Energy efficiency for community buildings

Vital Villages

asiantaeth ynni SevernWye energy agency

This booklet was produced by Severn Wye Energy Agency.

Severn Wye is a charity and not-for-profit company, established in 1999 under the European Commission SAVE programme to promote sustainable energy and affordable warmth through partnership, awareness-raising, innovation and strategic action.

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Introduction

For communities, improving the energy efficiency of their buildings has never been more attractive thanks to the benefits this offers: reducing energy consumption, better long term security through reduced running costs, and warmer community spaces.

With rising fuel prices it is more important than ever for communities to stop, take note, and reduce the amount of resources that their community building is consuming.

Whilst surveying community buildings there are common issues that appear again and again, so the Vital Villages team of energy advisors have put together this booklet to help you to improve your community building.

Right: examples of a gas meter and, below, an electricity meter

Energy use

Learning how much your energy use costs and when it is used is key to understanding how to use less and to save money.

To do this you need to know how much energy you use, and this means taking regular meter readings.

We recommend taking these once a month (or weekly if possible) and recording the data in an energy diary.

To take this one step further you can have an energy monitor installed.

These are cheap and easy to install, and provide real time energy use information to the users of the hall.

It is particularly useful to record the base load (minimum background electricity required) of the hall, and then to ensure that this energy level is achieved every time the building is unoccupied.

It will help you to:

- Identify the biggest users in your building
- Find out the baseline consumption
- Find out where you can save
- Change users' habits

Below: the display unit of an energy monitor

How much do appliances cost to run?

To illustrate how much appliances cost to run, the table below shows how much it would cost to run a number of different appliances for set amounts of time.

Appliance	Duration	Units (kWh)	Approximate cost
Dishwasher (1.05 kW – new A-rated appliance)	1 full load (30 min quick wash)	0.525	7.35p
Kettle (3 kW)	1.75 litres of boiled water	0.15	2.1p
Microwave over (0.75 kW)	5 mins	0.0625	0.875p
Electric grill (3.4 kW)	Medium heat for 0.5 hrs	1.7	23.8p
Radian electric cooker ring (2 kW)	1 hour	2	28p
Fridge	24 hours	1-2	14p-28p
Freezer	24 hours	2-3	28p-42p
Vacuum cleaner	1 hour	1-2	14p-28p
Energy saving lightbulb	1 hour	0.011	0.154p
Conventional lightbulb	1 hour	0.060	0.84p

The above costs are based on a unit price of 14p per kWh.

How much do appliances cost to run?

You can, however, make these calculations yourself if you know how much a unit (kilo Watt hour: kWh) of electricity costs you.

This information is displayed on your bill.

You will also need to know the power rating of your appliance (this is usually displayed on a label on the appliance itself, often on the back or underside), and have a calculator to hand.

If the label on your appliance says 2 kW, then it would use 2 kWh if it was left on for an hour.

If the appliance is displayed in Watts it is easy to convert to kWs as there are 1000 watts in a kW – the formula is below:

Watts ÷ 1000 (to get kW) x minutes ÷ 60 = consumption. Then multiply this by unit cost, e.g. 14p

Using the oil radiator below as an example, running for 1.5 hours, the calculation would be:

2,000 ÷ 1,000 x 90 ÷ 60 = 3 x 14 = 42p

So to run this radiator for 1.5 hours will cost 42p. Over a week this would cost £2.94, and £11.76 over a month.

This calculation works for appliances that use a constant amount of power. For appliances that use a varying amount of power (such as a fridge that turns itself on and off) it's best to use an appliance monitor to measure the energy use.

Below: a label from an oil radiator showing the power rating as 2,000 W

How much do appliances cost to run?

Appliances are getting more efficient – but, like heating systems, they need to be operated appropriately in order to minimise energy consumption

Appliances that run continually, such as fridges and freezers, deserve the most attention, and should be first in line when considering replacement.

Monitoring appliance consumption is easy to do, with the help of a plug-in electricity monitor.

This simply displays the live power and cumulative energy consumption of a single plugged-in device, or a whole plug bar, giving you an accurate picture.

