St Clement's Court operate at about 67% annual efficiency. The additional saving in gas is worth over £1,000 per year and should lead to a payback in under four years, based on the overcost of about £3,500. If the savings from the separation of the plant and the use of condensing boilers are added the annual savings on the operating costs of Holly Court are worth well over £2,000 to the Anchor Housing Association, compared with the operation the original heating plant. Similar housing schemes in other parts of the country should realise comparable savings. In cases where the energy use is higher the savings will be comparatively greater and the payback period shorter.

Condensing boilers have been slow to penetrate all markets in the UK. The reasons for this are due partly to the cost of these appliances, but also to the conservative nature of the industry in its approach to new and untried technology. To help the industry to come to terms with condensing boilers the Energy Efficiency Office is funding other initiatives which it is hoped will encourage the wider adoption of this technology. One such initiative is the development of a guide for designers and installers and this work has been undertaken in conjunction with CIBSE. In addition a programme of seminars in different parts of the country, commencing in March 1989, will help to bring the benefits of these appliances to a wider audience of potential users.

Conclusions

A slightly higher capital investment in condensing boilers can yield substantial and worthwhile savings on operating costs for the building owner. The return on the additional capital is recovered within 3-4 years for applications in housing. In larger buildings where energy use is higher the payback is even shorter. A recent project in a hospital realised a payback in less than 12 months.

The separation of space and hot water heating and the matching of plant more closely to predicted load are cost-effective measures for retrofit, and should be regarded as good design practice for new schemes, even if conventional boilers are still employed.

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Energy efficiency in buildings

Information Leaflet 12

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Modern Heating Plant in Sheltered Accommodation

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Sheltered accommodation fulfills a vital role in providing housing for an increasing population of elderly people. To keep operating costs at affordable levels these homes need to be heated as efficiently as practicable. Three measures are described: the provision of separate plant for space heating and domestic hot water, boiler sizing and the use of high efficiency condensing boilers.

Introduction

In sheltered accommodation where gas-fired centralised heating plant supplies both space and hot water heating the common practice has been to over-size heating plant in relation to the peak load demand. This practice was all very well while energy was relatively cheap, but today's heating designer is required to be more conscious of running costs and must consider a more energy efficient approach to the provision of heating and domestic hot water services.

The article starts by considering two simple measures: (1) the correct sizing of plant to load and, (2) the separation of space and domestic hot water

The original heating plant (left) at Holly Court and (right) new condensing boilers

For more information
on energy efficiency demonstration projects in buildings sponsored by the Energy Efficiency Office and managed by the Building Research Energy Conservation Support Unit (BRECSU)

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heating. The second part of the article examines the additional benefits provided by modern high efficiency 'condensing' boilers in terms of energy savings and investment opportunity.

Sheltered housing and special care housing is experiencing a boom in building. The main reasons for this are the increasing age of the population and other social factors such as peoples' desire to remain independent for as long as possible. As far as can be seen this trend will continue and there is likely to be an increasing demand for this type of housing in the future. To ensure that rent is maintained at levels which the tenants can afford it is important that heating and maintenance costs are kept to a minimum.

Improving performance

There are many sheltered housing schemes built several years ago which now face the need for a major replacement of heating plant. Under these circumstances the building owner has the opportunity of reducing his running costs by installing heating plant designed to modern, energy efficient standards.

Typical examples of 20 year old sheltered housing are Holly and St Clement's Courts, two nearly identical sheltered housing blocks on the same site at Irlam, Manchester, and owned by the Anchor Housing Association. Each block contains 30 flats (1 and 2 person), a warden's flat, common room and laundry. Both buildings were originally fitted with gas-fired centralised heating plant comprising two pressure jet boilers, each rated at 117 kW output, and two hot water storage calorifiers (675 litres capacity each). The plant was well over-sized even for the winter peak demand, having a combined output of 234 kW to meet a maximum predicted load of 172 kW.

The heating system suffered further inefficiences concerning the summer operation. Space heating has to be on-hand at all times in sheltered housing. In summer it was usual to close down one boiler and use the second boiler exclusively for the provision of hot water.

Under this system of operation the domestic hot water continued to circulate through the cold boiler losing heat in the process. In the event of a cold spell space heating needs to be restored easily (usually at the discretion of the warden), and a system of completely isolating the boiler is not practical.

