ENERGY EFFICIENCY
in community buildings

NEA

Campaigning for Warm Homes

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The information on the following pages has been based on knowledge gained over 21 years of NEA's experience of conducting energy audits and installing measures in community centres and village halls. It is designed to assist you in making decisions to reduce fuel costs and improve the environmental performance of your building. The text contains technical guides and flow charts based on our experiences. You may find the checklist and flow chart a useful start in your planning process. From the information gained from study of the flow chart and from knowledge gained from the walk round survey you can identify your priority problem and pick the technical guide that can help you.

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INTRODUCTION

National Energy Action (NEA) is the national charity that campaigns for warm homes. The main focus of NEA's work is tackling the heating and insulation problems of low-income households through improvements in energy efficiency. However, NEA is also committed to bringing the benefits of energy efficiency to local communities, including inner city and rural areas through improvements to community buildings.

Many community buildings are cold, draughty and hard to heat, for example old schools, church halls and pre-fabricated buildings. The majority have been donated to voluntary groups when their original use has finished and are in a poor state of repair.

Improving energy efficiency in these buildings is an ideal vehicle for increasing awareness of the need to use energy efficiently and encouraging users to make energy saving improvements in their own homes. A warm, comfortable building provides a better working environment for staff, volunteers and the users of the building and will make it easier to let, particularly during the winter. A building's improvement programme can therefore achieve increased comfort, reduced fuel bills, improved public awareness and increased income from letting.

As we live in an era of rapidly increasing fuel prices it is critical that we spend as little as possible on fuel for both our homes and our centres. At the same time we must ensure that buildings are adequately heated to combat dampness and condensation and to ensure the comfort of users. A major difficulty for management committees is how to prioritise the work to be carried out. Is the building too cold or is it expensive to heat? Or is it a combination of both?

Where to start and what to do first is often the question that management committees have to consider. This publication sets out to guide you through the energy information, which is available to enable you to make accurate and cost effective decisions for your building.

The objective of any energy efficiency work is to reduce the energy used in a building and to improve comfort by a combination of:

- Improving insulation standards to walls, floors and roof spaces.
- Reducing unwanted ventilation by draught-proofing external doors, internal doors and windows.
- Improving the operating efficiency of heating systems by replacement or improvements, installing new systems and/or controls.
- Reducing the cost and quantity of hot and cold water used by occupants by fitting water managers, flow controls, time switches and point-of-use heaters.
- Reducing the consumption of electricity used to provide lighting by fitting low energy lighting and time controls.
- Raising the awareness of building users of good practice in energy efficiency.
- Reducing CO2 emissions by installation of renewable energy measures.
- Copies of publications giving advice and information on grants for homes is available from NEA, e-mail **info@nea.org.uk**

THE BUILDING AND its USERS

Things to Consider

- The original use and age of the building will determine how energy efficient the building structure is or was when it was built, e.g. buildings constructed after 1990 will be more energy efficient than those built before 1990.

Freshwater Hall, Isle of Wight

- The range of users in your building will need different temperatures to achieve comfort levels. Children and older people require 21°C whereas more active groups such as dancers and keep fit enthusiasts need temperatures of 18°C for comfort.

- You will need to consider the number of rooms, the comfort levels needed in each room and determine the amount of heating required. Levels of comfort may also differ where rooms have south facing windows that benefit from solar gain in the summer or north facing rooms that are cold all the year round.

- Information on the times and hours of use of the building is needed to assess the difficulties in heating a building when occupation is intermittent. This also enables improvement work to be prioritised such as insulating the fabric of the building or upgrading the heating system.

- Analysing the cost of fuel used for heating and the quantity gives some indication of how much fuel is used. As a guide, the May to September costs will be for lighting and hot water. Therefore, by subtracting the energy costs for the April to September period from those for October to March, a fairly accurate figure of energy costs for heating the building can be obtained.

- Despite recent price rises mains gas is still the cheapest form of heating and if you have this fuel stick with it. All other methods of heating are more expensive, usually twice as much per kilowatt-hour of delivered heat.

- Does the heating system adequately warm the building? Is there a specific area of the building that is cold? Is the main hall cold and the rest of the building warm?

- Is the building draughty? Does it suffer from unwanted ventilation? Are draughts from fire exits a problem?

- Does the main hall have an open, suspended or lowered ceiling? In the main hall an open ceiling has the potential for ceiling fans; a lowered ceiling has the potential for added insulation.

- What type of windows does the property have? Do they have potential for draught-proofing if their structure is sound?

- What type of heating is used in the property? Is it an expensive fuel such as on-peak electricity, or is it a cheaper fuel such as gas?

- Has the property been refurbished? If so are the plans available and are the original plans for the building also available? This will give information to enable you to identify insulation standards on walls or roofs.

IDENTIFYING PROBLEMS AND SOLUTIONS

Once you have completed the checklist and consulted the flow chart you will have a guide to what changes are needed. If you wish to make progress you will have to make more technical decisions.

The next stage is to complete a technical survey. This may require you to draw on more technical advice than is available from users of the building, maybe from contacts within the community or from professionals. It is advisable that you read the accompanying technical material before conducting the technical survey especially if you have a fairly complicated heating system, or a variety of heating systems in the building, or if the building is of unusual design.