By monitoring an appliance for just a week, its annual consumption, and therefore cost, can easily be worked out.

Simple timer plugs should be used on devices that don't need to run all the time, such as vending machines or bottle fridges in bar areas, and these cheap devices can pay for themselves extremely quickly.

Below: an appliance monitor in action

Refrigeration and freezers

To get the most out of your current fridge or freezer follow these top ten tips:

1) Defrost freezers and freezer compartments regularly.

2) Keep the grilles at the back clean to help them conduct heat effectively.

3) Locate appliances in cold locations, try not to put your fridge next to a cooker or heater if possible.

4) Cover liquids and wrap food stored in the fridge. Uncovered foods release moisture (and get dried out), making the appliance work harder.

5) Let things cool before you put them in the fridge or freezer.

6) Leave space inside your fridge at the back and top to help cold air circulation, but otherwise you can save a little electricity by keeping it full.

7) Fill space in your freezer with bread or a scrunched up newspaper.

8) The less you open the door the more energy you will save.

9) Do not use mini fridges or wine coolers if possible. They can use twice as much energy as a small fridge. If using, only switch on when necessary or use a timer, and pre-chill drinks in a regular fridge.

10) Only turn on when required or use a timer if required at set times (bottle fridges for example).

Refrigeration and freezers

Need a new appliance?

Check your door seals. They should be tight enough to hold a piece of paper securely when the door is closed. If the paper drops out, your fridge is leaking cold air.

Also check your temperatures: fridges should be 2-5°C and freezers minus 18-22°C. Setting the temperature too low will waste energy. Also, if your appliance struggles to reach these recommended temperatures due to a fault or poor seals, they will not be working efficiently.

To work out if it's worth replacing your fridge or freezer, use a plug in energy monitor to see how much your fridge or freezer uses, then compare this with the energy label on new appliances.

Sarah's Story

Sarah was given a 20-year-old medium-sized fridge freezer.

She tried a plug-in energy monitor and calculated the running costs to be £221 per year (1582 kWh).

She later purchased a new, larger fridge freezer, and calculated its running costs to be £39 per year (277 kWh).

Payback time: 3.5 years.

Energy labels

Energy labelling is now familiar to most of us, but a new version of the EU-wide energy label has recently been launched.

The new label style (*see below*) makes it even easier to see the true consumption of a new appliance, and to compare models.

Look out for the new label when buying, and always consider the full lifecycle cost of a device.

For example, a top-rated A+++ fridge may cost £100 more to buy, but could save £200 or more in energy over its lifetime.

Energy labels

The label on the right shows the kWh use per year. Multiply this figure by the cost of your electricity per unit. This is how much the appliance will cost to run per year.

Opposite page middle: an example of an under-used fridge

Opposite page bottom: an example of a badly located fridge, with a storage heater tucked away behind — with their heat outputs working against one another

Below: the new version of the energy label clearly displaying an A++ rated appliance

Lighting

LED bulbs use around one tenth of the energy of halogen bulbs and have a much longer life, i.e. around 40,000 hours compared to 3,000 for a halogen bulb.

LEDs are now available for most fittings, but are more commonly used to replace halogen bulbs in a GU10 fitting.

Standard LED replacement bulbs

Typically no additional technology is required, simply unplug your Halogen and plug in your ultra efficient LED GU10 replacement – no transformer is required. Available in spot or wide angle versions in a range of colours.

Warm white bulbs: white with a hint of yellow/orange – ideal for mood and evening lighting.

Cool white: White with a hint of blue – generally brighter light, with a more daylight appearance.

Compact Fluorescent Lamp (CFL)

Replace remaining incandescent bulbs with equivalent compact fluorescent (CFL) low energy bulbs, or optionally with good quality LED bulbs, which save 80% of energy.

The colour of light

Fluorescent light can seem 'colder' than light from a traditional tungsten light bulb.

Modern compact fluorescent lights can be made in various "colour temperatures" and the colour temperature of some bulbs is shown on the packaging.

Fluorescent tubes

Many halls still have standard T8 and large T12 fluorescent tubes. Replacing these with the high frequency T8 or low energy T5 could save up to 40% of electricity consumption.

