30. The Village Hall: Heating

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Introduction

This information sheet has been prepared to assist village hall management committees when considering what would be the most suitable heating for their premises, together with the energy conservation and environmental issues which must be considered when seeking the optimum solution.

Committees will be encouraged to take a “holistic” view of their building, thinking about the comfort of the users and the performance of the building simultaneously with the selection of a heating system, that will ensure that the building is comfortable to use, whilst being inexpensive and convenient to run.

The efficient heating of a large, often intermittently used building such as a village hall requires careful consideration not only of the comfort of its many different users but also the protection of the building shell and internal fabric, including timber floor and decorations too.

Heating a village hall involves considerable expense, both in capital outlay for installation of the system and in long term running costs. The ideal solution may prove most costly, and a compromise may well be necessary. Modern control systems from simple time clocks and frost protectors to sophisticated control programmes and weather compensation systems can help to solve many of the difficulties and at the same time reduce running costs. On the other hand, in a building used by different groups of people, it may well be that the simplest heating system will be the best. However to achieve the best situation it is necessary to consider all the ways in which the building can be made to work for its users.

Statutory Acts and Regulations

Fire Precautions

The safety of people using the village hall is top priority. The local Fire Prevention Officer should be consulted at an early stage in plans for a new heating system, including its suitability and siting, and for advice on fire fighting equipment, detection systems and means of escape.

Building Control Regulations

New buildings, extensions and alterations, change of use and repairs which will alter a building, must comply with the current Building Regulations issued by the Department of the Environment. The installation of new heating systems is covered.

Building Control Approval: is required from the District Council or Unitary Authority under the Building Regulations. It is a good idea to get in touch with the Building Control Department to discuss the project and relevant requirements at an early stage before making a formal application. Officers in this department will be aware of all the national legislation plus local authority bylaws and regulations which apply. Architects and engineers can help with liaison between the hall committee and the local authority.

Public Entertainment Licence

The holding of a Public Entertainment Licence will also impose conditions including aspects of fire safety and health and hygiene. The Building Control Officer should be able to liaise with other relevant District Council or Unitary Authority colleagues, including the Environmental Health Officer, but direct contact with the relevant officer is normally the best way.

British Standards and Codes of Practice

There are British Standards (BS) and Codes of Practice (CP) which give technical details, specifications and performance standards which should be reached by producers and observed in their installation. There are standards and codes of practice for heating systems, but their text is often highly technical and it is probably best to ask an engineer or the Building Control Officer to advise. Advice is also available from the British Standards Institution, from whom copies of Standards can be purchased.

Assessing the Situation

Changes in air temperature, often in small spaces can be a reasonable indicator of thermal comfort. However, the comfort of people using a building can be influenced by factors such as surface temperatures, radiation and draughts.

When thinking about the design and operation of a heating system, it is all too easy to do the wrong thing by failing to understand various situations which will affect physical comfort eg preventing heat loss by insulation may not be tackling the main problem in a very intermittently used building. Heating a building for one or two hours use may not be effective if the air is warm at high level and not where the people are, or draughts are created by the type of heating used.

A balanced approach, allowing comfortable conditions to be established economically is the aim.

Each group of people using a village hall will have its own idea of what is needed from a good heating system - and they will all be different! Before deciding on a compromise solution, it is important to identify these groups which will actually find it impossible to use the hall, unless at least some of their requirements are met eg.

- Elderly people using the hall will need a warm and cosy environment.
- Children coming to a playgroup in the hall will require a warm and safe venue. Any heating unit within reach of children must be well guarded to prevent contact with any dangerous hot surface. (The maximum surface temperature of any surface should not exceed 43°C(109°F). It should also not be possible for them to touch the heating controls.
- The hall will usually need to be less warm when used for energetic sports. In a hall used for sports and games, low-level units are best avoided, unless recessed, and even high level projecting fittings could be damaged. Air disturbance in some heating systems such as ducted warm air may be unacceptable for sports such as badminton.
- When halls are used for drama, concerts and meetings or activities where a quiet atmosphere is required, noise is an important factor in the choice of a new heating system.

It is important to consider the effects of heating, or lack of it, upon the building fabric and contents. If a building is excessively dry through continuous heating and ventilation, organic materials like wood may crack and crumble. If a building is heated less but sealed up against draughts, increased dampness is likely and mould growth or rot and corrosion can set in. Fluctuations in temperature cause thermal movement in the building fabric and this can create cracking, blistering and sometimes leaks. Careful control of heating and ventilation rates may be required to avoid these problems.

Choosing a Heating System

Whether the building is used daily, or just occasionally should very much affect the strategy selected. What levels of insulation are available and whether there is any potential for collection of the sun's energy will also be of influence.

In a new hall it is possible to build-in the necessary measures to create an energy efficient and hence, low running cost building by careful evaluation of all the relevant aspects eg. use patterns, local climate and building orientation, available fuels, insulation levels, ventilation rates etc. When replacing a heating system or trying to reduce the energy use of an existing hall, it will be important to study how the complete building performs in respect of energy use and provision of comfort. The overall approach then may include a change of heating system (eg. in order to take advantage of more efficient, modern appliances), but it is also likely to include other works to the building in order to get the best possible performance. Selecting the best approach to heating and energy use is a complex task requiring the evaluation of the possible measures and influences which may vary considerably from one village hall to another. The advice of an architect and a suitable engineer is recommended before embarking on any significant expenditure.

