Guidelines
for Hut Managers
No. 14 December 2016*

Going Green – Energy Saving

Scope and context

These guidelines are designed to indicate how the energy requirements of mountaineering huts might be reduced and thereby reduce their carbon footprint. Energy costs seem bound to continue to increase for the foreseeable future and therefore hut operators would be well advised to take all possible measures to reduce, or at least stabilise, their energy consumption.

Many huts are old buildings that are constructed of stone. A lot of energy is needed to heat and light these buildings. It may prove difficult to reduce energy consumption in such huts but some savings can be made provided that clubs are prepared to review their overall energy consumption and then to take whatever steps could be taken to reduce it.

Energy saving schemes need to be cost-effective given the irregular occupancy of most huts. The payback time for some energy saving systems may be longer than the expected lifetime of the installed system and some systems will not be suitable for some huts due to the building's construction and location. Note that the costings quoted in this guideline are only approximate and you should undertake further detailed research.

Insulation

Well insulated huts use less energy. Improving the insulation of the hut to reduce heat loss is probably the most cost effective means of conserving energy and reducing fuel bills. Where possible windows should be double glazed and windows and doors made draught proof. Hot water cylinders and pipes should also be insulated. For detailed guidance see –
www.energysavingtrust.org.uk/home-insulation

Roof space

The hut loft should be insulated. Mineral wool (or more user-friendly polyester wool made from recycled p.e.t. bottles) or expanded polystyrene (200 - 250mm) are suitable for this purpose. Electrical cabling may need to be adjusted or extended in roof spaces in order to avoid the possibility of overheating where it is covered in insulation – refer to advisory literature provided by many DIY stores, e.g. B&Q. A suggested solution is to clip the cable to the main joists, which act as heat sinks.

Walls

It is not easy to insulate the external walls of huts that have solid stone walls. Provided that the hut's internal dimensions permit then insulated dry lining can be undertaken. This method involves using either plasterboard laminated with insulation and fixing the whole thing to the inside of the external walls or insulation fixed to the walls with battens (studwork) onto which the plasterboard is fixed. Timber cladding may also be used. The timber being fixed to battens on the walls with insulation inserted in between the battens and covered with a breathable membrane behind the cladding.

*See notes in the information box on page 8 re. the currency (version no.) of this guideline

Where space is limited then high-tech insulation such as Aerogel can be used. This insulation is very expensive but it has the highest insulation properties of all the materials currently available. See – www.lowenergyhouse.com/aerogel-insulation.html

Floor

The floor should also be insulated if at all possible. Expanded polystyrene (80 -100mm) or extruded polystyrene (50 - 75mm) are both suitable for underfloor insulation.

Water and space heating

Wood and multi fuel stoves

Solid fuel stoves are an effective way to provide intermittent heating. Stoves are available which have a back boiler that can be set to heat a hot water tank. Wood burning stoves offer the benefit of relatively low cost heating using a sustainable resource, together with a nice focal point for a hut. The thermal efficiency of wood burning stoves vary considerably so it is important to select an efficient model. See – www.whatstove.co.uk

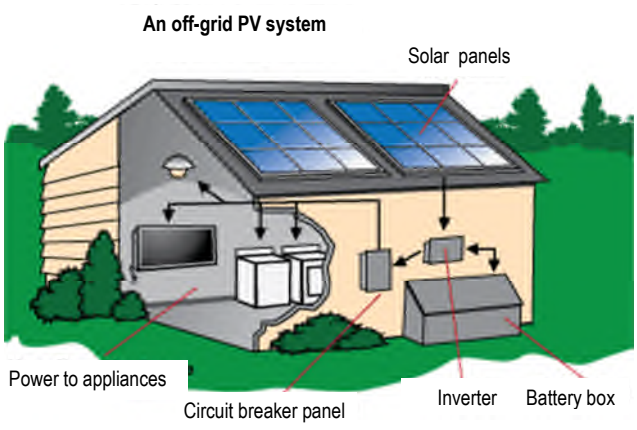
It is important that stoves are installed correctly, not only to ensure maximum efficiency but also to avoid fire risk and to ensure that adequate ventilation is provided to prevent the possible build up of carbon monoxide. A building warrant is required in Scotland for the installation of a new stove and associated flue.

Solar energy

Solar energy can be utilised by means of special panels, usually roof mounted. There are two types of system: photovoltaic (PV) and solar water heating.