T5 lamps are produced in different sizes and have pins spaced much closer together so are not directly interchangeable, but inexpensive adaptors are available so that T5 lamps can be used in existing light fittings.

T5 fluorescent lamps have a longer lamp life than T8 and T12 lamps, along with a better quality of light.

It is also important when replacing fluorescent lamps to purchase lamps with a triphosphor coating, which prolongs the light output of the lamp far into its operational lifetime.

This results in less frequent lamp changes and reduced replacement costs.

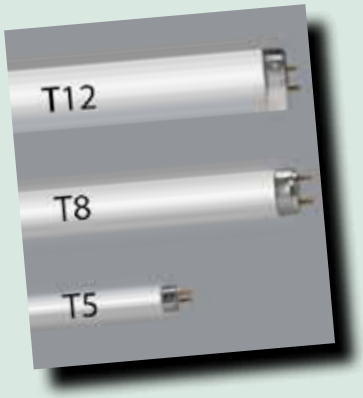
Not sure which type of Fluorescent tubes you have?

The number after the letter T is directly related to the diameter of the tube.

T12 = twelve eighths of an inch or 1.5 inch thick

T8 = eight eighths of an inch or 1 inch thick

T5 = five eighths of an inch thick



Building fabric

Buildings lose heat in only two ways – it is important to remember this.

These are *fabric heat loss* (i.e. poor insulation and high heat transfer rates through elements of the structure), and *uncontrolled ventilation* (i.e. draughts and unwanted air leakage).

Addressing both of these factors will lead to a long-term reduction in energy consumption.

The breakdown of fabric heating loss for many buildings is roughly as follows:

Walls: 35%

Loft or roof: 25%

Glazing and doors: 15%

Floors: 10%

Uncontrolled ventilation: 15%

Of course these proportions will vary depending on the building's shape, size, glazed area and the construction type of each element.

As building fabric improves, in newer and better-insulated buildings, then the uncontrolled ventilation aspect represents a higher share of the overall heat loss.

Below: cavity wall insulation being installed in a community building

Opposite middle: existing loft insulation disturbed by electrical work

Opposite bottom: example of well-laid insulation up to the recommended 300mm

Building fabric

Walls and roofs are key areas for fabric improvements in most buildings, and these should be tackled as follows:

Walls

If missing, cavity wall insulation should be added to existing cavity walls wherever possible.

For solid walls, external wall insulation is desirable in performance terms, but is expensive and often impractical. Internal wall insulation can be considered instead, and may be preferable in intermittently used buildings where a rapid warm-up is desired.

Roofs

Any standard lofts should be insulated up to 300mm depth where possible, with various materials available.

Where no loft exists, sloping ceiling, flat roof or rafter-level insulation can be installed via various approaches, although this is inevitably far more expensive.

Building fabric

Improved glazing

Whilst this is often desired for a variety of reasons, it tends to have the longest payback time of all fabric improvement measures, due to its high cost and the relatively small part of the building envelope that it represents.

Note that even the best double glazing will have a U-value (heat loss parameter) several times higher (1.3–2.0) than a well-insulated wall (0.15–0.35), and that triple glazing, whilst achieving lower heat loss, is very rarely justified under UK climate conditions.

Thick heavy lined curtains can be used to minimise heat loss from glazing.

Ventilation heat loss

This may be tackled through comprehensive draught-proofing, with attention paid to all openings in the building fabric, such as key holes, letter boxes etc.

However, heritage buildings are a special case, since their more sensitive fabric often needs to 'breathe'.

Ventilation and control of moisture in older buildings is a specialist topic, and proper advice should be sought before any work is undertaken.

Below: a gap between a steel door and a stone threshold, allowing cold air drafts to enter the building

Upgrading your boiler

If your boiler is more than 15 years old it may be time to think about replacing it with a modern, more efficient one.

It is better to plan to replace your boiler than to wait for it to break down, as you will be able to take your time and shop around to get the best deal rather than having to rush into whatever you can get at short notice.

You will also avoid the discomfort of the boiler breaking down in the coldest days of winter.