The efficiency of the system can be improved by separating the space heating and domestic hot water circuits and at the same time matching the

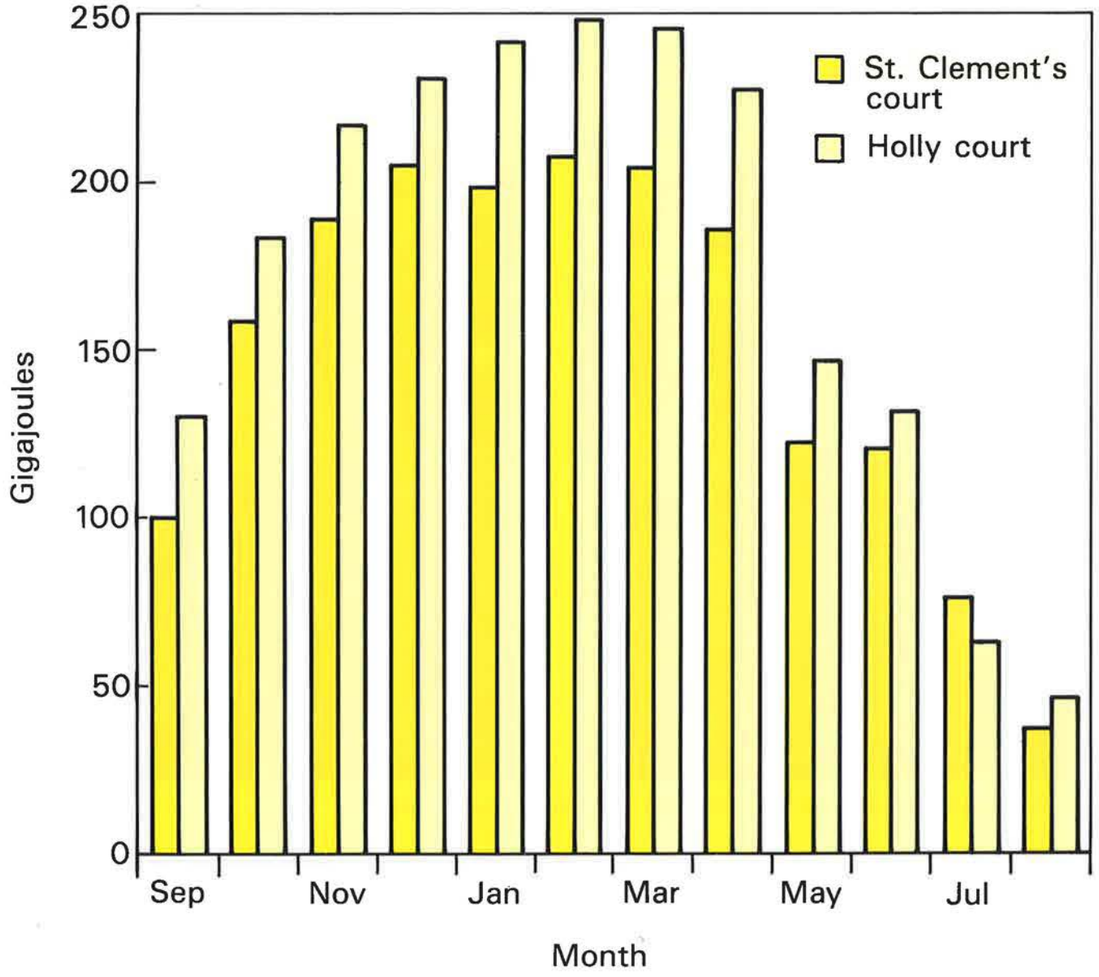

Fig. 1 Typical monthly consumptions for separate heating systems

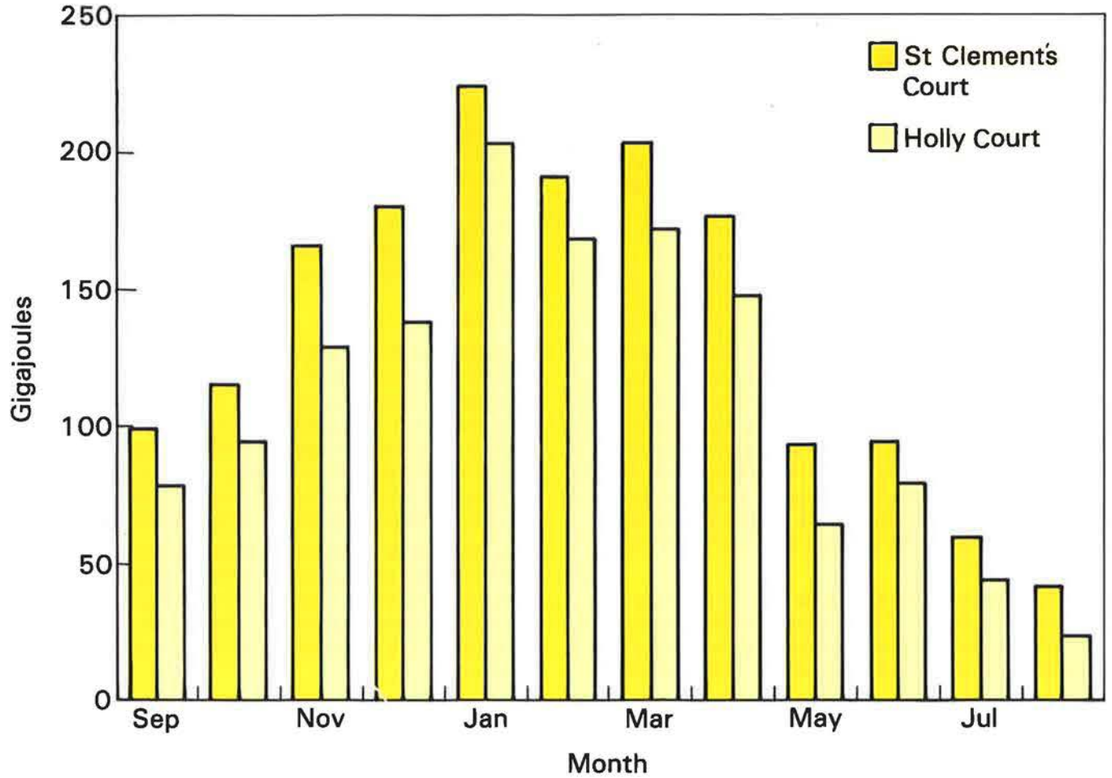

Fig. 2 Typical monthly gas consumptions. Condensing boilers in Holly Court

heating loads more closely with separate boilers. To examine the practicalities and energy savings from such a scheme the old plant in St Clement's Court was replaced by two gas-fired Potterton boilers (73 kW each) for space heating and two separate Andrews Industrial gas-fired hot water heaters (17.6 kw each) for domestic hot water. The new system used most of the existing pipework, valves and controls, and the combined output of the space heating boilers (150 kW) closely matched the design heat loss of the building.

Project monitoring

The project was monitored intensively by R.W. Gregory & Partners, Manchester, and the scheme was supported as a demonstration by the Energy Efficiency Office of the Department of Energy and managed on their behalf by the Building Research Energy Conservation Support Unit (BRESCU). Holly Court retained the old heating plant and was also monitored to compare energy savings and ensure that the same comfort standards and service were maintained in each building.

The monthly energy use in each block indicates that St Clement's Court uses less energy than Holly Court, see fig. 1. The annual energy savings amounted to about 310 GJ which at current gas prices (£3.6/GJ) is worth £1,116 per year. Other benefits included reduced plant noise and a small saving on maintenance costs, £104 per year. The total