

Like ancient Rome, Sheffield stands upon seven hills. In both cities the preservation of buildings has proved to be a difficult business.

Sheffield's chief enemy is supposedly more innocuous than a horde of marauding Goths, but it still causes thousands of pounds of damage each year. Sheffield is involved in a struggle against condensation.

Surface condensation and mould is a peculiarly British disease (although other European countries do admit to the problem). About 15 per cent of the UK housing stock is estimated to be affected by it. The Building Research Establishment puts the number of dwellings affected by "severe dampness" at 2 million, with a further 2.5 million affected to a lesser extent. Of these houses, BRE reports extensive mould growth in 0.25 million, causing "acute anxiety to the householders and giving rise to serious complaints."

Sheffield City Council gets a good deal of complaints. Much of its housing stock was built in the sixties and early seventies when scant attention was paid to possible condensation problems. Mould growth is rife in council houses and high rise blocks. Combating this growth is not just expensive, but also requires a careful co-ordination of effort involving council officials, commercial businesses and qualified engineers.

Behind Sheffield's campaign to combat condensation lies the new realism of the city council. The 'loony left' image of earlier years has been countered by a renewed spirit of co-operation between local government and the business community.

■ Partnership

High unemployment, aggravated by the 'rationalisation' of the steel industry, inspired the local Chamber of Commerce to get together with the council to form 'Partnership in Action', an initiative designed to promote Sheffield nationally and encourage new investment into the area.

The success of this initiative is manifest in the number of building projects going on within the city: shopping centres, office blocks, a science park and the facilities for the next Student Olympics to be held in Sheffield. In all these projects a sense of community inspires the people involved.

The fight against condensation, for example, has drawn together people from all areas of the city. It has involved private investment as well as public funding, polytechnic research as well as professional consultancy, private manufacturers as well as workers' co-



Breaking the mould

About 15 per cent of UK housing stock is affected by surface condensation and mould. Through district heating and advanced dehumidification, Sheffield City Council shows the benefit of encouraging imaginative commercial ventures to rid itself of a social scourge

operatives. The result has been a substantial improvement in the quality of home life for council tenants.

The attack is on two fronts: the provision of affordable heat through the establishment of a city-wide district heating scheme, and the development of advanced dehumidification systems.

Insufficient heating, poor ventilation and excessive moisture production in the home are the main causes of mould growth. The most obvious solution to these problems is to improve the domestic heating systems and thermally upgrade the building fabric with wall cladding and roof insulation.

This can be an expensive exercise, not just for the council but also for the tenants who have to pay the resulting heat bill. Sadly, condensation problems hit unemployed people and pensioners hardest, partly because they may not have the money to heat the home adequately, and partly because they are likely to be occupying the building for longer periods, all the time pumping moisture into the atmosphere.

Thermal upgrading is being carried out by Sheffield's housing department, but improving the insulation standards is not an answer

by itself. If the tenants can't afford to heat their homes properly, the building will simply act like a sealed plastic bag: the moisture produced by the occupants has nowhere to go. In some cases, thermal upgrading has resulted in mould growth in homes where there was none before.

Providing cheaper heat is the role of the district heating scheme. Central to its success is a municipal rubbish incinerator at Bernard Road, which has supplied heat to 2400 flats in the Hyde Park and Park Hill areas since 1975. Burning about 116 000 tonnes of rubbish a year, the incinerator has the capability to produce in excess of 30MW of heat, enough for most of the buildings in Sheffield and its environs.

A private company called Sheffield Heat & Power Ltd has been set up jointly by the council and Finnish CHP (Combined Heat & Power) experts Ekono. The intention is to build up a heating network throughout the city, phase by phase, using the incinerator as the heat source. Each phase should generate enough income to finance a further extension.

A view of Sheffield from the Sleadless valley



The financial success of this private venture relies not just on council support and favourable bank loans; it also relies on there being a sufficient amount of commercial and industrial buildings to supply the large heat load required to make CHP viable. The final push of the network out to the power station has been helped by the positioning of a major development site between Blackburn Meadows and the city centre. Large facilities being built for the Student Olympics may also come on line.

■ Optimism

Much of the company's optimism stems from the success of Phase One, the Norfolk Park residential tower blocks. The expertise of Ekono in accurately estimating the cost of laying pipelines helped budgeting, as did the co-operation of the council in allowing the digging up of roads. Sheffield Heat & Power has a licence which allows it to lay two lines, one for district heating and one for rental to other utility companies.

Close consultation with the residents generated strong support for the project. Indeed, the enthusiasm of the council tenants bodes well for the company as it prepares to sell its wares to private householders.

Cyril Hubbard, 63, is a tenant in one of the Norfolk Park tower blocks, and an ardent supporter of district heating. Before its installation, he and his wife relied upon an electric underfloor system only in the living room and halfway up their hall.

"It took the whole day for the rooms to come up to temperature. By then we'd gone to bed and the system clicked out, so we'd be perished again in the morning," he says.