Photovoltaic (solar PV)

How it works



PV systems generate electricity which can be used to power lighting and, with larger capacity systems, electrical appliances such as microwave cookers. An off-grid system is shown in the diagram. DC current from storage batteries is converted to AC (240 v) by an inverter. PV panels are usually roof mounted although they can also be mounted on the ground. If a hut has a mains electricity supply then surplus power can be sold to the grid.

See – www.energysavingtrust.org.uk/renewable-energy/electricity/solar-panels

Operating requirements –

- An unshaded south facing roof so as to to maximise the electricity generating potential. Experts claim that a roof facing 20 to 30 degrees either side of due S will still work well.
- Roof pitch – the ideal pitch is 35 to 40 degrees.
- Available roof area – at least 4 m^2 is needed for even the most basic PV system but an area of between 6 and 9 m^2 is better.

PV solar panels are easy to install with minimal internal work. Roof mounted panels are usually 'permitted development' so planning permission is not required unless the building is listed, in a conservation area or in a national park.

Cost

See the costings in the drop-down table on –

www.energysavingtrust.org.uk/renewable-energy/electricity/solar-panels

Maintenance

Costs are low as the system has no moving parts. The PV panels should operate for 25 to 30 years although their performance will decline with age. The inverter may need to be replaced and this would cost about £1,000 - 2,000.

The feed-in tariff scheme (FITS)

This scheme became available in the UK on 1st April 2010. Under this scheme energy suppliers have to make regular payments to householders and communities that generate their own electricity from low cost carbon or renewable resources such as solar electricity panels (PV) or wind turbines. The scheme guarantees a minimum payment for all electricity generated, as well as a separate payment for electricity exported to the grid. These payments are in addition to the reduction in electricity bills by using the power generated on-site.

Note: The FITS tariff is reviewed regularly by the UK Government. For current informatiion see – www.gov.uk/feed-in-tariffs/overview

To qualify for FITS you have to use a Micro-generation Certification Scheme (MCS) approved installer. To get FITS at the standard rate for solar PV your property needs to have an Energy Performance Certificate (EPC) of band D or better. If you have an EPC which shows that your property in a band E, F or G you will need to carry out energy efficiency improvements before you apply for FITs or receive the FIT at a lower rate for the lifetime of the tariff. You will need to pay for a visit from a Domestic Energy Assessor (DEA) to your property. The DEA will produce an EPC banding for your property. If the property is not already within band D you may need to pay for two EPCs, one for the initial survey and one after the improvements have been carried out. The DEA should be able to advise you about the measures needed to take your property to a band D and those which will take it beyond that level. The cost of an EPC varies. Normally they cost about £50 to £100 plus VAT. You may want to request an estimate from an EPC provider before commissioning an EPC. See –

www.energysavingtrust.org.uk/renewable-energy/electricity/solar-panels/feed-tariffs

Note: There is nothing to stop you buying and installing solar PV panels yourself, but you will not receive FITS payments.

The indicative payback period

10 -15 years, taking into account the the income from FITS, grid exports and energy savings.

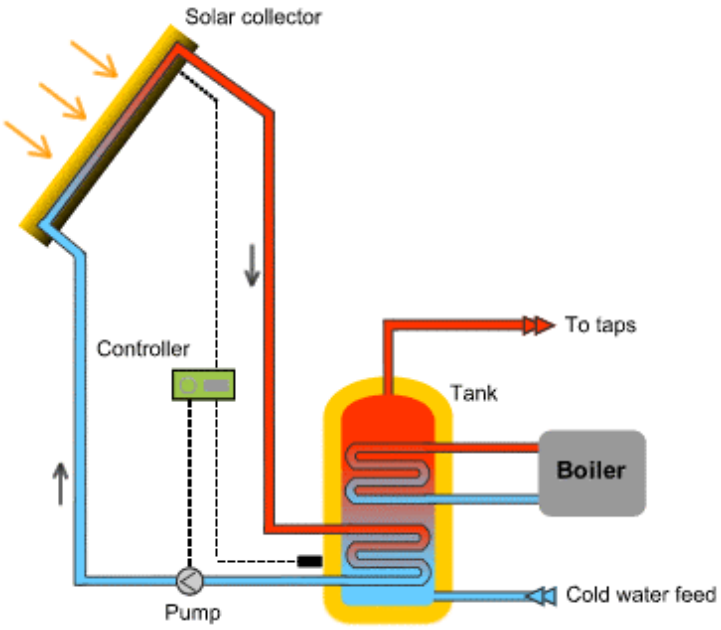
Note: An Teallach MC's hut, Strawberry Cottage, in Glen Affric, Scotland, is not connected to the national grid. Electricity for lighting is provided by an 8 x 75 W PV array. Electricity is stored in a battery array (12 x 2 V), which is usually sufficient to power the hut for a weekend if it charges up all week. The DC current from the storage batteries is converted to 240 V AC with an inverter. See – www.atmc.org.uk