savings on annual operating costs are therefore £1,220. The simple payback period on the investment of £7,000, which includes plant and installation costs, is less than 6 years. When compared to the expected life of the plant (about 16 years) this represents a good investment for a replacement system. Internal temperature measurements coupled with interviews with the tenants confirmed that the comfort conditions within St Clement's Court were retained.

High efficiency heating plant

Gas-fired condensing boilers promise greater efficiency than standard boilers through the recovery of heat that would otherwise be lost to the flue. The enlarged (or secondary) heat exchanger allows the condensing boiler to extract waste (sensible) heat from the flue gases. Under favourable conditions latent heat is also extracted from the water vapour generated during the combustion process. In a well designed system operating at optimum performance both sensible heat and latent heat will be recovered and the bench efficiency of the boiler could be as high as 94%. But even if conditions do not allow optimum operation the condensing boiler will still be more efficient than its non-condensing (or standard) counterpart because it is always recovering sensible heat.

The sheltered housing at Irlam provided the opportunity for a further investigation using condensing boilers. On this occasion the plant in Holly Court was replaced by two Broag 75 kW condensing boilers for space heating and two Andrews Industrial hot water heaters for domestic hot water. A similar control regime to St Clement's Court was imposed involving a Drayton Theta external weather compensator. But in other respects most of the heating equipment remained