# INFRA RED

# SAVINGS FROM INVISIBLE RAYS

Peter Heslop, until his retirement the Editor of the Department of Energy's *Energy Management* magazine, describes two different uses of infra red technology in the achievement of energy efficiency.

When you next sit in front of the TV, idly flicking through the channels by remote control, why not pause to consider how those same invisible rays could put your building – or even the room you are in – onto a more efficient wavelength?

Infra red sensing is today being applied to the efficient management of buildings, in very different ways.

The technology has already used as the basis for several classic energy surveys of building complexes. The technique has proved particularly useful when under pressure for results and when a number of widely dispersed buildings are involved. This was very much the case when an aerial survey of the City of Cambridge was carried out.

The recent introduction of a deceptively simple but elegant switching device could, in the right circumstances, hold out the promise of up to 48% energy savings in hotels. The potential for similar savings also exists elsewhere.

Infra red imaging cameras are expensive and not all energy consultants are prepared to invest in one. Pilkington Energy Advisors Ltd. (PEAL) have, however, invested both time and money in their cameras which are made by another Pilkington subsidiary, Barr and Stroud. These cameras have been proven on fighter planes, submarines and even tanks.

Now they are being used by PEAL to target onto hot and cold areas in business premises to pinpoint the heat losses which could seriously damage a company's profits.

As an energy management tool, infra red imagery can detect heat leakage not only from buildings but from plant processes within and from associated pipework.

An easily performed inspection after a contractor has installed insulation will demonstrate whether the work has been carried out correctly and to the required specifications, or whether any areas of insulation may have been omitted.

Most infra red surveys are done at ground level by an engineer operating the camera as he walks around the premises. He studies all or part of the works or offices as required. For more extensive surveys the camera can be operated from an aeroplane, as was the case in Cambridge.

Even satellite images can be called upon and these images can be assessed so that not only is waste observed but the heat being lost can be quantified. The results, despite or because of their novel origins, are proving of enormous value in a wide diversity of applications.

The survey report usually includes a video or still photographs. Sophisticated image processing colour analysis helps in interpreting them into quantifiable data.

Remote surveying is quick compared to conventional methods. This means that consultancy time is reduced, making the services of a consultant in this field even more financially worthwhile.

Without thermal imaging, weeks – or even months – could be spent in surveying premises. The British Aerospace Brabazon hangars at Bristol, for example, are a third of a mile long with much scaffolding and an awful lot of insulation to inspect.

The PEAL survey was completed quickly and did not disrupt the work in progress at Filton – another important advantage, particularly if production lines are involved.

The survey also represented what was happening at one moment in time over the whole site instead of being an assessment of results observed at different points over an extended period.

The video of the survey is an important and permanent contribution to the records of the building, or energy, manager. It may be viewed as often as desired and becomes a permanent reference point from which to carry out later re-evaluation of the premises. It is not unknown that, following this sort of fine tuning, an opportunity not previously observed has been capitalised on.

It would be wrong for any company to assume on the basis of some previous success or extremely productive survey that the savings have been maximised – that every pound possible had been cut from energy costs and added to the company profits. Maximising savings is a skill.

Knowing where the wastage occurs is one thing. How to cut it out with an appropriate level of investment is another. The minimum investment may not be the most economic. Understanding, appreciating and communicating all this is an important part of the consultant's work.

Eventually, reduced bills will prove the point – a further infra red survey when remedial work has been carried out will prove the point even faster.

The confidence to offer reliable advice comes from experiencing many energy-saving exercises in a wide range of premises by a team of experts who can integrate their collective experience to provide the most appropriate solution for each client. This is particularly true in the case of larger buildings.

When carrying out any survey of a building it has to be remembered that it is a very complex structure. Interpreting the results can tax the most experienced engineer. What the survey will reveal is the result of the compex interaction of all the prop-

