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DIY Energy Survey

Community Buildings DIY Energy Audit

Undertaking a DIY energy survey is a sensible starting point when assessing how to reduce energy use in your community building and to ensure a warm and welcoming environment for your hirers, volunteers and staff. The audit process will help you to identify and prioritise appropriate, cost-effective improvements and can form the basis of a carbon reduction action plan for the hall.

Undertaking the audit

- Undertake a comprehensive walkaround of your building. Make use of all your senses! For example, does one area feel particularly cold, can you hear a draught or spot gaps around a window frame?

- Make this a team effort as different people will pick up on different issues. There may also be local people with relevant expertise who can advise you, such as heating engineers or building contractors.

- Agree how often to review the audit. Repeat the process at different times of day and seasons and in contrasting weather.

- In addition to the walkaround survey, you should also regularly measure the hall's energy usage, recording the time and date of each reading. This will give you a good understanding of the pattern of energy use and how it can be better managed.

Once you have identified possible actions, prioritise them according to quick wins and/or urgency, followed by mid and long term goals:

- Step 1. Reduce energy use through behavioral change (eg labelling light switches).
- Step 2. Improve energy efficiency through physical improvements (eg insulation).
- Step 3. Invest in renewable technologies.

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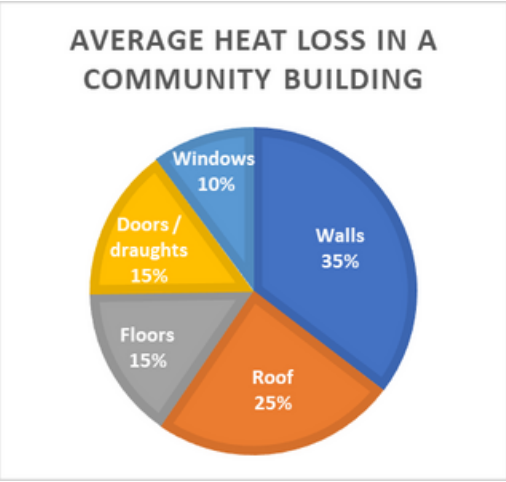
Other factors to consider

Community buildings are very diverse in age, structure and how they are used. While undertaking the audit, take into account:



- The age and structure of the building (eg construction, ceiling height, type of windows). Is the building listed and will any of the changes require planning permission? Identify any cold bridges (ie structures that run from the inside to outside of the building).

- The building layout. How many rooms are there, are they north or south facing? How often are the different spaces used and by whom? Is the heating system zoned accordingly? Is the foyer warm and welcoming as first impressions are important.

- Who uses the hall and how often? The rate at which humans give off heat can range from 100W when resting to over 1000W when undertaking exercise. This variation helps us to understand why different users need different temperatures. For example, a sedentary group such as a book club will need a higher room temperature than a badminton club.

- How many hours per week is the hall being used? Take a monthly average, or work from a summary of all the bookings for the whole year. How many hours per week is the heating on? Is the usage concentrated into a burst of hirings or is it spread out over the week?

- Who controls the heating? How much freedom do you give hirers to change the temperature and do you place any limits on this? (eg restricted thermostats). Are there clear instructions on how to leave the hall once the session has ended?

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1.Template Energy Audit Checklist

Audit date: .....

Audit undertaken by: .....

Weather conditions: .....

General

Check	Yes / No	Comments / Possible actions
How many hours in an average week is the hall in use?		
Can you hire different rooms at the same time?		
If yes, are these controlled as separate zones?		
How many hours per week is the heating on?		

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Insulation and draughtproofing

Check	Yes / No	Comments / Possible actions
Does the room temperature feel comfortable?		
How does this vary in different areas of the building?		
Are there any draughts and if so where from?		
Are windows single/ secondary or double glazed?		
Do external doors shut quickly / automatically?		
Do the main doors have a draught lobby?		
Does the building have a flat roof or a pitched roof?		

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Insulation and draughtproofing continued...