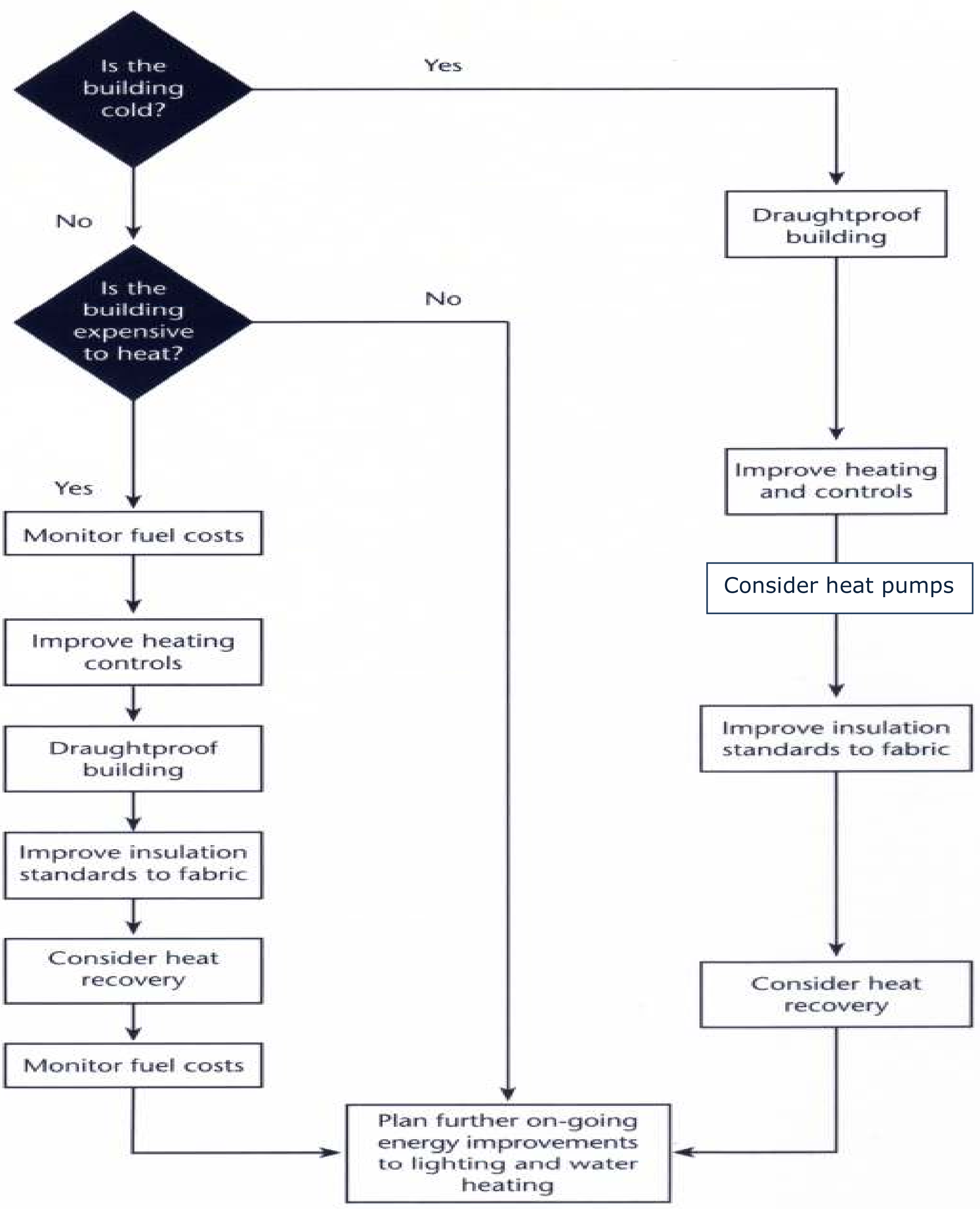
Advice on improving heating is usually available free from your local heating engineer. Advice on the structure of the building can be obtained by talking to a local building contractor or by seeing if the original plans of the building are available. There may be a local resident who has knowledge of older buildings.

Advice on insulation and draught-proofing can be obtained from insulation contractors located in your area.

Tanfield Lea Community Centre, Durham

BASIC CHECKLIST

Is the building difficult to heat?	☐ Yes	☐ No
Are the fuel bills higher than you would like them to be?	☐ Yes	☐ No
What are the average weekly energy costs for the winter period?	£	
What are the average weekly energy costs for the summer period?	£	
Are the heating costs covered by the hiring costs?	☐ Yes	☐ No
Total hours of use for the building on an average week		Hours
Average number of hours the building is heated in a week		Hours
Is the heating system easy to use?	☐ Yes	☐ No
Is the building fabric capable of being improved e.g. walls, floor, roof?	☐ Yes	☐ No
Does the building have any main source of heat loss, e.g. doors missing, open stage areas, gaps under external doors?		


Is the building cold?
Yes
No
Draughtproof building
Is the building expensive to heat?
No
Yes
Improve heating and controls
Consider heat pumps
Monitor fuel costs
Improve heating controls
Draughtproof building
Improve insulation standards to fabric
Improve insulation standards to fabric
Consider heat recovery
Consider heat recovery
Monitor fuel costs
Plan further on-going energy improvements to lighting and water heating

TECHNICAL SURVEY: A WALK-THROUGH AUDIT

Carry out this audit and then complete the recommended improvements.

SPACE HEATING		
Main heating system		
Fuel		
Appliance Age		
Type		
Controls		
Secondary heating system		
Should the heating system be replaced	☐ Yes	☐ No
Is the heating system capable of being upgraded?	☐ Yes	☐ No

WATER HEATING		
Fuel(s)		
Type(s)		
Controls		
Is water independently controlled?	☐ Yes	☐ No
Are hot water pipes lagged?	☐ Yes	☐ No

LIGHTING	Numbers	Size	Type
Fluorescent			
Standard bulbs			

VENTILATION DETAILS		
Do the main doors have draught lobby?		
Number of doors leading to the unheated space		
Number of windows		
Are they draught-proofed?	☐ Yes	☐ No
Are the doors exposed to prevailing winds?	☐ Yes	☐ No
Are they capable of being draught-proofed?	☐ Yes	☐ No

INSULATION STANDARDS		
ROOF DETAILS	**ALL**	**PART**
Pitched		
Flat		
Other		
Is the roof insulated?		
Is the roof capable of being insulated?		
Average room height		
WALL DETAILS	**ALL**	**PART**
Solid		
Cavity		
Timber/steel framed		
Other (please state)		
Do the walls suffer from condensation?		
Are the walls capable of being insulated?		
If so what method?		