Solar thermal

If correctly specified and installed, solar water heating can be very efficient. Good quality panels on a roof can supply 100% of hot water needs on sunny summer days to around 10% on a cloudy, winter's day, even in Scotland.

How it works

A solar water heating system has three main parts: one or more solar collectors – usually mounted on the roof, a pump connected to a controller and a hot water cylinder with two heating coils. The thermal fluid in the collector is heated by the sun and if the fluid in the collector is hotter than the water in the cylinder the controller activates the pump to pump the fluid through the coil in the cylinder so heating the water in the cylinder for showers and taps.



Operating requirements –

- Ideally, about five square metres of roof space, free of shade, which faces south. Roofs which face south-east or south-west may be used but they are not as efficient. The solar panels need to receive direct sunlight for the main part of the day.
- The panels need to be at an angle of between 20 and 50 degrees.
- The roof needs to be strong enough to support the panels.
- A larger hot water cylinder will probably be needed, preferably one big enough to hold at least two days' supply of hot water.
- Sufficient room for the larger hot water cylinder and a floor strong enough to support its weight. The floor may need to be strengthened.
- If possible, a pump powered by solar PV electricity as this will save energy.

Solar heating panels are one of the most efficient renewable energy resources available. It is claimed that they can provide 50 to 70% of hot water needs averaged throughout the year. They could provide most of your hot water from April to September and contribute to raising the water temperature during the remaining months of the year. The panels are compatible with most hot water systems. Roof mounted panels are usually 'permitted development' so planning permission is not usually required unless the building is listed or in a conservation area or National Park.

Maintenance

Maintenance costs are low. Most solar water heating systems come with a five or ten year warranty and require little maintenance. The panels need to be inspected annually and checked by an accredited installer every 3 to 5 years or as specified by the manufacturer.

Cost

See the costings in the drop-down table on –

www.energysavingtrust.org.uk/renewable-energy/heat/solar-water-heating

Savings

About £60 to £100 per year depending on how much hot water it produces, what fuel it replaces and whether the system is eligible for support from the Renewable Heat Incentive scheme.

A solar thermal system has been installed at Muir Cottage, the Cairngorm Club's hut near Braemar. The system saves 1,200 kWh/year plus £235 RHI/year for 7 years after installation.

Non-domestic Renewable Heat Incentive (RHI)

The non-domestic RHI scheme helps businesses and non-profit organisations to meet the cost of installing renewable heat technologies. Claims may be made for heat pumps and solar thermal collectors. Payments are made over 20 years and are based on the heat output of the system used.

See – www.gov.uk/non-domestic-renewable-heat-incentive

The indicative pay-back period

12 to 15 years if the system saves £100 per annum and generates £500 from RHI. Energy costs continue to rise so future savings may be greater.

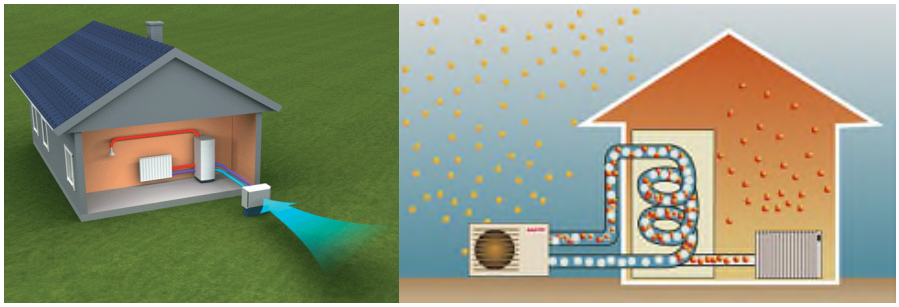
Energy from the air and ground

Heat pumps

Heat pumps take heat from the ground, air or water and use it for space heating and sometimes to heat water. These pumps do have some impact on the environment because they need electricity to power them. However, the heat they extract from the air, ground, or water is almost limitless.