Renewable energy technologies should be considered (see our renewable energy booklet) if your system is not on mains gas.

Lagging pipes

Lag pipes in all non-heated spaces, including cupboards, transit corridors, beneath floors etc, subject to access. This will reduce heat loss from pipes and prevent overheating in summer.

Controls

Heating systems tend to be the largest energy consumer in a building, and thus play a very important role in determining a building's running costs.

Very few heating systems, whether good or poor, are fully optimised; improving the control of any existing heating system can always yield meaningful energy savings, at relatively low up-front cost.

Below: an example of lagged pipes in the boiler room – note that the valves should also be lagged to save heat loss

Central heating systems

The ideal heating control system

The ideal heating control system provides precise control of running times and temperatures in each area of the building, according to usage patterns.

Firstly, this requires the heating system to have as many 'zones' as there are different building areas, each with independent controls.

Heating times should be able to be varied by day, and thus a seven-day timed programmer is preferred.

Temperature control

Temperature control is usually by means of well-located room thermostat in each zone.

Time and temperature control can be combined into a single unit called a 'programmable thermostat', which allows temperature to be set by time.

In other words, you can set an operational temperature (say, 20°C) for in-use times, and a setback temperature (say, 10°C) for other times, to prevent the building from getting too cold or damp.

Below: a room thermostat set to 15°

Opposite page middle: a thermostatic radiator valve or TRV on an individual radiator

Opposite page bottom: a tamper-proof cover on a room thermostat

Central heating systems

Refinements

Refinements include an 'optimum start' facility, meaning that there is no need to worry about warm-up times; the system simply 'learns', for example, when to fire up so as to reach 20°C by 10am.

Other options include weather compensation, which can vary the flow temperature according to the outside temperature.

Note that full control systems are also available for some electric heating installations.

Tamper-proof controls

Tamper-proof controls are also encouraged in community buildings, although it is sensible to provide an override facility, so that hall users can boost the heating for, say, 1 hour – but no more.

Setback times

Experiment with different setback times for pre-heating of the hall. On milder days/ weeks, this may be reduced from 60 mins to 40, 30 etc.

Electric heating (standard tariff)

Electric heaters

Electric heaters are only suitable for buildings that are used infrequently.

Where a building is used regularly and has a higher demand for heat, investment in alternative heating options should be considered.

A pellet boiler or a heat pump, for example, may provide a more efficient alternative in some buildings.

Controls

Electric heating switches should be such that they cannot be left on accidently. The controls should also include a thermostat to unsure that the space is not over heated.

Experiment with different setback times for pre-heating of the hall. On milder days/ weeks, this may be reduced from 60 mins to 40, 30 etc.

Immersion heater

If you heat your water using standard electricity, you may have a hot water storage cylinder fitted with an immersion heater.

Water should only be heated when needed.

There should also be a timer, normally found near the hot water cylinder, which can be used to set the time that the water is heated.

If the building only requires a small amount of hot water it may be cheaper to run an instantaneous water point system, rather than heat a whole tank of water.

See our renewable energy booklet for information on solar thermal and renewable heating options.

Electric heating (Economy 7)

Economy 7

If electric night storage heaters are the main means of heating, you should be on an Economy 7 tariff. This means that you benefit from a cheaper tariff for the electricity used during seven hours overnight.

It's important to use this cheap rate to charge up your storage heaters and heat up your hot water (if needed) with an immersion heater. The exact times of the cheap tariff vary so check with your supplier.

Storage heaters

Night storage heaters are designed to store heat from electricity supplied at the cheaper night time tariff and then release it the following day.

Controls

Your storage heaters will usually have two controls: one that controls the amount of 'electrical' energy going in overnight (the input) and one that controls the amount of warm air coming out (the output).

However, as long as it's warm, the heater will radiate some heat from its outer casing.

Check you storage heater manual to see it the heater has automatic weather compensation, if so alternative control settings will apply.

If not, please see over the page for further instructions on how they should be controlled.