Check	Yes / No	Comments / Possible actions
Is the roof properly insulated? (NB The recommended depth for mineral wool insulation laid on loft floor is 27cm)		
Does the building have solid walls or cavity walls? (The pattern of the brickwork and width of the wall will give you an idea*)		
Are the walls sufficiently insulated?		
Is the floor solid or suspended timber?		
Are there draughts from the floor? Is the flooring material in good condition?		

*https://www.cse.org.uk/pdf/wpdcc_how_to_recognise_cavity_walls.pdf

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Space and water heating, water usage

Check	Yes / No	Comments / Possible actions
Does the heating system work well?		
Have there been any complaints from building users?		
Are people in the building dressed appropriately for the time of year?		
Are portable heaters being used?		
Is the heating on, but windows/doors open?		
Are there timers for heating and hot water? Are they set to match occupancy times?		

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Space and water heating, water usage continued...

Check	Yes / No	Comments / Possible actions
Are heating thermostats working and set to the right temperature (19-20°C)?		
Who has access to the heating controls and does this lead to any problems?		
Has your boiler been serviced regularly?		
Are there any obstructions in front of the radiators or heaters? (eg curtains)		
Do the radiators have thermostatic radiator valves? Are they used effectively?		
Are the radiators in one room running at roughly the same temperature?		

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Space and water heating, water usage continued...

Check	Yes / No	Comments / Possible actions
Is heating on in unused spaces (eg cupboards, corridors)?		
Are blinds or curtains closed at the end of the day to cut down on heat loss?		
Is the hot water tank insulated and are all hot water pipes lagged?		
Is water heated at point of use?		
Are there any signs of leaks, dripping taps?		
Are taps left running after use?		
Are flushes on toilets and urinals working properly?		

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Space and water heating, water usage continued...

Check	Yes / No	Comments / Possible actions
Are there any signs of water constantly running into toilet pans or urinals?		
If you have urinals how do they flush? (eg mechanical or sensor?)		

Lighting

Check	Yes / No	Comments / Possible actions
Are low-energy (LED or CFL) light bulbs being used?		
Are lights on in empty rooms/unoccupied areas? (if so, where?)		

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Lighting continued...

Check	Yes / No	Comments / Possible actions
Are there occupancy sensors in intermittently used areas?		
Are lights on when daylight is sufficient?		
Are the windows and skylights regularly cleaned?		
Are light fittings clean?		
Are light switches clearly labelled?		
Is external lighting switched off during the day or set on a timer?		

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Lighting continued...

Check	Yes / No	Comments / Possible actions
Are lights located in appropriate places?		

Appliances

Check	Yes / No	Comments / Possible actions
Are there any appliances or chargers which are left on all the time?		
Are there any appliances or chargers which are left on all the time?		

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Appliances continued....

Check	Yes / No		Comments / Possible actions
Are there any appliances or chargers which are left on all the time?			
Are any appliances left on standby?			
Is the fridge/freezer defrosted regularly?			
Is the fridge/freezer door left open longer than necessary?			
Is the fridge thermostat working and set to the right temperature (2-4 °C)?			

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Appliances continued....

Check	Yes / No	Comments / Possible actions
What other electrical appliances (e.g. TV, radio, projector, kettle) are regularly used? Could they be used more efficiently?		
Do all appliances have high energy efficiency ratings?		

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Guidance on energy efficiency improvements taken from CSE data[1]

Insulation and draughtproofing

Energy, in the form of heat, is lost from buildings through the fabric of the building (walls, floors, windows and roof), and through gaps, mainly around doors and windows. You should look over the whole of the building to establish the situation and pinpoint where insulation and/or draught proofing will help to reduce heat loss. It is important to assess this before considering heating, as the energy efficiency of the building fabric will influence choices around a heating system.