Factors which will affect the choice of a suitable heating system include:

- climate
- building location, orientation and shape
- type of building construction and insulation
- size of building
- frequency of use
- availability of fuel, eg. are mains gas or electricity available?
- fuel costs
- type of use, eg. sports activities, lunch club for the elderly
- availability of storage space, eg. for oil or liquefied gas
- capital cost constraints

It is impossible to make generalisations and the optimum heating system will depend very much on the situation and use of each individual hall.

Before making the final choice, it is essential that the basic differences between the available heating systems are understood. Apart from the different heat delivery systems, different types of heat emitters will be appropriate for different spaces and uses. With continuing developments in the heating industry, advice should always be sought locally from professional mechanical or electrical engineers with community building experience who are able to provide unbiased and up to date information and who are aware of the local situation.

When installing a new heating system it is worth considering which rooms will be used at the same time as each other on a regular basis. It is then possible to plan a system which takes this into account and allows different areas to be heated independently by the same central system or even by different methods.

Heat Conservation and Ventilation Requirements

Energy, in the form of heat, is lost from buildings by conduction through the walls, floors, windows and roof (building fabric losses). Warmed air escapes through gaps, mainly around doors and windows and is replaced by cold air from outside (ventilation losses).

Look over the whole of the building to establish the existing situation and pinpoint where insulation is needed to reduce building fabric heat loss and where draught proofing will help to reduce ventilation heat loss. The advice of a heating engineer and/or an architect is useful at this stage.

Whilst heat loss is normally the most significant drain on energy, it is not the only way in which energy (and thereby cash) is consumed. Water heating and electrical fittings can also be significant energy users in the building. The replacement of light bulbs with low energy types will pay dividends over time in overall electrical consumption.

The demand for hot water is likely to vary greatly over the week in a village hall and it would generally make little sense to heat a whole tank, or cylinder just to use a small amount. Some form of local instantaneous appliance may well be the best option for water heating. Solar panels can usefully contribute to energy savings in the hot water supply.

Ventilation requirements

Draughts certainly lead to undesirable heat loss but some ventilation will always be necessary to prevent rooms becoming stuffy and to minimise condensation. Important safety considerations require adequate ventilation in rooms where gas, oil or solid fuel appliances are in use. Areas such as underfloor and cold roof spaces **must** be ventilated to keep the timbers there healthy.

In the main hall, ventilation requirements will depend on the activity taking place. Open windows provide an obvious source of fresh air but may not always be practical. Ventilation strips in windows avoid direct draughts, allow less noise to escape, are more controllable and avoid security problems. Sports activities will obviously require much greater ventilation than sedentary events and an extractor fan may be required. Regional Sports Councils can advise. Reconciling ventilation needs for different activities together with efficient energy conservation is not an easy task and here again, an architect and/or engineer will be able to advise.

Preventing Condensation

All air has water vapour in it, and this is increased by moisture in breath, perspiration, damp clothes, cooking and some forms of heating. Hard physical activity will add considerably to the moisture level. Warm air is able to hold more water vapour than cold air, so that when air with a high vapour content cools, some of the moisture condenses out. This condensation can take two forms; surface and structure.

Condensation is a common problem for village halls and similar buildings. When heated intermittently, the fabric of the building and surfaces such as walls and floors remain cold, and therefore vulnerable to condensation from moisture-laden air. There are a number of ways that this can be minimised:-

- **At source** - try to reduce the presence of water vapour by removing it at source. Careful choice of heating system, switching off boiling kettles, use of an extractor fan when cooking and keeping the door to the kitchen closed all help.

- **Background heating** - low background heating helps to ensure that the fabric of the building and its surfaces never go completely cold. This may not be affordable in a hall which is infrequently used.

- **Insulation** - by insulating a cold surface, not only is heat loss reduced, but because warm air now meets a warm insulted surface, surface condensation is also reduced. However, there are hidden dangers! Areas now isolated on the ‘cold’ side of the insulation become cold and more prone to condensation damage; ventilation and/or a vapour barrier will be necessary.

- **Vapour Barriers** - a correctly placed vapour barrier on the 'warm' side of insulation prevents moisture penetrating. Barriers can be sheets of a waterproof material such as polythene or foil, and some plasterboards have a barrier incorporated in them. Surface treatments such as gloss paints will reduce moisture penetration.

- **Ventilation** - ventilation on the 'cold' side prevents the build-up of moisture-laden air and reduces the possibility of condensation. Roof and underfloor spaces must be well ventilated to protect the timbers, and a ventilation space between insulation and cold surfaces such as walls is recommended.