Mr Hubbard's winter heating bill was in excess of £200 for a quarter. Meanwhile, he had mould growing in both the living room and the spare bedroom. Now, he has radiators

in every room and a warm up time of 15 minutes to 70°C. His heating bill has been more than halved with a nominal increase in rent of less than £3. With pipes running throughout the tower block, even the communal hallways are kept warm. The only mould growth comes from Cyril Hubbard's home wine-making kit.

Unfortunately, this happy story of mould-free living is no comfort to people living in council houses on the other side of town. On the Foxhill estate, located to the north of the city on an east-facing hillside, the condensation problem is acute. The housing consists of terraces, maisonettes, flats and bungalows. Many of the buildings are so badly designed that they act like giant sponges, sucking in moisture and retaining it.

With no district heating available, the ideal solution for many of these buildings is mechanical ventilation with heat recovery. Again, the price of such a refurbishment project is prohibitive. In problem homes such as these, the answer is dehumidification. In a neat tie-up between the council, the polytechnic and a local engineering co-operative, valuable research has been carried out to assess the validity and cost effectiveness of domestic dehumidification.

The story of the advanced dehumidification scheme dates back to 1982, when Phil Asquith of Sheffield's Department of Employment and Economic Development was assigned to advise an engineering co-operative, Mons Precision Services, on product development.

"My brief was simply to provide assistance with development and research," he says, "but it quickly became more than that."

Mons specialised in refurbishing equip-

Phase One, a collection of 15 tower blocks on the Norfolk Park Estate, has already been completed. Phase Two involves a push into the city centre, taking in several council buildings and retail areas, and, perhaps, the polytechnic.

While this expansion goes on, the company plans to build a power station three miles out of the city at Blackburn Meadows. Initially, the station will attempt to be financially viable purely in terms of electricity generation. The large amounts of heat produced as a by-product of generation will be ignored, although heat recovery systems will be installed. Tenders are now being taken for either a combined cycle gas turbine system or a pressurised fluid bed coal-fired station, with a 50-150MWe output.

■ Goals

The ultimate goal is to extend the heating network right out to the power station, before making use of the waste heat as the primary heat source for the system, thus replacing the waste incinerator. Sheffield will then have a fully-fledged CHP station, with a network already installed at no extra cost.



Hot water at 110°C and 25 bar runs from the Bernard Road incinerator to the Norfolk Park tower blocks via insulated steel pipes (left).

Each block operates on a secondary circuit connected to the main pipeline via a plate heat exchanger in the basement.

At the moment water returns to Bernard Road at 70°C, with the incinerator venting 60 per cent of its capacity to atmosphere. Emergency back-up is provided by three 6 MW gas-fired package boilers.

Sheffield Heat & Power chief executive, David Lawrence, expects this system to be replaced by a CHP station by the end of 1990—"or 1991 if we choose to build a coal-fired station."

ment, but the council felt they should develop their own product line. It seemed a natural step to consult the polytechnic to see if they could come up with any ideas.

■ Suggestive

It was Dr Malcolm Denman of the Mechanical and Production Engineering Department who suggested a dehumidifier. He has worked for a number of years on the problem of condensation, developing a computer program for predicting weather trends, and designing heat exchangers

His design for an advanced dehumidifier generated two patents from a unit which uses less energy than any other dehumidifier on the market, whilst delivering the second best extraction rate.

"I was surprised at how easy it was to improve on the designs that were already on the market," he says. "Most of my students could make better models."

The initial tests on the Monseco unit were so encouraging that the council applied for

and won EEC funding for a large scale energy demonstration project. One hundred homes on the Foxhill estate were fitted with Monseco dehumidifiers, which were monitored over a period of two years. The project yielded important information about the performance of the unit, and an appraisal of how householders took to domestic dehumidification.



The Facer maisonette had an acute mould problem.

Results were impressive: 93 per cent of returned questionnaires (60 per cent of those sent out) showed that tenants were happy

with the machine, with 95 per cent agreeing that it had reduced condensation in the home. Perhaps, more tellingly, only 7 per cent refused to pay the running cost of the unit once the demonstration project had finished.

Results from the 1987/88 winter show an energy consumption of 1.19kWh per litre of water extracted, giving a cost of 6.5 pence per litre at a tariff rate of 5.47 p/kWh. At the beginning of the project some units were extracting more than four litres of water a day. Having to empty that much water each day certainly impressed the tenants.

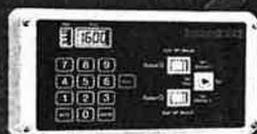
In some cases, though, even the Monseco unit was not enough. The Facer family, for example, had such bad condensation problems that the unit couldn't get rid of the moisture fast enough.

■ Facing problems

"It was streaming down the walls," said Mrs Facer. "I'd sometimes feel the carpets and they'd be soaking wet."

It's only by visiting such homes that the

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The relative inefficiency of conventional dehumidifiers inspired Malcolm Denman (left) to develop the Monseco advanced unit.

Based on American air conditioners, most of them are arranged so that damp air is drawn across a cold evaporator plate to condense out moisture. The air is then warmed across a condenser and discharged. In colder climates it leads to a noisy, inefficient unit which has a tendency to ice-up. The problem comes when the air is less than 100 per cent. The unit is forced to bring the air temperature down to dewpoint and condense out moisture.