FLOOR DETAILS	ALL	PART
Solid		
Suspended timber		
What is the finish of the floor, carpet, vinyl, ceramic tiles, wood etc?		
Are there specific areas of floor where draughts occur, e.g. gaps in skirting board?		

WATER USAGE

Is your water metered?	☐ Yes	☐ No
If yes, what are the average costs?	£	
Number of taps		
Number of cisterns		
Number of urinals		

HEATING SYSTEMS

	Improvements	Energy Saving	Cost
Gas/Oil Fired Boilers	Replace with high efficiency boiler	25%	£3,000
	Fit optimisers	10-20%	£200
	Improve room thermostats with electronic controls	8-10%	£150
Radiators	Fit thermostatic radiator valves	5% for total system	£25 / each
	Fit reflective panels behind radiators	10%	£10 / each
Storage Heaters	Weather watcher to heating circuit	15%	£200
	Replace old storage heaters with modern fan-assisted heaters	10%	£400 / heater
Heat Recovery/ Solar Gain	Install heat recovery systems or HR ventilation systems	25%	£2000

LIGHTING			
	Improvements	**Energy Saving**	**Cost**
Reduce costs	Replace 38mm diameter tube with 26mm tube	10-14%	£1.50 / tube
Improve efficiency	Replace fittings with high frequency fittings	35%	£60 / fitting
	Replace all standard bulbs with low energy bulbs	80%	£1-2 / bulb

HOT WATER			
	Improvements	**Energy Saving**	**Cost**
From central heating boiler	Split water and heating	50% in summer	£100 / £200
Boiler (electric)	Set thermostat to between 55°C – 60°C	15%	£10
	Change to point of use heaters	40%	£100 / unit
Boiler (gas) or instantaneous heater	None		

INSULATION			
	Improvements	**Savings**	**Cost**
Lofts	Fit 150mm of loft insulation	10-15%	£3/4 per m
Walls	Fit cavity wall insulation	10-12%	£3/4 per m
	Fit internal wall insulation	10-12%	£40 per m £ 6 per m DIY
	Fit external wall insulation	10-12%	£40/50 per m
Floors	Insulate under floors	5-10%	£20 per m
Windows	Double glaze windows	2-5%	£300 / 400 per m

DRAUGHTPROOFING			
	Improvements	**Energy Saving**	**Cost**
Draught proof doors and windows leading to external elements or unheated spaces	Draught-proof double doors	5-15% in total	£30 / door
	Draught-proof single doors	5-15% in total	£20 / door
	Draught-proof windows	5-15% in total	£15 / window
Seal gaps in brickwork	Use quality silicone sealant	2%	£5 / door £2 / window

The cost of the energy saving measure should be balanced against the savings obtained by the measure. Analysis of your energy costs will give you a guide on how much in money terms you can save. This is known as the payback time.

It may be that you wish to increase comfort levels in your building and therefore increase the usage of your building. For example, draught-proofing windows and doors in community centres can save up to 15% of energy and increases comfort levels considerably.

PLANNED IMPROVEMENTS

HEATING

HOT WATER

LIGHTING

WALLS

CEILING / LOFTS

DRAUGHTPROOFING

RENEWABLE ENERGY

ACTION PLAN

GATHERING INFORMATION	
Is more information needed?	
Who would I have to approach to find the information?	

FOCUSING ON THE PROJECT	
List the problems and probable causes	
List the possible solutions in order of priority	
List the possible sources of funding	
List the Energy Savings/Carbon Savings	

GETTING OTHERS INVOLVED	
Who?	
How to make contact	
Who will make the contacts?	
Timescale for the work	

TECHNICAL NOTE

Renewable Energy

Rising energy costs and the effects of climate change have raised the profile of renewable energy and for some buildings a reduction in heating and hot water costs can be achieved by the installation of renewable energy. As the majority of energy in community buildings is used in heating the building, renewable energy should be concentrating on providing heating or assisting in providing heating. Before considering installing any renewable energy equipment all possible insulation measures should be installed in order to reduce the required heat load on the building. All renewable energy solutions require large capital investment and you must consider carefully which solution is of the most benefit to your building and its users before committing funds to the project.

As with any large capital project you should speak to the planning department at your local authority early in your project development.

Micro Wind Turbines

Building mounted micro wind turbines have been developed and marketed over the last 5 years as a method of producing electricity to be either fed into the national grid or used in the building.

There are two types of domestic turbines, mast mounted (free standing, 2.5kW – 6kW) and roof mounted (1kW – 2kW).

The turbines must be mounted in exposed positions, without the turbulence caused by large obstacles, in an area with an average wind speed of > 5m/s.

Advice must be sought from your local authority regarding planning permission and a building survey is advised for roof mounted turbines to ensure that the building can withstand the movement.

Micro wind turbine

Solar Thermal Water Heating

Is the most established form of renewable energy, the system consists of panels on the roof, a pumping station and a storage cylinder of a minimum size 160 litres which can link into the existing hot water system. There are a number of different designs and sizes of panel with the final decision made on volume of water usage, roof size, storage and cost of installation. The solar collector panels are either flat panel or evacuated glass tubes with the choice for a building being dependent on the building location and the amount of available daylight in the given geographical area.   They are best suited where the building has a high demand for stored water such as showers or bathing and has a roof with a south or south east facing elevation.

Installation during roof overhaul

Heat Pumps

Heat Pumps have been used in buildings in Europe for many years; they use refrigeration technology to absorb and generate heat and until recently in the UK have only been used in new build community centres. They use mains electricity to operate and when used correctly they can produce heating costs per kilowatt-hour lower than mains gas.

Ground source heat pumps (GSHP) are best suited to new build or major refurbishment of existing buildings. Air source heat pumps (ASHP) are best suited to well insulated buildings either new build or existing (to reduce heat load requirement).