The optimum solution may involve both ventilation and vapour barriers. The need for ventilation in rooms for comfort and health has already been mentioned; it also checks condensation, as moisture-laden air is replaced by fresh air. In kitchens, toilets, changing areas and showers an extractor fan will almost certainly be necessary. Fans whose operation is controlled by the humidity in the air are available.

Insulation and Draught Proofing

Mandatory minimum levels of insulation for new buildings, extensions and alterations are stated in the Building Regulations and obviously set minimum desirable levels for all buildings.

Although installing insulation may well be a 'Do it Yourself' task, expert advice should first be sought about suitable types and siting, together with the need for ventilation and water vapour barriers.

Fire Safety is a vital consideration. Flammable materials and those which give off toxic fumes when burnt should be avoided, particularly for surface insulation in rooms. Seek advice from your local Fire Officer.

The Roof

Much heat can be lost from the roof and the appropriate form of insulation will depend on the roof construction.

Flat roofs can be insulated externally using slabs of a waterproof insulation which is an excellent insulation technique, but it can be a difficult procedure and because the insulation needs to be weighted down, it can add significantly to the structural load on the roof. Perhaps more commonly, flat roofs can be insulated internally using an insulated ceiling lining such as fibreboard. With a timber roof, it is crucial to prevent condensation getting into the timber by use of a vapour barrier and adequate roof space ventilation.

Pitched roofs with conventional ceilings can be insulated with rolls of insulating material or loose-fill insulation, in the way familiar for domestic lofts. Gloves and a mask are recommended for handling most of the materials used for this and crawling boards should be used over the gaps between joists. Vapour barrier and ventilation considerations apply. Thought must also be given to water tanks and pipes in the roof space, which may freeze in severe winters. They should be well lagged around the top and sides, but the area directly under them should not be insulated, allowing entry for a little warmth.

For the environmentally conscious, there are some insulation products available from re-cycled materials. One such material is a cellulose fibre product made from re-cycled newspaper. Information and recommendations on these can be obtained from the Centre for Alternative Technology.

Open pitched roofs without a ceiling may be insulated between the rafters, and left open or covered with insulated plaster board. Again, it is important that the timbers remain ventilated and the vapour barrier is used. It may be worth considering adding an insulated suspended ceiling, though this may restrict some activities eg. badminton.

Walls

The outside walls of buildings with a cavity wall construction can be insulated by filling the cavity with an insulating material such as polystyrene beads, mineral or glass fibre. This type of work must be carried out by a specialist, and Building Control permission is normally required.

Walls may be insulated internally using insulated plasterboard which includes a vapour barrier, or slabs of an insulation material which are then covered by, or bonded to, plasterboard. Condensation in the fabric of the building must be prevented by a vapour barrier on the 'warm' side or ventilation between the 'cold' side and the fabric. Internal insulation is difficult where walls are uneven and may need a framework of battens fastened to the walls.

Gaps around the floor and skirting boards should be sealed, but where noise might be a problem, use a compressible sealant to reduce sound transfer.

Windows

Windows are generally areas of considerable heat loss and can cause severe down draughts of cold air.

One way to cut down heat loss is to install double glazing, whether in the form of hermetically sealed units or by adding a second pane of transparent material such as glass or clear polycarbonate to create an air gap. Also, low emissivity glass can further save energy and reduce condensation. The sealed units are expensive, particularly to install in existing buildings and savings will be slow to repay capital costs. It is possible to install secondary double glazing as a DIY project, but the capital costs may still be quite high. However, secondary double glazing can also help to reduce noise emission from the building. Problems with secondary glazing can include condensation forming inside the air gap on the outer pane. Fire risks must be considered if using flammable materials such as cling film, and also if the system used prevents the window being opened as a means of escape.

Windows can be draught proofed and gaps between the frames and walls sealed. To allow rapid ventilation when needed and a means of escape in the event of fire draught proofing must not prevent the opening of windows.

Curtains and blinds can have a significant effect on reducing heat loss by acting as insulators and excluding draughts, particularly if they are made of a heavy fabric and have a thermal lining. They should be well fitting and effectively seal off the window area, ending on a sill, on the floor, or behind a radiator if this does not pose a fire hazard.

Floors

Standards of thermal insulation for new floors are stated in the Building Regulations, but insulating existing floors is not easy and may not repay the work involved.

Insulation beneath a suspended timber floor is, sometimes possible, but there are many attendant risks if ventilation air flow is obstructed. Where underfloor heating is selected insulation is vital to prevent heat being lost to the ground.

More immediately rewarding approaches may be to eliminate draughts coming up through the floor, by sealing cracks and holes; or by laying some form of sheet material or carpeting together with an underlay.

Entrances and Doorways

Doorways can, of course, be responsible for large heat losses and a draught lobby at the entrance is ideal. Self-closing doors complying with fire safety regulations, together with draught-proofing for doorways between cold and warm areas, will also reduce heat losses. A warm air heater or radiant heater in a room above an external doorway can effectively provide a thermal curtain.