Below: open storage heater controls

Electric heating (Economy 7)

Input

You can vary the setting to store more heat when the weather is colder. It's recommend that you adjust storage heater controls on a daily basis, to reflect the following day's expected weather conditions and the different usage requirements for the building. Set it high in the winter, and medium in the autumn and spring.

Output

It's most economical to set the output control to minimum during the night, when the hall is empty, and to keep it low for as long as you can during the day. That way you will keep as much heat as possible for the building if used during the evenings.

When the building begins to feel cold, turn up the output a little. If you find that you are still running out of heat, try turning the input control higher for more heat the next day.

Immersion Heater

If you heat your water using Economy 7 electricity, you may have a hot water storage cylinder fitted with an immersion heater. The water heats up at night and is stored for use during the following day and evening.

There should also be a timer, normally found near the hot water cylinder, which is set to heat a cylinder of water during the cheap period. This means that you will have a full cylinder of hot water at the beginning of each day.

It's very important that the controller is showing the correct time, otherwise it will heat up at the wrong time.

Dual immersion heaters have the function to top up the hot water during the day as the cylinder has a second element at the top of the tank.

Hot water tanks (all)

- Ensure that your hot water tank is set to 60°C. This is hot enough to kill water born bugs and diseases without wasting energy and risking scalding.
- Always make sure hot water taps are fully turned off.
- Make sure that your hot water tank is insulated with a hot water tank jacket of at least 80mm thick.
- Where there is only a small demand for water, point-of-use water heaters may be worth consideration, rather than heating a whole tank of hot water.
- Ensure that the water cylinder is appropriately sized to fit the building's water requirements. Do not over size the cylinder as this will waste energy.

Top right: example of unlagged pipes on an hot water boiler

Right: electric instant hot water unit provides on demand hot water

Water efficiency

Although water usage is not the primary focus of this leaflet, it's strongly recommended that consideration is given to reducing water consumption.

Reducing hot water consumption also saves energy.

Some water companies provide free water saving packs, which include some of the devices stated below.

Here are some tips:

- All water outlets should be fitted with aerator fittings. Aerators mix air with the water giving the impression of a higher volume of water – this should include aerating shower heads. This has the potential to reduce water use/costs by up to 40%, and to save on hot water energy costs as well.
- Self-closing taps should be installed ('percussion taps').
- Low water use WCs should be installed. In the short term water displacement devices could be installed in the cisterns of all the WCs, such as flush savers or 'hippos'.
- Waterless urinals should be installed. In the short term, any automated flush controls should be replaced with occupancy sensors, avoiding regular flushing through the night.
- Hot water pipework should be insulated. Once a tap is turned off, the pipe between the source and the tap is still full of hot water. By insulating this pipework, the water stays hotter for longer – reducing run-off waste when the next person uses the tap.

Other top tips

- Ensure that external doorways are kept closed during cold weather, and that the existing curtains are closed in the main hall at dusk, to reduce heat loss through the glazing.
- Regularly review your energy supply tariffs (at least annually, subject to contract tie-ins etc), to ensure that you are always paying the lowest available unit prices for electricity, gas and oil.
- Record your water meter readings regularly. If the readings show a sudden increase it may be because there is an underground water leak that you cannot see.

Middle: a movement sensor for a urinal flush system

Right: it's worth regularly checking your taps for any leaks and replacing any worn washers

Further support and advice

Link to Energy

This is a free-to-use online database helping you to find sustainable energy installers and tradespeople in your area.

www.linktoenergy.org.uk

Energy Saving Trust

The Energy Saving Trust offer impartial advice to communities and households on how to reduce carbon emissions, use water more sustainably and save money on energy bills.

www.energysavingtrust.org.uk

English Heritage

English Heritage have produced a useful guide on how to improve the energy efficiency of historic buildings.

www.english-heritage.org.uk/publications/energy-efficiency-historic-buildings-ptl

Sust-It

Electrical energy efficiency website.

www.sust-it.net

Cadw

The Welsh Government's historic environment service working for an accessible and well-protected historic environment for Wales.

www.cadw.wales.gov.uk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TURN THERMOSTAT TO
15°
BEFORE LEAVING

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This booklet was produced by Severn Wye Energy Agency for the Vital Villages project.

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