Malcolm Denman's design eliminates the first stage of the cooling process by including a crossflow air to air heat exchanger, transferring heat between the air entering and the air leaving the evaporator. This device has led to a 50 per cent increase in performance efficiency.

full effect of condensation can be felt. Black mould can cover nearly every wall; water covers the windows. In the end, clothes begin to smell of damp and cleaning becomes well nigh impossible.

Luckily for the Facer family, the polytechnic offered to install a prototype mechanical ventilation system which has conquered their problem. Ironically, the housing department plans to refurbish their house, and remove the unit. Mrs Facer is guarding her ventilation system jealously.

"I don't understand why the council wants to take it away when they know it works," she says. "My home's ninety-nine per cent better than it was."

The demonstration scheme has clearly

raised the consciousness of the tenants. They now realise that mould growth can be overcome. It's up to the housing department to order more Monseco dehumidifiers; it has yet to do so.

"With problem houses like these, dehumidification is a cost effective measure," says Malcolm Denman. "Of course, the ideal solution will always be mechanical ventilation with heat recovery."

Meanwhile, Phil Asquith is still fighting to get Monseco units built in large quantities. To spread the word on dehumidification he has formed a Condensation Advisory Service to help other city councils with problems.

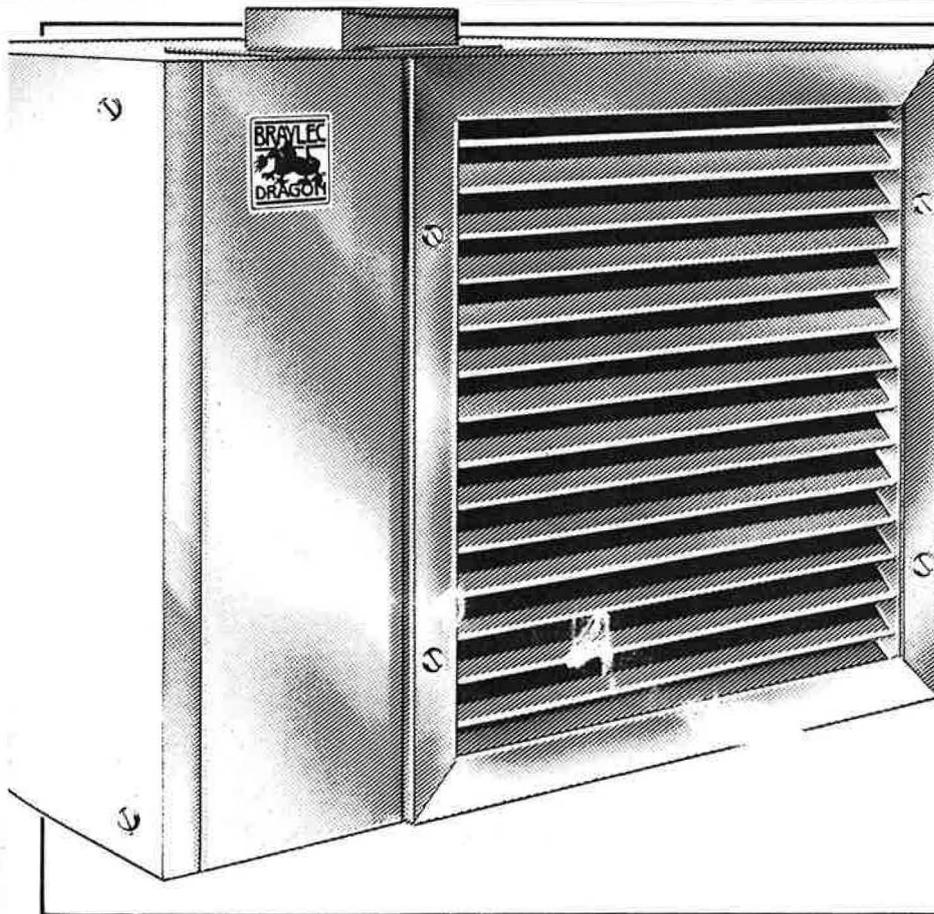
"We now have the instrumentation. We need to sell the consultancy," he says.

"Unfortunately, Mons by itself didn't have the marketing skills to sell the Monseco, so we've arranged a deal with a private manufacturer in the south to produce advanced dehumidifiers under licence."

The initial brief to create jobs in Sheffield may seem to have gone by the wayside. However, both the Electricity Council and several air conditioning manufacturers are beginning to see a large market for domestic dehumidifiers. District heating is taking off in several UK cities. By spreading the word, Sheffield may yet create jobs, albeit indirectly, in other areas where improvements to the housing stock are badly needed. □

For more information
Sheffield Heat & Power.....circle 247
Dept of Employment
& Economic Development.....circle 248
Monseco Advanced Dehumidifiers
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Thanks to Dr Malcolm Denman of Mechanical and Production Engineering Dept, Sheffield Polytechnic, and Phil Asquith of Sheffield's Dept of Employment & Economic Development.



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