Frost Protection

It is important that all water services to the building (ie. lavatories, cloakrooms, kitchens and central heating systems where appropriate), are protected from the effects of below zero temperatures. This can be achieved in several ways in addition to ensuring appropriate insulation:-

- Background heating: the heating can be left on at a very low level at times when freezing temperatures are expected.
- Tubular or panel heaters: these types of electrical heaters can be placed in areas vulnerable to frost damage, such as kitchens and toilets, and in conjunction with a thermostat set at a few degrees above freezing, will switch on automatically when temperatures fall to this level.
- Pipe protection: water pipes can be protected by trace heating using a special electric cable wrapped around them and thermostatically controlled to prevent freezing.
- Frost-stats: a thermostat set a few degrees above freezing point can be used to switch on a central system or suitable individual units when temperatures fall. Two stage frost protection is a more efficient method where the frost-stat is arranged to start the heating pump alone to begin with. This circulates the heating at its current temperature and only if the temperature of this water drops to low temperature, will the boiler be fired.

If no separate committee room is available, folding or removable dividers or heavy fire-resistant curtains can reduce the area of the hall to be heated for small meetings providing the heaters have independent controls and the screens are full height. Draughts can still be a problem though.

Fuels

Before choosing the fuel for a new heating system check any existing system and also find out what is available. The cost of bringing a new electrical or a new natural gas supply to premises can be considerable, as can the provision of storage facilities for fuels which need them. The size of the new heating system may simply require an up grading of the current electricity or gas supply and the relevant local supplier should be consulted to check whether this is possible.

Cost will, of course, be one of the factors involved in the decision. Long term running costs are important, but initial provision and installation costs must also be considered. Discussion with committees running neighbouring halls may give some indication of relative running costs, but account always has to be taken of differences in size and use.

In each area, gas and electricity companies have their own system of tariffs and there will be one which best suits the hall's circumstances. For example, an off-peak electricity tariff offers cheaper electricity at night and is suitable for running storage heaters. A weekend electricity tariff offers cheaper electricity in the evenings and at weekends. There are many different tariffs now available and some may require installation of a new meter. The local suppliers can provide advice as to the most appropriate tariff for a given situation.

Types of Fuel and Power sources

Electricity

Electricity is generally less expensive than natural gas to connect to a building. Depending on the size of the heating system, the size of the supply may need upgrading. Electricity needs no storage, it is a clean and efficient fuel. Heating apparatus do not require flues, giving more flexibility in terms of its positioning.

Electricity can be expensive to run if not suited to the building construction, or use, or the incorrect system is utilised.

Natural Gas

Natural gas may be expensive to connect to a building but running costs can be lower than those of electricity. No storage is needed, but for a large heating system the supply may need upgrading. Appliances burning natural gas will need an appropriate flue, or if an existing chimney is used, this **must** be lined. If a building is close to an existing gas service main and it is intended that gas be used for heating, it may be possible to get the supply connected without charge. Local suppliers can advise.

Liquefied Petroleum Gas (LPG)

Liquefied petroleum gas (LPG) is the term used for butane or propane. LPG is readily available and is not subject to cuts or drops in pressure. It powers the same types of appliances as natural gas and, whilst its running costs are generally more expensive than natural gas or oil, LPG should be considered where natural gas is not available, or where portable applications such as mobile heaters are required. If the appliance is unflued, the water vapour produced can be a problem and adequate ventilation will be required to minimise condensation. LPG can provide a useful source of emergency lighting.

Butane is supplied in cylinders and is used **only** for mobile heaters (where the cylinder maybe inside the casing) and small portable appliances such as barbecues.

Propane is supplied in cylinders or, more economically, piped into bulk tanks, both of which are always stored outside. Typically, an LPG powered installation for a village hall will require a bulk storage tank of 1,200 or 2,000 litre capacity, with the gas being supplied to the building via an underground pipe. The provision of the tank, which must be situated a minimum of 3 metres from any wall, building or boundary and within 25 metres of the tanker for refuelling, will, of course, require capital outlay. A small installation may only require a set of 2 or 4 cylinders, which may be placed against a wall if desired, with automatic change-over valves switching from the empty to full cylinder.

Oil

Oil may be an option to fire a central heating boiler if natural gas is not available. A storage tank is required, safely sited and raised off the ground, with access for refuelling. Depending on size, it may require a catchment pit underneath it, capable of holding the contents of the tank in the event of leakage. The running costs of oil powered systems can vary and should be investigated at the time.

Coal

A form of coal is another option for a central heating boiler. A storage area is needed, the boiler will require a flue or chimney, and there will be the problem of ash disposal. Self-feed

boilers are available to reduce labour, with automatic air control dampers which can be set to control the rate of fuel consumption and heat output as desired.

Unlike gas and electricity, solid fuel boilers must burn continuously, though with modern controls this can be at a very low rate when heating is not required. They are therefore only suitable for halls which are used very frequently or where background heating is required for much of the time, and where local regular (daily) attendance is available.

Wood

The comments on coal also apply to wood. It may be a suitable choice in areas where a plentiful supply is available and controls on smoke emission permit it.

Solar Heating

The possibility of using passive solar energy should be considered. If your hall has large south facing windows these will absorb heat during the day and reduce the amount of heat needed from the heating system. This works best in buildings where the structure is reasonably heavyweight because the structure will absorb the energy coming through the windows and release it after dark. This will not work with lightweight structures such as timber.