Roof insulation

If your roof has little or no insulation then this is perhaps the first measure you should consider as it can be one of the most cost- effective. Around a quarter of a building's space heating loss can be through an uninsulated roof and the most appropriate form of insulation will depend on the roof construction. Flat roofs can be insulated externally or internally using boards or slabs. Pitched roofs can be insulated using loose-fill or by laying rolls of insulation above ceilings where present or placing slabs between rafters where not. Insulated suspended ceilings are another option. With a timber roof, it is crucial to allow for adequate ventilation and/or vapour barriers for long term protection.

Typical savings: 10-20% of space heating energy

Wall insulation

Large amounts of heat can also be lost through the external walls of a building. Where cavity walls exist, specialist advice should be sought about filling the cavity with insulating material such as mineral or glass fibre. Solid walls tend to be harder to insulate. Like roofs, they can be insulated either externally or internally, with the latter usually being the cheaper option. This typically involves insulated plasterboard applied to wooden batons fixed to the inside wall. An alternative involves sheets of foam-like material which can be glued to the wall. There's guidance on identifying solid/cavity walls on the EST website (www.est.org.uk).

Typical savings: 10-20% of space heating energy

[1] Centre for Sustainable Energy https://www.cse.org.uk/local-energy/download/an-energy-survey-pro-forma-76

Community Buildings DIY Energy Audit

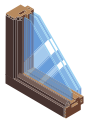
Guidance on energy efficiency improvements taken from CSE data[1]

Sealing gaps around windows, doors or floor skirting

Gaps around the floor, skirting boards, windows and doors can result in cold draughts and significant heat loss so they should be sealed wherever possible, whilst ensuring that adequate ventilation is maintained for spaces that need it.

Typical savings: 10-15% of space heating energy

Double glazing



Windows are generally areas of considerable heat loss and can cause down draughts of cold air. One way to cut down heat loss (and noise) is to install double glazing, either in the form of hermetically sealed units or by adding 'secondary' glazing such a second pane of glass or clear polycarbonate to create an air gap. Curtains and blinds can significantly reduce heat loss by acting as insulators and excluding draughts, particularly if they are made of heavy fabric and have a thermal lining.

Typical savings: 5-25% of space heating energy

Floor insulation

Installing floor insulation can be disruptive and is not often undertaken as a retrofit measure unless there are significant additional works required such as floor replacement. However, insulation beneath a suspended timber floor is sometimes possible, and where underfloor heating is present insulation is vital to prevent heat being lost to the ground. A more simple and cost effective approach would 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.

Typical savings: 3-5% of space heating energy

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Guidance on energy efficiency improvements taken from CSE data[1]

Space and water heating

There are many different types of heating/cooling systems using different types of fuel. Many of those in community buildings are old, inefficient or not operated property, which results in higher bills, higher carbon emissions and ineffective heating or cooling. Take a look at the system in your building and find out what it comprises and how it is actually used.

New boiler/heating system

Your building's space and water heating may be provided by a central boiler or by stand-alone heaters, or a combination of both. You should seek advice on whether this arrangement is appropriate. If the heating system is 15 years old or more it is likely to be relatively inefficient, especially in the case of a non- condensing boiler, and you may want to consider a replacement. Your decision will be influenced by your water-heating needs i.e. will the boiler provide hot water for basins or kitchen, or will these use stand-alone 'instantaneous' units. If the main system uses an expensive heating fuel (oil, electricity LPG) you may want to consider switching to mains gas or wood, although this can incur significant capital costs.

Typical savings for a new condensing boiler: 15-20% of (boiler) heating energy

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Guidance on energy efficiency improvements taken from CSE data[1]

New heating controls

Community buildings are normally used intermittently, leading to difficulties in allowing suitable warm-up times and timely switch- off. This can mean that the heating is often left on for much longer than needed. Advanced controls such as timers, programmers and zoning (individual control of more than one area) can lead to significant savings and more comfortable temperatures. The heating system and the control system need to be chosen together as different forms of heating lend themselves to different forms of control. It is also important to decide who will be in charge of the heating system, as operating it properly is essential if it is to work effectively. And thermostatic radiator valves (TRVs) and room thermostats should be regularly checked as people may fiddle with them and change their optimum settings.