Ground Source Heat Pumps

The GSHP system extracts heat stored within the earth due to solar gain and concentrates it giving useful heat. There are two main types of GSHP heat collection system, a trench system which is more commonly known as a slinky system and a borehole system. The slinky system is used for buildings that have a lot of external land space. A trench is dug to a given depth and a heat exchanger is laid within the ground and then covered by earth. A given rule of thumb is that you must have a trench area one and a half times the floor area of the building. When working with community buildings this figure may rise to around double the size of the building floor area.

'Slinky System'

A borehole system is more commonly used for buildings with more restricted space. With the borehole system the cost of installation will rise due to the extra machinery and man hours required to drill the holes. A heat exchanger is then laid into the borehole extracting heat as it travels deeper into the ground. A given rule of thumb using a borehole system is that 20 metres in depth is the equivalent to 1Kw of heat output required for the building. All boreholes should be situated approximately 10 metres apart from each other to ensure sufficient heat can be extracted from the ground.

'Borehole System'

A GSHP will typically distribute its heat through a wet underfloor heating system and that is why new build is the chosen vehicle for this system. Running the system at a lower flow temperature (35°C) will result in better efficiencies and lower running costs from the heat pump. Prior to any installation of a GSHP it is vital that a geological survey is carried out to ensure it is possible to install the heat exchanger within the ground in question. A GSHP system operating correctly and efficiently can have prices comparable to mains gas.

Air Source Heat Pumps

In the last four years new developments of heat pumps that draw heat energy from ambient air have been developed. Air source heat pumps (ASHP) are located outside the property and extract heat from the ambient air to produce useful heat. ASHP systems have lower water flow temperatures than a standard boiler so it is vital that the required heat load is calculated correctly. For new build properties under floor heating is advised as this works at a much lower temperature than convection heaters. However for existing buildings the most effective method of distributing heat is to use either oversized radiators or fan assisted convector heaters. The other limitation with heat pumps is their heating output in Kw. The maximum Microgeneration Certification Scheme (MCS) accredited unit is 16 kW and where the required heat load is in excess of this it is necessary to increase the number of heat pumps. There is no limit to the number of units that can be linked together, and if a building requires 26 kW of heat two units could be installed into the system to meet the demand. Heat pumps operate on the standard 240 single-phase electrical supply and achieve between 260 and 350% efficiency depending upon the flow temperature required and the ambient air temperature.

ASHP components have a design life of approximately 20 years compared to high efficiency gas boilers which have a 7/10 year life. With a gas boiler costing in the region of £700 and an ASHP costing around £2200, the whole life costs are very similar.

Advice should be sought regarding planning permission before any heat pump is installed.

Photovoltaic Panels

Photovoltaic panels (PV) are installed on a south facing elevation and convert sunlight into electricity, the electricity produced is direct current and can be used to charge lead acid batteries but to be used in a standard electricity system it needs to be converted to 240 volts AC. If the correct meter is installed it may be possible to sell any surplus electricity back to your energy supplier.

It needs in the region of 16 square metres of panel in order to generate 1kW of electricity and it will take a large area of roof space to take this size of panel.

Best suited in buildings which have south facing elevations, have a large demand for electricity through the day and when a supplier is prepared to enter into an agreement to buy back surplus electricity.

Biomass Heating

Biomass products can be used to produce heat for radiators and water heating. The most popular fuel to use is wood pellet, which can be used in automatic feeding boilers; usually these boilers are of large energy output with a minimum of 20 Kilowatts. Installation of these boilers is fairly straightforward, and issues that need to be considered are:

- What storage capacity for fuel is available; at least two months supply is needed
- What is the supply chain for the biomass fuel; how far does it have to travel to your centre?

Best suited to larger community centres with long periods of hiring and heating, where there is adequate storage for wood fuel and a good local supply of processed fuel.

Wood pellet manufacturing in Wales

Heat Recovery

Heat recovery systems extract heat from the building, remove any moisture and then dump the air back inside the building. This process works well in modern reasonably air tight buildings. In older buildings unless they are extensively draught-proofed heat recovery will not work as instead of drawing in moist air the units draw in cold air from outside.

A new development has been to use air from an enclosed chamber built against the south facing tiles in a loft space. Air is passed through the chamber and fed into an air-handling unit which filters the air and then dumps it into the building. These units work effectively in older buildings as they do not need to be airtight.

When installed in the right building these units can reduce heat load by up to 25%.

Installing Heat Recovery Ventilation

Technical Note – Heating

Heating of any community building or hall will account for approximately 65-70% of the energy costs, and is therefore the most important sector of energy consumption to control and use effectively.

Increased competition in the supply of fuel means that there are a variety of costs for mains gas and electricity, and the first stage of any energy audit is to make sure that you are paying the least for the fuel used in the building (see section on purchasing fuel).

If your building is heated by electricity you should check immediately that you are on the correct tariff. Most electricity suppliers have a range of tariffs and you should seek guidance on the one which is most suited to the hours of use of your building and the amount of energy used.

The ideal heating system is one that brings a building up to a desired temperature rapidly and then automatically maintains it at that desired temperature.

The choice of fuels can be limited to the fuel available in your area. Most urban halls and community centres have gas available, whereas many rural halls have no access to gas and use electricity, oil or bottled gas. Despite the recent and frequent price rises mains gas is still the cheapest form of heating for community buildings.

Renewable energy has a place in reducing energy costs but at present the installation of renewable energy is still an expensive installation (see section on renewable energy).

The cost of fuel for heating must be considered against the efficiency of the heating appliance in converting the fuel into usable heat, installation costs, servicing costs and in infrequently used buildings, the cost of operating a heating system to protect against frost.

With any heating system if the heat emitters are capable of coming into contact with people (especially children) they must have surface temperatures below 42°C or be adequately guarded. If you make or order new guards you must ensure that the controls are not obscured.

Technical Note – Electric Heating

Electric heating is common for many community buildings particularly in rural areas where mains gas is not available, and the cost of installing an oil central heating system can be prohibitive.