There is a great difference between passive solar energy and the 'active' systems associated with solar panels. Typically solar panels are sited on the roof and absorb sunlight converting it to heat or electricity. The technology of these systems is constantly being improved, but at the time of writing it is not possible to recommend them as economic either for space heating or for heating water unless a lot of hot water will be used.

As installation costs become relatively less expensive, this situation could change, so that energy savings repay the installation costs in a suitably short period

Heating Systems

When a heating system is switched on, the temperature in a room rises because heat is transferred into the room by one or both of two main processes. Radiation results in the transfer of heat energy across a space without air movement. Convection transfers heat by the continuous movement of warm air away from the heater, and in some appliances this is assisted by a fan. Once the heat energy reaches an object such as a person or a piece of furniture, transfer continues by the process of conduction.

Central heating

Low Pressure Hot Water

Water heated by natural gas, liquid petroleum gas (LPG), oil, solid fuel or an electrical boiler is distributed by a pump via a network of pipes (usually copper) to radiators or fan convectors (also known as emitters) to provide radiant and convective heating.

The heating system will require an open expansion water tank together with a cold feed supply to compensate for water loss. The tank should be located at a high level in the building and connected to a rising main cold water supply via a ball-valve arrangement. The system must receive consent from the Building Control Department of the Local Authority and comply with the "Water Supply Bylaws" a copy of which should be available from the local water authority. It is possible to dispense with the feed and expansion tank and install a pressurised system. These systems are becoming more widely used where it is desirable to avoid tank storage.

Boilers: Boilers should generally be placed in an ancillary room, but should be easily accessible to allow regular maintenance thus ensuring both safety and efficiency. Boilers running on combustible fuels require air for combustion and a means of removing the exhaust gases. The operation of the boiler can be controlled by an automatic time switch.

Balanced Flue Boilers: In a balanced flue boiler, air is drawn in and exhaust gases expelled through one vent in an outside wall. This type of boiler must therefore be placed adjacent to an outside wall, unless a fan assisted model is chosen, which then allows the use of ducting from the boiler to the vent. Balanced flue boilers are available with a wide range of heat outputs, but may not be sufficiently powerful for heating particularly extensive accommodation. It is however, possible to use two domestic boilers together to achieve the required output and this has the advantage of allowing one to run at maximum efficiency most of the time.

Conventional Flue Boiler: Conventional flue boilers have a chimney for exhaust gases and a separate vent for incoming air. They are useful when it is not possible to site the boiler near an outside wall, or when an existing chimney is to be used. It may be necessary to choose this type if a very large heat output is required.

Condensing Boiler: The most efficient appliance is a condensing boiler. Exhaust gases are cooled before expulsion and the resulting condensed vapour removed by an overflow pipe. The higher cost of this type of boiler will be recouped by the lower fuel bills which result from its increased efficiency.

Conventional heating systems

These systems incorporate radiators or natural convectors and do not incorporate any device for forced air movement. Modern radiators generally have rear finned sections to increase the heat output.

Approximately 70% of the heat output from a “radiator” is by natural convection and the remaining 30% is by radiation. The use of low surface temperature radiators (LST) should be considered, especially where small children are likely to come into contact with them.

Thermostatic control valves can be fitted to each radiator, so that the temperature of rooms can be controlled individually.

Fan convector heating systems

These systems rely on forced convection for heat transfer and generally include a fan built into the unit casing to increase air movement. The fan can be thermostatically controlled to give control of individual room temperatures and also to prevent them blowing cold air when the system is not up to temperature.

Warm-air systems

Warm air is generated by a fan blowing air over a heat exchanger or hot source. The unit may be a single central unit or several large units in the case of a large hall. The system may be based on an Air Handling Unit incorporating a heat exchanger served with hot water from the central boiler, direct gas firing or an on peak electric element.

Alternatively the heat source may be provided by a purpose made package unit with indirect gas or oil fired heat exchanger or off peak electrical storage. In the case of the gas or oil fired heaters a flue is required. The units may be of a balanced or conventional flue type.

The resulting air is then distributed to the space or spaces either directly via outlets on top of the packaged units or ducted via sheet metal ducts to the outlets in rooms to be heated.

There are two main types of ducted warm air systems. The non-return system has a single ducted air supply. The return system has a return air duct which collects air from the heated rooms and returns it to be reheated, together with a small amount of new cold air.

The non-return system is less expensive and simpler to install. The return system is cheaper to run and requires a shorter pre-heating period because of its utilisation of recirculated warm air.

The correct siting of outlets is important to avoid the 'hot head/cold feet' situation. It is also important in halls used for sport, as the movement of air can affect, for example, the flight of a badminton shuttlecock. In halls with very high ceilings, much of the warm air will be lost in this area, drawing cold air in at lower levels.

With all forced air systems the quietness of operation is important. Much can be done to reduce the noise by ensuring the fan is the correct size and is suitably sited and mounted, and by lining the ducts, but it may be that some warm air heaters would still be too noisy in rooms used for quiet activities eg. concerts, meetings etc.