Typical measures and savings:
Time controls on electric hot water tanks: 20-50% of water heating energy
Presence detector controls on electrically heated rooms: 10- 40% of space heating energy
TRVs: 5-10% of space heating energy
General upgrade of heating controls: 5-25% of total heating energy

Point-of-use water heaters

The demand for hot water can vary greatly over the week in a community building and it makes little sense to heat a whole tank of water just to use a small amount. Some form of local instantaneous appliance, usually powered by electricity or gas, may therefore be the best option for water heating. This also avoids long pipe runs where a hot tap needs to be run for some time before hot water is obtained.

Typical savings: 10-30% of water heating energy (where replacing centralised supply)

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Guidance on energy efficiency improvements taken from CSE data[1]

Insulation of hot water pipework

Hot water pipework which is uninsulated will result in heat being lost to the surroundings and where the pipe runs through unheated spaces, it will not usefully contribute to the heating of the building. Insulation of hot water pipes and valves can therefore be a simple, cost-effective measure.

Typical savings: 5-10% of space/water heating energy (depending on length of pipes)

Lighting

The majority of community centres are lit by fluorescent lights. These are relatively energy efficient but most can be upgraded to higher efficiency slim-line 'T5' tubes or better still LED fittings. In most situations simply replacing fluorescent tubes with LEDs is not possible because of the load and the starter motors (ballast) which can compromise the result. It is more costly but far more effective to replace the whole light fitting with an LED unit which can generally be found in a similar size to reduce the need for redecoration. New fittings require more of a capital outlay but result in better savings in the long run. Standard light bulbs or compact fluorescent lamps' (CFLs) should be replaced with LED bulbs which are now widely available. These give substantial energy savings, last 15 years or more and are now available in virtually all shapes and sizes.

Few community buildings have anything other than manual on/off switches for lighting control, meaning that lights are often left on unnecessarily for long periods. Timers and motion sensors can be an effective way of making significant savings, providing they are installed and set-up correctly taking into account the room or area's occupancy patterns.

Typical measures and savings:
Replacement of T12 or T8 tubes with T5: 40-50% of lighting energy
Replacement of T% with LED fittings: 45-65% of lighting energy
Replacement of tungsten filament bulbs with LED: 80-95% of lighting energy
Automatic lighting controls: 20-50% of lighting energy

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Guidance on energy efficiency improvements taken from CSE data[1]

Electrical appliances

Community buildings usually contain a range of appliances such as kettles or water boilers, fridges, microwave ovens and office equipment. Most new devices are now supplied with an energy efficiency rating, so by replacing old appliances with new ones (e.g. rated A++) substantial savings can be made. Simple programmable on/off timers can also be highly effective on a range of equipment including instantaneous water boilers, photocopiers and printers.

Typical measures and savings:
Time controls on office equipment: 20-60% of associated electricity use
Replacement of an old fridge/freezer with an A++ unit: 50- 80% of associated electricity use

Water use

There are a number of simple, low-cost measures that can be taken to reduce water use. If this is hot water, then there will be savings in energy, but even by saving cold water used in basins, sinks and toilets you will be saving energy because of the energy and carbon emissions associated with the water's supply and treatment.

Typical measures and savings:
Spray taps: 0.04 tonnes CO_2 per year (for a typical wash basin in use 6 days per week)
Volume control in toilet cisterns: 0.01 tonnes CO_2 per year (based on 12 flushes per day, saving 2.5 litres per flush)

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Calculating your annual energy use and associated CO2 emissions

The Centre for Sustainable Energy[2] set out the following method for calculating your CO2 emissions and for estimating the reduction in CO2 emissions resulting from the improvement measures you have identified.

·Multiply your annual energy use in kWh by the conversion facture for that fuel (gas, oil etc) to calculate the tonnes of CO2 (see table below). For gas and electricity, you can get kilowatt-hour (kWh) figures from your utility bills. Oil and LPG are usually billed in litres, so for oil multiply number of litres by 10.3 to get kWh, and for LPG multiply number of litres by 6.96 to get kWh.