A decision must be made on what type of heating system to use. Ideally any system chosen would rapidly raise the temperature in an individual room or part of the hall on demand. To achieve this many buildings with evening use rely on on-peak overhead radiant heaters. These heat the air by radiation and convection, with the warm air heating the people in the hall. From the safety aspect these heaters are very good, normally fitted above head height but have the disadvantage of heating your head while leaving your legs cold. The other disadvantage is that they usually have no thermostatic control and rely on the occupants of the hall switching them off when they are warm and then back on again when they are cold. The second problem can be overcome by the use of time switches and thermostats, but it will not overcome the main problem of the hot head/cold legs syndrome.

An alternative is to use electric panel heaters or fan heaters fixed to walls. These can have convector fans that will distribute warm air and they can have thermostats and time switches built into them. A hall however will require several heaters and they will not always move warm air to the centre of a hall and are often felt to be ineffective in a large hall.

A recent advance in electric heating has been the development of quartz infra-red heaters which produce heat using a method similar to natural sunlight. The short wave rays of heat warm the skin of people who come into contact with them and not the surrounding air. They are suitable for occasions when people are sedentary, e.g. meetings and talks and, correctly spaced can provide comfort in buildings with very high ceilings such as churches or converted schools. They can move heat over long distances (up to seven metres) and are unaffected by draughts, but use on-peak electricity and may be expensive to maintain, depending upon the type.

Where halls have a large proportion of daytime use, storage heating can be a cheaper alternative than radiant or quartz heating.

Most electric heating can be upgraded by use of electronic detectors and thermostats to switch heating on when the hall is occupied; maintain the temperatures by a thermostat; and switch off when the building is unoccupied.

Off-peak electricity is normally supplied for seven hours (Economy 7) between the times specified by your local supplier. In some areas it is seven hours at night, others it is 6 hours at night and one hour in the afternoon or 5 hours at night and 5 hours during the day (Economy 10). However, on these tariffs, daytime electricity may cost more and the quarterly standing charge is often higher.

By comparing your heating costs in winter against the times the building is used during the day you can see if the change would be worthwhile. If the majority of heating is through the day and you are heating with on-peak electricity, it may be worth switching to the off-peak tariff.

The most efficient type of off-peak storage heater for a community building is a fan-assisted storage heater. The most effective types have a twin-speed fan and an internal thermostat. This ensures that the charge of electricity taken by the heater core is retained in the heaters until it is needed by the owners of the hall.

Existing storage heaters can be made to operate more effectively by fitting a device known as a weather watcher. This is an electronic device with a sensor which monitors the outside temperature, and for example if it’s a mild night it will reduce the charge going into the storage heater and therefore reduce the cost of electricity required.

As storage heaters operate by storing a charge overnight and releasing it through the day they do operate more effectively in a well-insulated building. When installing any heating system you should consider how the building could be insulated and draught-proofed. By improving the insulation standards the heating load and operating costs can be reduced.

If you have storage heating in your building and consider that the heaters are inefficient you should check the insulation standard and draught-proofing in the building.

De-stratification ceiling fans should also be considered if you are attempting to heat a building which has a high ceiling (above 3m in height).

Ceiling fans can be used with any heating system to force down hot air from the ceiling void. They work most effectively in high open ceiling buildings that are 3-4 metres in height. The simplest types have three blades and a speed/reverse control. In winter they push hot air down from the roof-space and in the summer they are reversed to provide ventilation. In winter they recover 10% of the heat produced by your heating appliances.

Technical Note – Gas and Oil

Gas and oil fired systems offer particular flexibility as the fuel used costs the same throughout the day. They can be made to operate more efficiently by considering the warming up and cooling down times for the system and setting the heating controls accordingly. To do this a seven-day timer is essential, with a digital timer giving more accurate control.

Play groups, older people and those watching theatre or lectures will require higher background temperatures than those taking part in activities such as dancing, martial arts or keep fit. To ensure this range of conditions is met accurate thermostats are required.

If the system has a thermostat in the main hall accurate control can be achieved by use of electronic thermostats with tamper-proof settings. A further element of energy savings can be made by installing a thermostat with a setback control. This maintains a temperature at for example 16°C. If the user group finds the hall cold they can boost the temperature to for example 19°C for between 30 minutes and four hours. After this time period the thermostat drops the temperature back to 16°C. These devices can save between 10-15% of heating costs.

The heat can be distributed by:

- Radiators
- Blown air
- Convectors
- Radiant tubes

Radiators

Radiators are of a similar design to household radiators, usually on a larger scale. They may have internal convector fans or may be enclosed with some sort of fan assistance. They are all provided with hot water through pipe work with the hot water provided by a central boiler. If the building has many rooms it may be divided into zones with each zone having its own thermostat and zone valve. It is a very versatile system as radiators can be repositioned when the shape and size of rooms change. The boiler and radiators require frost protection.

Blown air

Hot air produced by a central boiler is distributed by metal trucking throughout a building. These systems can be noisy and blow dust as well as air around a building and must be carefully designed and installed in order to meet the needs of the users of the hall. This is normally an economical method of heating a large building.

Gas Convector Heaters

Gas convector heaters are highly efficient gas fired heaters that fit at floor level against an external wall and are self-contained having a heater and blower built in, and require only a gas supply and electricity for the fan. They supply instant heat up to 15Kw on demand and when controlled by a thermostat, are very efficient and economical in use. They must be fitted with guards on the external flue and the internal casing. They can be linked with passive infra-red detectors and thermostats to provide instant heat when the halls are used.

Radiant Tubes

Radiant tubes use a similar technology to that of quartz infra-red heaters in that the heat is produced in straight lines just like sunshine, but in this case the heat is provided by gas in a steel tube.

The heaters are fitted at high level and usually have a high output, 20 kW being an average figure. They are not attractive to look at but are very quiet in operation and economical in large high areas such as sports halls.