"Pressurised" warm air heating

This type of heating works on the principle of forcing warm air into the building under pressure and thereby reversing draughts by forcing air out through any gaps in the building fabric. The systems usually utilise a gas appliance (sometimes a balanced flue type) to heat the incoming air and efficiency is improved by discharging the combustion gases into the flow of warm air.

In very large volume spaces used for short periods of time, this system can have some cost advantages, but there are a number of possible disadvantages to be considered, eg. when used over longer periods, the loss of heat through the forced ventilation may offset any cost savings and the possibility of noise and smell must be considered, especially in smaller spaces. Regular maintenance of this type of system is vital to ensure that the heating unit burns efficiently. Any deficiency in the process could lead to the production of noxious gases in too large volumes.

Ventilating Heating System

In recent years an innovative system has been successfully used in a number of village halls. The system works by drawing filtered fresh air into the building and mixing this with re-circulated and warmed air at appliances in the room being heated. The air moves at a low velocity and in the summer the ventilation continues without being heated.

It should be noted that this system runs on electricity and the peak time use can be expensive. However, in a well insulated building, the slight positive pressure reduces draughts and the overall costs can still prove economic.

A proprietary system is manufactured by ELVACO UK Ltd and at the time of writing there were no other similar systems known to the author.

Individual Units

Electric Heaters

The installation of an electric heating system is often cheaper than gas, though it will probably involve upgrading the incoming supply and fuse system and supplying new power wiring and installing new sockets at each heater location.

Off-Peak Storage Heating: Storage heaters are free standing or wall mounted units which take in heat during off-peak night time periods on the cheaper tariff. The stored heat is then released during the day at a rate controlled by a thermostat. Some storage heaters are fan assisted, giving more control over the rate at which the heat is released. Some systems have a sensor which allows the overnight build up of heat to be suited to the outside temperature. This type of heater may be useful during the day and particularly as background heating. On cold days there may be insufficient heat stored to heat the room satisfactorily in the evening though some modern heaters have a dial which can boost the heat output in the evening. Some off-peak tariffs allow for heat to be taken in for a short period during the day to boost capacity. It is a less flexible form of heating which cannot respond easily to sudden changes in external temperatures or sudden changes of occupancy. Storage heaters normally require very little maintenance.

Convector Heaters: Convector heaters circulate heat by convection and may be fan assisted. They can be switched on and off and thermostatically controlled individually or room by room to provide a simple flexible heating system.

Tubular Heaters: Tubular heaters have a high surface temperature and need protection in the form of wire guards. They are not usually considered to be suitable for use in general public areas. They can be useful in cloakrooms, toilets and kitchens etc. to provide a very low level of heating to combat damp and to keep the temperature above freezing. They are usually fixed to a wall, just above floor level. Tubular heaters can be switched on and off manually, or by an individual or central time clock. They can have individual or centrally placed thermostats.

Panel Heaters: Electric panel heaters operate in a similar way to tubular heaters, but as they are totally enclosed in a casing they do not need a guard and so have a more attractive appearance. In-built thermostatic control, or, in fan assisted units, a speed selector, provides accurate and economic temperature control. For a new, highly insulated building, panel heaters can provide an attractive option both in capital and running costs, especially for smaller rooms.

Fan Heaters: Electric fan heaters are usually wall mounted above head height. While not being thermostatically controlled, there is a choice of level of heat output. They should be carefully sited so that warm air is circulated round the hall effectively.

Noise from these heaters can be a problem and they are probably not suitable in rooms used for drama, concerts or meetings where a background noise is unacceptable.

Fan heaters can be useful as part of a system, providing a short heating up time, particularly in areas where noise is not a consideration.

Radiant Heaters: The advantage of radiant heaters is that the heat they provide is transferred to people and objects in the room, rather than the air. This is particularly useful in large halls with the high ceilings where non radiant systems would be wasteful in heating large volumes of air. Radiant heaters also require very short heat-up periods.

Radiant heaters are mounted well above head height. A problem may be localised hot and cold areas - the ‘hot heads/cold feet’ situation. To avoid this, it is important to install the correct number of units for the space and to site and space them correctly. Using these heaters to supplement under floor heating is worth considering in well used halls.

If required, radiant heaters can be angled to heat the fabric of the building. To ensure some heat reaches the floor it is a good idea to delay the putting out of tables and chairs until the heating has been on for a while. They can also be useful over entrance doors, even if there is another type of main heating.

There are a number of types of electric radiant heaters.

Infra-red Strip: Short wave energy from a heating element is directed by reflective plates to where it is needed. The heaters can be thermostatically controlled, and switching on and off can be controlled by individual or central timeclocks.

Quartz Halogen Heaters: These are modern units operating in a similar way to the infra-red heaters, but using visible light energy. They are very effective, and provide a very quick source of radiant heat.

The red glow can be a problem, particularly if the room is to be used for showing films or slides. Some models have gold coloured reflectors which makes the output less red.

Gas-Fired Heaters: These can use piped natural gas or stored LPG.