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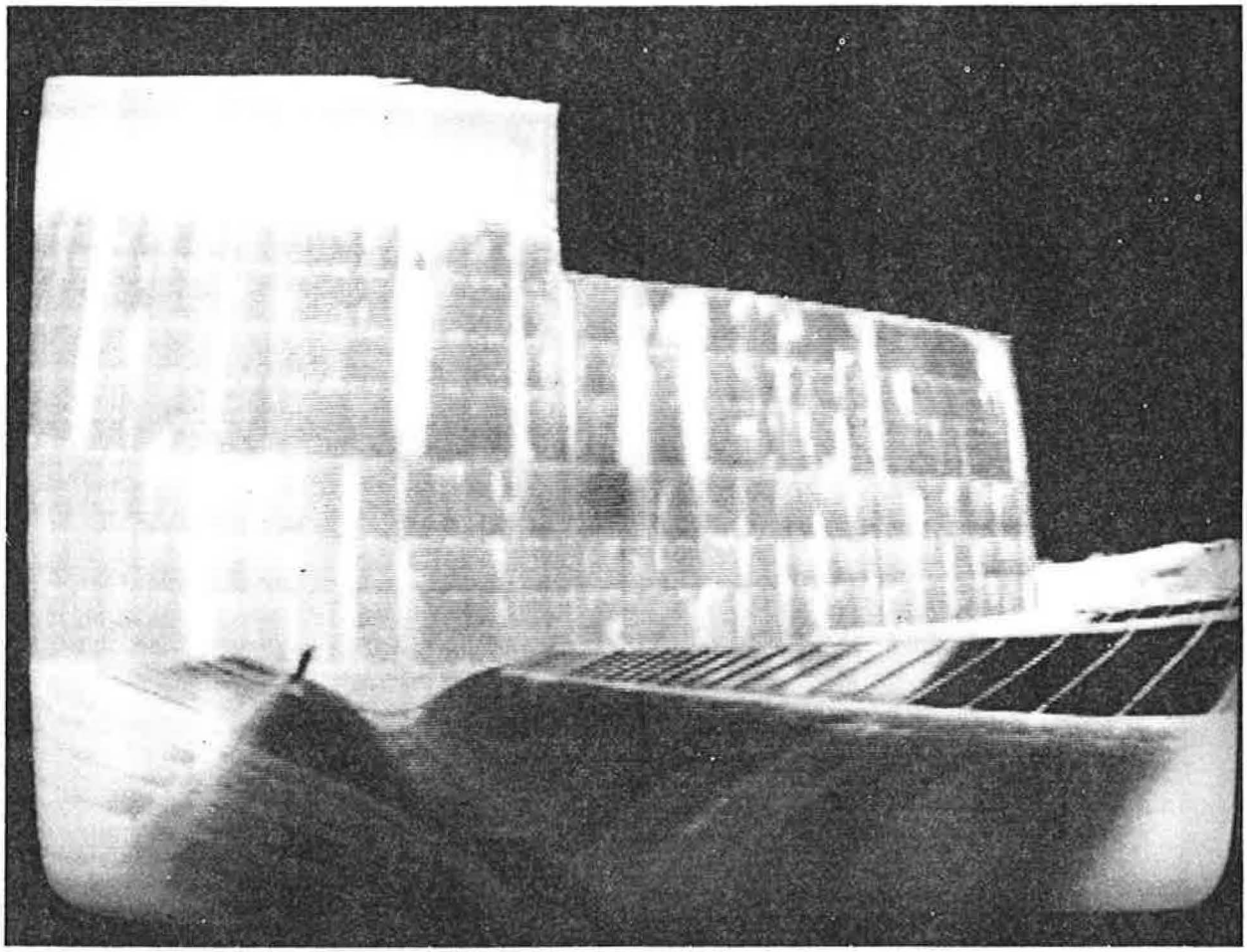


**An Infra-red thermogram taken of a major warehouse after insulation and cladding. The thermogram shows clearly the presence (and absence!) of insulation beneath the cladding and illustrates the quality control potential of this technique.**

erties of the building's components.

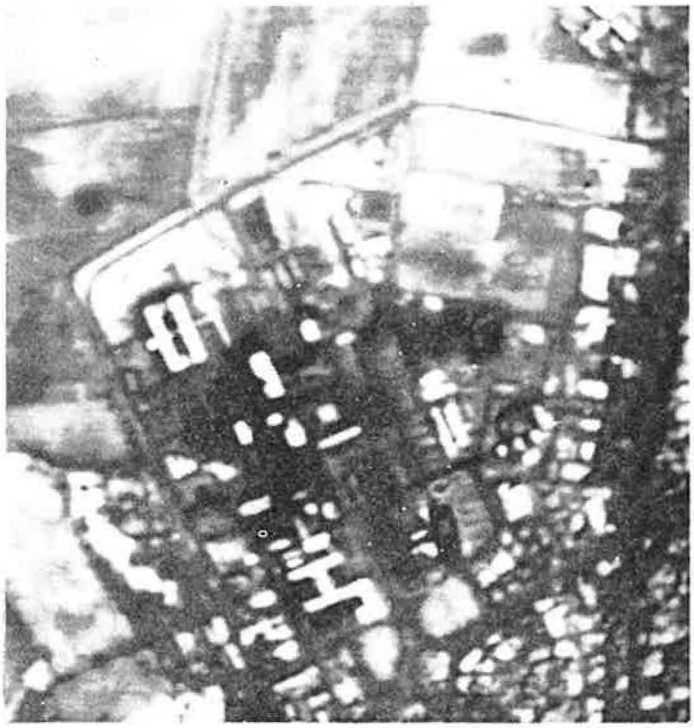
For this reason prediction, using conventional methods of calculation of heat losses through an element of building, has usually been an over-simplification.

Equally, effects such as thermal bridging and edge effects are extremely difficult to predict. The infra red camera records faithfully the result of all this interaction but considerable care needs to be taken in interpreting what this record means.

This is especially true if the survey suggests there is good reason to consider that structural changes are necessary to make the building efficient. This presents a real problem to the consultant.