Air Source Heat Pumps

Air source heat pumps absorb heat from the outside air. This energy is then used to heat radiators, warm air convectors and hot water in the building.



How they work

See –

www.energysavingtrust.org.uk/renewable-energy/heat/air-source-heat-pumps

There are two types of system available –

Air-to-water systems

These distribute heat via a wet central heating system. Heat pumps operate at lower temperatures than a standard boiler system and therefore they are more suitable for under-floor heating systems or radiators with a large surface area.

Air-to-air systems

These systems produce warm air which is circulated by fans but do not heat water.

Operating requirements –

- Space outside the building where the unit can be fitted to a wall or placed on the ground.
- The building needs to be well insulated and draught-proofed for the heating system to be effective.
- Planning permission may be required. There are certain planning constraints imposed on these units, mainly due to the noise issue and aesthetics. In Scotland, planning regulations require that not more than one unit may be installed within 100 m of each neighbouring property.

Potential benefits –

- Lower fuel bills where conventional electric heating is being used.
- No fuel deliveries.
- Provides space heating and possibly hot water.
- Easier to install than ground source heat pumps but may not be as efficient.

Potential efficiency

For English and Welsh huts that are heated with electricity, air-to-air units can halve bills. They have much lower running-costs than night storage heaters and are more controllable. However,they are more expensive to install and they do need more maintenance. They may not be suitable for huts in the Scottish Highlands because of the lower winter temperatures.

Cost

See the costings in the drop-down table on –

www.energysavingtrust.org.uk/renewable-energy/heat/air-source-heat-pumps

The indicative pay-back period

20 years based on current energy prices and estimated savings.

Maintenance

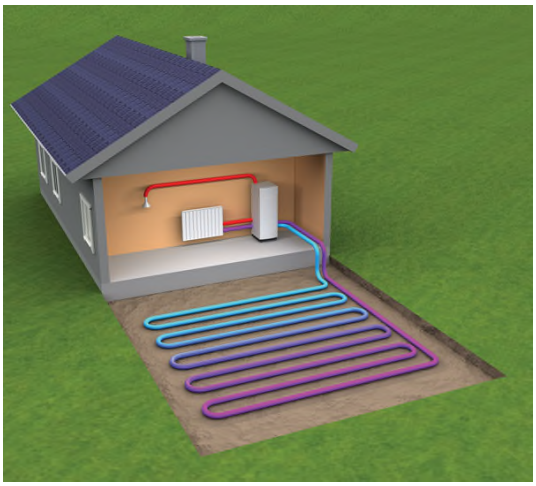
Air source heat pumps have an external unit with moving parts, which will be exposed to the damp British climate and therefore perioidic maintenance will be required. The external heat exchanger is kept at an optimum working temperature by means of an internal defrost cycle system to ensure its operation in all seasons. Their operating life is about 20 years. The fan can be noisy – about the same as a washing machine on spin cycle – so it should not be sited close to windows and doors. These units should be sited a minimum distance from any dwellings near the hut; consult your local authority's building control department and see –

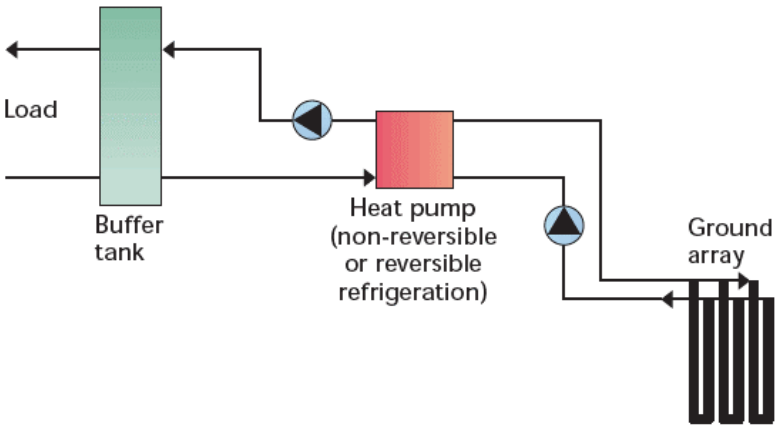
www.energysavingtrust.org.uk/renewable-energy/installation

Ground Source Heat Pumps

How they work

The principle is similar to that used in air source heat pumps, i.e. 'reverse refrigeration,' but in this case heat is extracted from the ground via a long run of buried pipe.