Balanced Flue Convector Heaters: Balanced flue gas fired units can provide a simple and flexible system. They must be placed on an outside wall, through which the flue pipe passes, terminating in a cowl and wire guard. Temperature control can be through individual or central thermostats and on/off switching can be via individual or central timeclocks if required.

The units are quite bulky and, as the casing can become hot an internal wire mesh guard is recommended, to prevent accidents, particularly to children.

Radiant Heaters: The principles have been outlined in the section on electrical heaters. Choices are:-

Black Tube Radiant Heaters: Flue gases from a burner are directed through long black U-shaped tubes. The tubes are backed by steel reflective plates directed downwards and the apparatus is installed above head height. Little heating is lost to the roof space. The units are designed for use in industrial situations and are not attractive to look at. In premises with normal levels of ventilation the exhaust gas is removed via a flue.

Glowing Radiant Heaters: These are similar to electric radiant heaters and must be placed well above head height to give a sufficient spread of heat. As with all radiant heaters, they provide a very quick form of heating, with little heat being lost to air space.

The units do not have flues and the exhaust fumes and water vapour are expelled into the room. Because of this they are only suitable in rooms with adequate ventilation, provided either naturally or with a system of fans. Using this type of heater in areas with inadequate ventilation adds to the problem of condensation and can result in damage to the fabric and furnishings of the premises.

Portable Gas Heaters: Portable gas heaters are freestanding flueless heaters powered by a cylinder of LPG and it is important that they are adequately guarded. Catalytic models are safer than the more common radiant type used domestically. They provide a versatile source of heat for small areas and can be moved to where they are needed, for example for committee meetings or pre-heating rooms. The main disadvantage with this type of heater is that fumes released into the room contain water vapour and can cause or add to problems of condensation. Portable gas heaters are not suitable for use when children are present and are not permitted under fire regulations when a public entertainment is in progress.

Underfloor Heating

A common experience in many village halls where high level radiant heaters are fitted is the feeling of warm head and cold feet. Also, where convector heaters are used there is a well known tendency for the warmest air to be at the highest part of the space. For halls which are well used throughout the week an option worthy of consideration is the modern generation of underfloor heating systems. Because underfloor heating works as a radiant

source it introduces heat at low level, where the people are. Indeed, unlike the other systems, underfloor heating produces a temperature gradient which is lower at the higher levels than at the low level. This has the added benefit of increased protection of roof timbers.

The advantages of underfloor heating are that there are no visible units intruding in to the space and the low surface temperature means that comfortable conditions can be provided with a great degree of safety for small children and elderly people.

These systems have a relatively slow response time and are therefore unsuitable in halls used only for short periods, a few times each week. However in well used buildings the building fabric can be protected by maintaining a background warmth (a night set-back facility ensuring economic use of energy) and timer controls can ensure that the hall is comfortable when required.

Wet System

This system uses warm water (approximately bath water temperature) to distribute heat around the whole floor area. Special plastic tubes are used which expand inwardly and do not corrode. The heat is transferred normally to a cement screed, but a wide range of floor finishes are acceptable, including the timber floors common in village halls. Modern systems usually have pipes laid on a supporting, or 'laying' element and there must be insulation underneath.

The warm water for the system would be provided by a boiler and use of a gas condensing boiler can add further efficiency and hence, lower running costs.

Electric Heating

This is similar in many respects to the wet systems except that the heat is provided by electric cables laid in the floor screed. Electric underfloor would normally be used as back ground heating with on-peak heating provided by another source (eg. radiant heaters). This is because the electric system uses the floor slab as a large storage radiator heating upon off-peak electricity at night and slowly giving it off during the day. The principles regarding the heating pattern in the room are similar to wet systems, but the economics need to be evaluated in respect of electricity tariffs.

Heat recovery

Some halls require mechanical ventilation and where this occurs, it is worth considering heat recovery in the system to return heat from the exhaust air back to the boiler or tanks. This is a specialist system and an engineer or architect should be consulted.

Heat Pumps

Some halls have looked at the possibility of utilising natural heat from the ground or nearby water. Where possible this can be a benefit in energy efficiency, but this is a specialist system and an engineer or architect should be consulted.

Heating System Control

Management

Before thinking about the different types of control available it is important to decide who will be in charge of the heating system. This will often be the hall cleaner or caretaker and s/he will need to know the general principles of heat conservation as well as how the apparatus

works. Whenever possible, other people should be discouraged from altering the heating controls. However, if they are to be allowed to do so, full instructions should be provided, and where relevant, a reminder to switch off after use.

It may be possible to make heating economies by planning the timetable of users carefully, so that, for example, sports activities requiring lower temperatures take place on the same day and other days are reserved for less energetic pursuits. Try to convey the management committee's concerns about energy conservation to the groups which use the hall, and involve them in the strategies which will result in keeping fuel bills, and hence hiring costs, down.

The heating system and the control system need to be chosen together as different forms of heating lend themselves to different forms of control.

Temperature Control

Most systems have a control to adjust the level of heat output.