Fortunately for PEAL, their engineers can predict with great accuracy how their recommendations will behave, thanks to the Pilkington Hot Box – a large scale thermal test facility designed to reproduce accurately the various operating conditions likely to be encountered. Those recommendations, therefore, requiring substantial investment can be backed up by physical evidence.

It is not difficult to appreciate the



**An Infra-red thermogram taken over the City of Cambridge as part of a survey to identify the efficiency of council house loft insulation. This two hour survey provided the immediate evidence to enable Government grants to be claimed before an imminent deadline.**

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contribution of infra red imaging techniques, backed by reliable scientific measurments, to energy efficiency in buildings. Certainly it is state of the art stuff, especially if the images are recorded from orbiting satellites.

There is, however, another development which, despite being closer to hand is equally exciting. It is the use of infra red in heating control.

Heating controls are the first line of defence in building energy management. However, the mere existence of a thermostatically activated control does not mean that the building or the room in which it is situated is being adequately controlled.

During periods when heating is required, a thermostat will switch on the heating when the temperature in its immediate vicinity falls below a given temperature and will switch it off again when the localised temperature rises. The two points are usually only one or two degrees apart.

Several things can go wrong with the use of room thermostats. If the room is cold, people misguidedly believe that by raising the thermostat setting the room will warm up more quickly. When the room is perceived to be too warm, doors and windows will be thrown open.

Tamper proof thermostats are one option but these are sometimes seen as a challenge to individual ingenuity and the settings changed regardless. The energy waste caused by such actions can add enormously to heating costs.

There is now a less vulnerable solution to this problem. Such units use passive infra red to sense whether a room is occupied. When a presence is detected, a pre-selected heating programme is initiated. This accurately reflects a much more suitable heating pattern than a simple control thermostat.

Used in a hotel for example, units like the 'Tristat' from Energy Specialist Products allow a "high" temperature to be set by a guest who may feel cold on entering the room. Energy waste comes when the room is vacated and the heating is left on high.

Should the guest leave the room, the Tristat programme allows a pre-set waiting period of between five minutes and one hour. After this it reverts to a "mid" temperature. After a second time period, equal to the first, if the room remains unoccupied the unit lowers the setting to a pre-set low temperature.

However, should the guest return, the temperature will automatically return to the original setting.

Despite being new to the market, the unit has already been installed in several locations including an hotel complex in Lancashire. Preliminary results indicate that the cost of the installation will be recovered through reduced fuel bills in about one year.

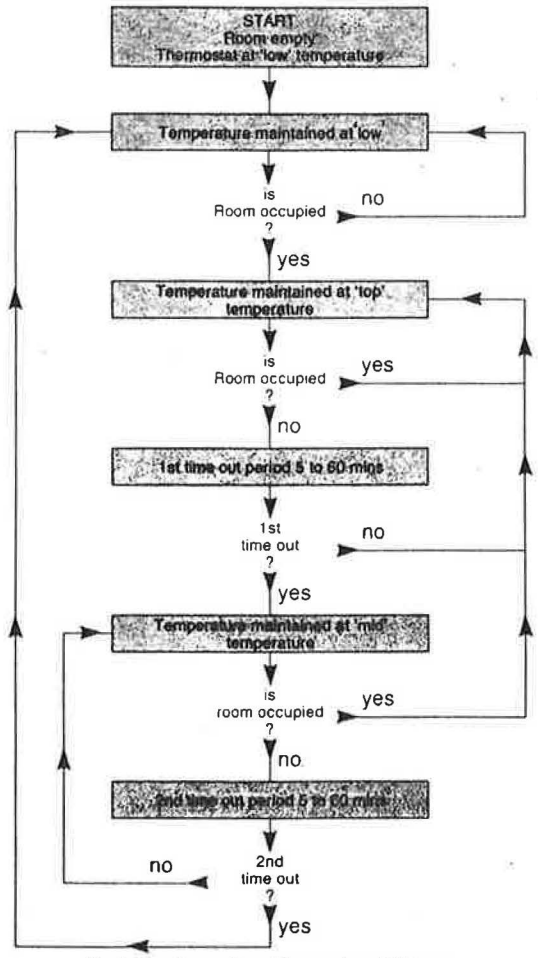
There are, of course, other methods of sensing presences in rooms but infra red is one of the cheapest and very reliable.

The first energy saving campaigns were based on the simple philosophy of "switch off something". This is still a good way to save but it is difficult to motivate individuals to make a direct energy saving decision. Intelligent controls will do it for them without motivation staying constantly alert.

Using a thermostat by itself to control room heating is much like throwing darts when there is only sufficient light to see the outline of the board. You cannot tell where the dart has landed and so you have no feed back with which adjust your aim.

Energy efficiency will always be like playing darts and only precise information about the aim will keep everything on target.

ROOM ENERGY MANAGEMENT CONTROL FLOW DIAGRAM




Top temperature — Target temperature set by user
Mid temperature — Intermediate temperature calculated by control
Low temperature — Setback temperature set by systems manager
Time out period set by systems manager

PEAL : CIRCLE 252

ESP : CIRCLE 253