Fuel	Annual use	Conversion factor (tonnes CO2 per kWh)	=	Tonnes CO2
Gas	kWh	0.000184	=	
Oil	kWh	0.000253	=	
LPG	kWh	0.000217	=	
Electricity	kWh	0.000462	=	

Estimate the CO2 savings from the measures you have identified. By applying the percentage savings figures given in the previous section to your annual energy use as noted above, you can estimate the CO2 savings that are likely to result from the energy efficiency improvements you are considering.

[2] Centre for Sustainable Energy https://www.cse.org.uk/local-energy/download/an-energy-survey-pro-forma-76

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CO2 savings from energy efficiency measures

Improvement eg Insulation	Approx. CO2 saving	Applicable energy use [kWh/yr]	Approx. energy saved [kWh/yr]	Conversion factor [tCO2/kWh]	Approx. CO2 saving [tonnes/yr]

Column 1: This is the measure you are considering eg roof insulation

Column 2: Approx. saving (%)
This is the estimated CO2 saving (%) given earlier, e.g. for roof insulation this is 10-20% (of space heating energy). As savings can vary depending on the specific circumstances of the measure, the ranges given are approximate and you will need to estimate a figure using common sense (e.g. insulating a very short piece of pipework will result in a low energy saving compared to cladding several long sections of piping.)

Column 3: Applicable energy use
This is the proportion of your total energy use that the saving refers. This is fairly straightforward if you heat your space using a fuel for which you are billed separately (it will be the relevant kWh figures you supplied for your annual energy use above). But, say your space is heated by electricity. Then it's not so simple because you'll also be using electricty for lighting, appliances etc, so you need to estimate the proportion of electricity that space heating accounts for. Similarly, your water heating system may use the same fuel as that for space heating.
As an approximate guide, total energy use in a typical village hall may be split as follows: space heating 70%; water heating 5%; lighting 15%; electrical appliances 10%.

CO_2 savings from energy efficiency measures

Column 4: Approx. energy saved
This is the actual amount of energy (kWh) that is likely to be saved from the measure; e.g. for roof insulation and an annual space heating requirement of 40,000 kWh, this figure would be 15% of 40,000 = 6,000 kWh.

Column 5: Conversion factor
This is the value used to estimate CO_2 savings resulting from the quantity of energy expected to be saved. The conversion factor is dependent on fuel type and can be taken from the figures at the beginning of this section above; e.g. where oil is the fuel of interest, the conversion factor will be 0.000253 tCO_2/kWh.

Column 6: Approx. CO_2 saving
This is the estimated CO_2 savings resulting from the quantity of energy expected to be saved; e.g. for an annual space heating saving of 6,000 kWh where oil is the fuel used, the saving will be 6,000 kWh x 0.000253 = 1.52 tonnes CO_2 per year.
Note – for water efficiency measures, you can estimate CO_2 savings directly from the figures given.

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Developing a carbon reduction action plan

Once you have a list of possible improvements you can develop a carbon reduction action plan setting out priorities for action, costs, timescales and responsibilities. Identify areas where fundraising will be needed and agree who will review this plan and how often.

Action	Responsible person	Time frame	Costs	Comments	Comments (eg fundraising requirements, obtaining three quotes, need for planning permission)
Short term					
Mid term					
Long term					

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Further resources

If you have any questions regarding this energy audit, please contact the Community Buildings Team at CCS on **sallys@somersetrcc.org.uk**

- Centre for Sustainable Energy - A wide range of information including community building case studies, funding sources and information fact sheets visit: https://www.cse.org.uk/local-energy
- The Carbon Trust website has a range of publications and good practice guides that are available to download visit: https://www.carbontrust.com/
- Energy Saving Trust visit: https://energysavingtrust.org.uk/
- Somerset Climate Action Network visit: https://somersetcan.org.uk/

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01823 331222

info@somersetrcc.org.uk

www.ccslovesomerset.org

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