Controls

A central heating system can have a number of controls. However in older boilers the main control for the boiler is the boiler thermostat, the primary function of which is to control the temperature of the heat exchanger of the boiler and therefore to control the output water temperature. These older gas and oil heating boilers can also be made to operate more efficiently by the addition of a device known as a time delay optimiser.

When the heating system reaches operating temperature, i.e. at the end of the warm up period and the return water temperature is at the required temperature, the boiler thermostat senses the high temperature and switches off the boiler. After a fairly short period of time, 30 seconds on average, the boiler thermostat senses a drop in temperature and starts up the boiler for a very short time, 30-50 seconds until the thermostat switches the boiler off again. This is known as dry cycling and occurs as long as the boiler is in operation. The optimiser stops this happening

Older gas and oil boilers (but not combination boilers) can have a boiler optimiser fitted. This introduces a time delay and increases the time the boiler switches off from 30 seconds to between 60 and 120 seconds. These devices, which can save between 10-20% of the fuel used in a boiler, cost between £80 and £300 to have fitted. Some manufacturers claim up to 30% savings can be obtained. However these can be fairly difficult to obtain unless the boiler is operating for up to 12 hours per day, and average savings of 10% will be obtained on a building that is heated for approximately 30 hours per week.

When a boiler has to be replaced due to its age or lack of spares it can be only replaced with a high efficiency boiler, at present the Building Regulations require that any replacement gas or oil boiler has to be band A or B.

It is important with any fuel burning appliance whether mains gas, bottled gas or oil, that the appliance is regularly serviced both to maintain its efficiency and to ensure its safe operation.

Heaters and boilers that burn fuel inefficiently can produce carbon monoxide.

Technical Note – Lighting

Lighting typically accounts for 15% of energy use in a building. The majority of community centres are lit by fluorescent lights which are very energy efficient, but if they are fitted with 35mm tubes the tubes can be replaced by slim-line 26mm tubes in the existing fittings. This will result in energy savings of 10-15% per tube. If tubes are bought by the box very substantial discounts can be obtained. Regular cleaning of reflectors and shades can also improve the efficiency and the output of the light.

Standard light bulbs can be changed to low energy light bulbs giving energy savings of up to 80% and lasting up to eight years. They should be used in rooms that require lighting for more than one hour at a time as frequent switching on and off reduces the life of the bulbs. One problem is that they are easily stolen so they should be fitted in a location that is not accessible without ladders, or where they can be enclosed in a light fitting.

Large DIY stores often have offers on low energy fittings, lights and bulbs at prices below those of normal retailers.

If you are replacing light fittings you should buy those that are already fitted with low energy tubes known as 2D tubes in order that the running costs will be much lower.

If you are replacing fluorescent tubes check the cost of high frequency units which operate at 35% of the operating costs of standard fluorescent lights.

If a major overhaul of the lighting system is taking place the opportunity to replace the light fittings with high frequency fittings, or replacement of the ballast units with high frequency ballasts should be taken. This will reduce the energy used by the lights by 35% and will double the life of the tubes.

If the tubes are located in areas where maintenance is difficult the installation of electric/electronic starter units can double the life of existing light tubes at a very low cost.

Technical Note – Hot Water

Hot water typically accounts for 10% of energy used in the building and is normally provided by one of two methods:

- Stored water in a cylinder
- Point of use (instantaneous water heater)

Stored Water

Water stored in a cylinder can be heated either by the main system for the central heating or by a separate source, but whichever method is used the water should be stored at 60°C. This is the most economical temperature for storing water. Above this temperature the water can be too hot for children to use; below this temperature the water can develop the bacteria Legionella. If you have stored water, and need quantities of hot water at temperatures suitable for children to wash their hands thermostatic mixing valves can be fitted underneath each washbasin to reduce the temperature to 42°C. The amount of water used both hot and cold can be reduced by 70% through the installation of push taps or flow restrictors to the washbasins. In order to reduce the risk of Legionella and to comply with safety legislation stored water must be chemically dosed each year.

If the stored water cylinder is heated by a gas or oil central heating boiler in the summer period when the central heating is not needed, then the boiler is firing up only to heat water to wash cups or dirty hands. This is not fuel-efficient. A short-term measure would be to wire in an electric immersion heater (with time switch) for use in the summer. If you can afford to, invest in electric ‘point of use’ heaters to reduce energy losses.

Point of use heaters

Instantaneous heaters can be either gas or electric and are very energy efficient as they convert energy into heat very efficiently. There is also no possibility of the growth of the Legionella bacteria.

If your centre is used by vulnerable groups, older people or children, it may be worth contacting regional agencies representing these groups to see if funding is available to install point of use heaters on the grounds of safety.

Where water meters are installed it is important to control the use of both hot and cold water. One main use of water is in the gents’ toilets where the urinals flush on a regular basis to maintain hygiene. Retrofitted water control systems fitted to the urinal cisterns can reduce water flow by 80%.

Technical Note – Insulation

Community buildings constructed to more recent standards have much higher insulation standards than those built before 1990 and are therefore cheaper to heat. It is still possible however to install insulation in buildings constructed before that date without altering their style or internal decoration.

Insulation starts to operate effectively when the building reaches a state of steady heat loss, that is, when the building starts to fill up with warm air and it then starts to leak out of the building. As a general rule a building has to be heated for a minimum of two hours for this to happen.

Insulation of the building has two further benefits; it raises the internal temperature by approximately 2°C and can reduce condensation on walls.

Lofts

Where the building has a loft, consideration should be given to insulating the loft space with a minimum of 250mm loft insulation material, this will reduce the heat loss by 20-30%. British Standard 5803 covers the materials to be used and methods to install the material. Any materials used should comply with BS5803 and the loft space should be checked to ensure adequate ventilation is in place after the insulation has been installed.

Where areas of the loft space are boarded out it may be possible to blow loose-fill insulation under the boarding using specialist equipment. Normal loft insulation is a DIY job that users of the building can carry out providing that safety precautions are observed. The suppliers of the insulation materials detail safety precautions on packs of insulation. The minimum safety requirements are to wear a dust mask, overalls and gloves.