Central heating systems generally have a central thermostat controlling the temperature of the water being fed to the radiators, and the setting of this should be chosen to suit prevailing conditions. It is possible also to have a room thermostat which controls the pump which circulates the water. A disadvantage of this is that the level of heating supplied to other rooms depends entirely on the temperature of the room with the thermostat.

More sophisticated systems have a thermostat in each room which controls the heat circulated to them, allowing for independent heating. Further temperature control can be achieved by either manually turning individual radiator valves on and off, or fitting each radiator with a thermostat to do this. The temperature and circulation of warm air in a ducted system are controlled in similar ways.

Individual heating appliances such as convector heaters or balanced flue space heaters can be set at the required level or thermostatically controlled. All the heaters in the system can also be under the control of a central panel. In some electric storage heaters, the rate at which heat is stored can be varied to suit prevailing temperatures, as can the rate at which the heat is then emitted.

Modern heat control systems can be very sophisticated indeed, allowing inside and outside temperatures and room occupancy to be taken into account.

The simplest form of automatic control is a time switch which switches the central heating system or individual units on and off at preset times during the day. There are more comprehensive time-switches which can be programmed for a week or month at a time, to co-ordinate the heating with the hall's timetable. Heating-up times must be taken into account when deciding switching on times.

Further gains in the efficiency of a central heating system are possible by using an optimiser which is a controller which monitors inside and outside temperatures and adjusts both the heating-up time before occupancy and the boiler output accordingly. Energy management systems incorporate these controls while also ensuring that the boiler and heat circulation cycles operate together as efficiently as possible. Energy management systems offer great potential benefits, but only if they are carefully set up and used by someone who has a clear understanding of all the different aspects involved.

Metered Heating

The advantages of metered heating are that it is a very straightforward system and that groups using the hall pay their own heating costs and are therefore less inclined to waste heat.

Disadvantages include the need for someone to come in to switch on the heating before the activity begins: systems with short heat-up times will therefore be most appropriate. Using a meter means that modern programming and control methods will not be applicable. Money stored in meters can also lead to security problems, particularly if meters are visible to the public.

It is possible to provide a split system, particularly using electricity where background heating is provided automatically to protect the building and top up heating for comfort is provided by a meter.

Maintenance

Whatever heating system is chosen, regular maintenance is vital, to ensure continuing safe and efficient operation. Trying to save money by skimping on maintenance is not an option for a responsible management committee. It is best to have a servicing contract with a reputable heating firm or with the relevant fuel company.

Check time-switches and any adjustable controls regularly, to be sure they are set appropriately. The radiators of hot water central heating should be bled regularly, using a radiator key, to remove air bubbles which become trapped and reduce efficiency.

Useful Organisations

1. Professional Design Advice

The Royal Institute of British Architects (RIBA) no longer provides a 'hard copy' list of architects with experience of working with community groups because it quickly became out of date. However in its place it has a 'live' list through the database maintained by the RIBA Clients Advisory Service (CAS). This is continuously updated and contains details of other skills and experience which clients may require.

66 Portland Place, London W1N 4AD, 020 7580 5533

2. Product and Technical Advice

British Standards Institution, Linford Wood, Milton Keynes MK14 6LE
01908 226888

Building Control Department of local District Council

Building Research Establishment Advisory Service, Garston, Watford, WD2 7JR
01923 894040

Building Research Energy Conservation Support Unit (BRECSU)
Building Research Establishment Advisory Service, Garston, Watford, WD2 7JR
01923 664258

Chartered Institute of Building Services Engineers (CIBSE), Delta House, 222 Balham High Road, London, SW12 7AE
020 8675 5211

Energy Efficiency Office (Also Regional Energy Department of Environment Efficiency Offices), Marsham Street, London, SW1P 3EB
020 7276 6200

British Board of Agreement, PO Box 195, Bucknalls Lane, Garston, Watford, WD2 7NG

Calor Gas Enquiries - Heating, cooking , lighting or hot water:

Calor Warmline - Freephone 0800 626 626

Calor Gas Ltd, Jonathon Barker, Appleton Park, Slough, SL3 9JG
Tel. 01753 540000, fax: 01753 586037

Centre for Alternative Technology, Machynlleth, Powys SY20 9AZ Tel. 01654 702600

Calor Gas Regional Offices:

Calor Scotland
Falkirk Road, Grangemouth
Stirlingshire FK3 8XS
Tel: 01324 474747
Fax: 01324 473991

Northern Region
171 Elland Road
Leeds, LS11 8BU
Tel: 01532 707193
Fax: 01532 760060

North Western Region
Dock Yard Road, Ellesmere Port
South Wirral L65 4EG
Tel: 0151 355 3700
Fax: 0151 357 1944

Eastern Region
Manor Way, Coryton
Stanford-le-Hope
Essex SS17 9LW
Tel: 01375 671244
Fax: 01375 643437

Southern Region
Millbrook Trading Estate, Millbrook
Southampton SO9 1WE
Tel: 023 8077 7244
Fax: 023 8078 9228

South Western Region
1-4 Portland Square
Bristol BS2 8RR
Tel: 01272 232828
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