The price of loft insulation varies depending on the volume of material purchased and the supplier of the product. It may be cheaper and safer (if access to the loft space is difficult or dangerous) to check with an insulation contractor to obtain a quote. The volume of material purchased by contractors can sometimes make this cost-effective.

If you have work carried out by electricians or plumbers and they need to work in the loft space make sure they replace any loft insulation that may have been moved.

Walls

If the building was constructed after 1930 it may have cavity walls, 30% of the heat is lost through the movement of air through the cavity when the building warms up. Providing the building is correctly constructed with clear unblocked cavities, cavity wall insulation can reduce the heat loss by 15%. Cavity wall insulation can be carried out by one of three methods:

- **Man made mineral fibre**
  This is the same material used for loft insulation which is blown into the cavity from the outside using specialist equipment.
- **Urea-Formaldehyde (UF) foam/Polyurethane (PU) foam**
  This is injected from the outside of the building into the cavity using specialist equipment and foams inside the cavity filling the void.
- **Polybead**
  This is an injected system of polystyrene beads, injected from the outside of the building into the cavity. The system is particularly suitable for cavity walled buildings with a timber cladding finish on the external surface, as the beads form a barrier to stop water penetrating the structure of the building.

A registered contractor, who will give a guarantee for the work carried out, must install all forms of cavity wall insulation. Mineral fibre systems and polybead systems are covered by British Board of Agrement certificates and the UF foam systems are covered by the British Standards' registered firms system.

Cavity wall insulation is not a DIY job and must be carried out by a registered contractor who will give an insurance backed guarantee for a minimum of 20 years.

Technical Note – Condensation

Condensation can be a source of problems in buildings that are heated for short periods of time. Condensation is caused when warm moist air comes into contact with cold surfaces.   It can generally be identified as water running down walls or mould growth on external walls. Condensation mould growth is often extremely difficult to eliminate.

The most effective method of combating condensation is to remove it at source by the use of extractor fans. The disadvantage is that heat you have paid for is also extracted. The best compromise is an extractor fitted with a humidistat control which will switch the fan on and off as required. Alternatively a time switch fitted to the fan can be manually set by the hall users at the end of a hiring session. A further alternative is to fit a positive input ventilation unit which gently supplies tempered, filtered air into a building using otherwise unused heat within a roof.

Participants in activities that generate moisture (dancing, fitness sessions) should be encouraged to use extractor fans where fitted instead of opening doors or windows. If you have a kitchen area that produces moisture it is essential that an extractor fan is fitted in the kitchen and is used.

Additional insulation to the building fabric (cavity wall, loft insulation) has the effect of raising the internal temperature of a building and so warming the surface of the building reducing the opportunity for condensation to occur.

Where condensation is a serious problem or when equipment installed such as computers produce poor air quality a system of continuous ventilation is a simple solution. Positive input ventilation comprises of a unit which inputs a continual flow of dry air into a building, the dry air forces out damp moist air and improves air quality.

Technical Note – Draughtproofing

It is estimated that up to 15% of the heat generated can be lost through gaps in doors, floors and windows. The draught-proofing of existing buildings is a fairly easy task as there are many products available that can reduce unwanted ventilation in a building. Draught-proofing usually consists of fitting draught excluders around doors and windows and sealing gaps between window frames, door frames and the building.

Buildings that have double entrance doors to give access for wheelchairs and baby buggies usually have to open easily. This can mean they have large gaps at the centre where the doors meet. This unfortunately means draughts in the building and draughts mean cold air.

The main hall will have emergency exits usually leading to the outside and will have a gap at the bottom of the door to allow it to open easily.

Specialist draught-proofing seals are available that can effectively seal gaps in doors and windows at fairly low cost and are designed to last a minimum of 10 years. Draught-proofing manufactured to British Standard 7386 is tested to operate for 10 years under normal conditions and only draught-proofing manufactured to this standard should be fitted. Draught strip manufactured to this standard is not normally available in DIY shops and must be supplied by specialist draught-proofing or insulation contractors.

A competent DIY person or joiner can carry out fittings of draught strips. Technical information on fitting draught strips is available from suppliers of materials.

When attempting to reduce unwanted ventilation care must be taken not to block air vents in kitchens, toilets and any rooms where fuel-burning appliances (gas boilers, fires) are located. If you are unsure about the requirements for air supply to your appliances please check with the heating engineer who normally services your heating equipment. Buildings that are heated by electricity or have balanced flue heating or water heating appliances have no problems with air supply requirements for the appliances.

Technical Note – Health and Safety

The management committee has a responsibility to ensure that the building is safe for **all** users. It is recommended that there should be a formal health and safety policy for the centre. As a minimum this should provide for:

- a first aid box
- an accident book
- a fire escape plan for the building
- written instructions for use of equipment
- written instructions for emergency procedures

Remember that the different users of the building will have a variety of requirements that should be reflected in the policy.

As the centre is open to the public you can be inspected at any time by the fire service who are responsible for ensuring the public are not at risk when using the centre. They will check that fire extinguishers are serviceable, of the correct type and number, and that the fire exits are clear. They will also check that you assessed all the risks to the occupants of the building.

The management committee has a responsibility to ensure that the building is safe for all users, and talk to any disabled users as they may have ideas to make their use of the building easier.

If the hall is used by a playgroup for more than two hours a day you have to register with the local authority or the body responsible for inspection under the Children's Act.

Heating and hot water

DSS guidelines are used as a basis for determining standards for heating and hot water. These cover surfaces such as radiators and water from taps and state that temperatures must not exceed 43^{o}C.

In practice that means that heat emitters accessible to children and older people must be guarded or located at high level. Guards can be metal cages, wooden or rigid plastic covers. In addition hot water stored in a cylinder should be kept at approximately 60^{o}C, both for energy efficiency and health reasons. If water is stored at 43^{o}C there is a danger of bacteria growth, which can cause Legionnaires disease. To overcome this problem the hot water in the tank must be stored at 60^{o}C and thermostatically mixed under the sink with cold water to give an outlet temperature of 43^{o}C. With electric point of use heaters this problem does not arise as the water very rarely reaches 43^{o}C.

Technical Note - Community Buildings Product Information

NEA constantly reviews and updates information about insulation materials, energy efficient products and other energy saving devices. Most of the information can be found on the internet. NEA can be contacted for advice on projects or for technical advice, contact arthur.scott@nea.org.uk or vic.eynon@nea.org.uk or adam.jones@nea.org.uk or paul.cartwright@nea.org.uk or lesley.hall@nea.org.uk. For funding advice contact helen.walker@nea.org.uk. We will get back to you but as we are often out surveying and improving buildings it may take 5 to 7 working days.

Technical Note - Fuel Switching

Deregulation in the gas and electricity market has opened up competition within the gas and electricity market. Consumers can now shop around for suppliers who they feel may supply their fuel at the most competitive rates.

In the last few years fuel has increased substantially making it even more necessary to shop around for the best deal.

If you have been on your current tariff for some time you may be on a domestic rate and care should be taken when switching. All community centres are now classed as businesses and as such are charged business rates by fuel companies.

There are two basic methods to switch fuel, by telephone or through the internet. If you know which supplier you would like to switch to you may choose to ring them direct (see below). Or if you have access to the internet you can do so via several specifically designed websites (see below).

Access to the internet allows you to use price comparison websites. There is a six to eight step process on the domestic websites which allows the calculator to find the best deal, for example you may need to input the address details, usage in kWh or monthly/annual payments, how you want to pay and how many rooms in the property. It will then give you the annual savings you can expect. However business switching websites do not supply this information and the website asks only for a phone number so the company can call you back.

Your new supplier will inform your old supplier that you are switching. You will be requested to telephone in your final readings so that you can receive a final bill. Be prepared for your supplier to try to persuade you not to switch, if you are sure in your course of action don't be swayed! The process takes approximately 6 weeks.

There are many varied tariffs available, some companies no longer have a standing charge but have a higher unit charge. Some offer incentives such as Air Miles or Nectar points. There are online tariffs, Economy 7 – charges less during the night than through the day, Green Energy – renewable energy (wind, sun, replaceable sources etc) or Capped tariffs – guaranteed prices for a specified time as well as many others.

Most companies offer discounts for taking both gas and electricity (dual fuel) and also if you pay by monthly direct debit.

Be aware that prices change constantly and the least expensive supplier today may not be the cheapest tomorrow.

A few tips:

- On receipt of a bill, if an estimated reading is quoted, contact the utility company with the correct meter reading – avoid unexpected large bills.
- Always check that the current reading on the last bill is the same as the previous reading on the current bill.
- Check the bill is yours – yes, it does happen!
- You may be on an old preserved tariff (such as a 3 part tariff). Check that you will still be on this tariff if you switch suppliers.
- Is the centre a registered charity, you may be able to access a special tariff.

When switching, **BE REALISTIC**, don't be fooled into thinking your monthly payment can be reduced substantially, this may be a tactic the fuel company is using to persuade you to switch. You may end up with a very large bill at the end of the year.

Websites:

www.energyhelpline.co.uk
www.saveonyourbills.co.uk
www.comparebusinessenergy.co.uk
www.thepowerswitch.com
www.ukpower.co.uk
www.unravelit.com
www.uswitch.com
www.commercial-power.co.uk

The major business gas and electricity suppliers are:

British Gas Business
E.ON
npower Business
Scottish and Southern Energy
ScottishPower
EDF Energy

Case Studies

Carterton Village Hall

Carterton Village Hall in Oxford is a large community centre with a main and secondary hall, meeting room, bar lounge, kitchen and toilets. It is used 7 days a week and due to being a pre-fabricated building with a flat roof energy costs were over £7,000 per year.

The building was warm and comfortable but the survey identified that the boilers had few controls and the building was fitted with over 60 standard light bulbs. The boilers were fitted with simple boiler managers, the radiators were fitted with reflector panels and the washbasins were fitted with water saving controls. The standard light bulbs were replaced with low energy bulbs. The energy costs were reduced by over 20% in the first year saving £1,500.

Sparth Community Centre

Sparth Community Centre in Rochdale was built in 1985 and consists of a main hall, meeting room, offices and kitchen. It is used 6 full days a week and spends £2,400 per year on energy. It has a gas fired central heating system and is of cavity construction with timber windows. The building has good controls and is warm, but it suffers from major condensation problems in the hall with pools of water forming overnight. The building was surveyed and found to be suitable for cavity wall insulation, draughtproofing and some window replacements. The improvements could have made the condensation worse by reducing air movement through the building. A decision was made to fit positive pressure ventilation units in the building to provide warmer dry air to the building 24 hours a day, to cavity fill, draughtproof and replace some window glass with double-glazed units. The Centre Manager has reported after 12 months that energy use is down by 12%, and that the building is much warmer with no pools of water on the floor of the main hall.

High Wray Village Hall

High Wray village hall in Cumbria was chosen as an example of a hard to treat village hall, it was constructed in the 1890s of typical Lakeland stone and was heated by direct acting electric heaters. The building was generally cold and damp.

The building was improved by the installation of an air source heat pump heating system and improvements to the insulation standards. The opportunity was given to the hall to have a prototype Heatking 12 kW air source heat pump installed together with fan convector heaters and controls. The committee provided additional insulation and draught-proofing in order to ensure efficient operation of the heat pump. The system was the first heating only air source heat pump heating system installed into an existing community building in England and to date has been very effective at providing affordable warmth and comfort to the building. Funding for this project has been raised both by local and national groups. At present renewable energy heating systems are expensive installations with the costs being approximately two to three times that of conventional systems, however the running costs are at least half that of conventional heating systems and environmentally are the cleanest (in terms of carbon output) heating system.