See – www.energysavingtrust.org.uk/renewable-energy/heat/ground-source-heat-pumps

Cost

Follow the *url* at the bottom of page 6 (above) and see the costings in the drop-down table.

Wind energy

Wind turbines

You should note that the laws of physics are not particularly kind to small wind turbines; a small turbine in an area with low average wind speed will yield very little power. Wind turbines may also be subject to damage in extreme wind conditions.This website provides information on average wind speeds across the UK on the basis of postcode or lat+ longitude – www.rensmart.com/Weather/BERR
Small wind systems can be connected to the national grid and surplus electricity sold to one of the power companies.

There are two types of domestic-size wind turbines –

Mast mounted

These are free standing and need to be erected in a well exposed position. Sizes range from 2.5 - 6 kW upwards.

Operating requirements –

- An exposed position with an average wind-speed of not less than 5m.s^{-1}.
- No large obstacles like other buildings, trees or hills which interfere with the flow of wind and cause turbulence.
- The site should be some distance from the building otherwise noise from the turbine maybe unacceptable.
- Planning permission from the local authority may be needed so check first with the local planning department.

Roof mounted

These turbines are smaller than mast mounted systems and they can be installed on the roof of a house or mountain hut. Planning permission may be required. These devices typically generate 1 - 2 kW. Noise should be taken into consideration when selecting a roof mounted turbine, see – www.renewabledevices.com/rd-swift-turbines/overview/ and
www.which.co.uk/reviews/wind-turbines/article/installing-a-wind-turbine/home-wind-turbines

Costs

See the costings in the drop-down tables on –
www.energysavingtrust.org.uk/renewable-energy/electricity/wind-turbines

Maintenance

Wind systems need to be checked every few years. A well-maintained turbine should last over 20 years. Storage battery life is normally between 6 and 10 years.

Load control

Wind turbines are designed to be under an electrical load when operating. The two most common loads for a wind turbine are a battery bank and the electrical grid. A diversion load sensor/controller is used to keep the wind turbine in its designed operating range and keeps

it under constant load. When the generator circuit is connected to both a battery bank and the national grid the controller switches to the latter when the batteries are fully charged and back to the batteries when they require charging. This keeps the battery bank from overcharging and the wind turbine always under load. See – www.windynation.com/jzv/inf/articles

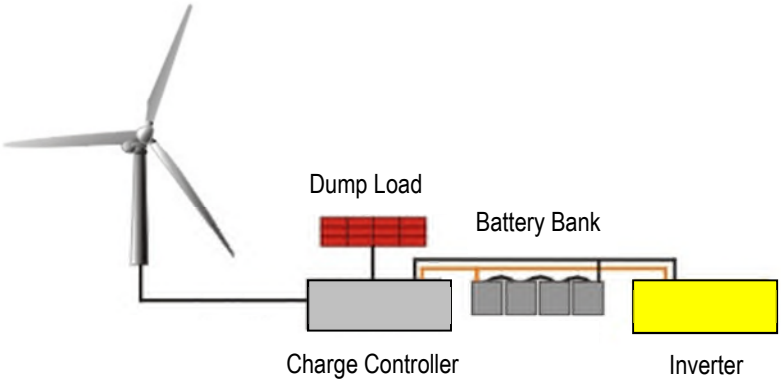


Diagram of an off-grid wind generation system with a dump load. In huts that have mains electricity the power can be fed into the existing wiring circuits and excess power can be exported to the grid and sold to energy suppliers.

When the generator is not connected to the grid it is necessary to have an alternative way of dumping the load when the batteries are not being charged. This may take the form of some kind of electrical resistance, such as a heating element. This heating element may be an immersion heater in a well insulated cylinder to provide a source of hot water water for a hut. See for example – www.reuk.co.uk/wordpress/wind/wind-turbine-water-heating/

The Scottish Mountaineering Club's CIC hut on Ben Nevis has a wind turbine and battery storage system. When the batteries are fully charged the turbine, if generating, dumps power to an electric storage heater. For further information contact the SMC via – www.smc.org.uk

The feed-in tariff scheme (FITS)

The UK government is not currently providing any grants for the installation of wind turbines. It is currently offering the Feed-in Tariff Scheme (FITS), which means energy suppliers have to make regular payments to householders and to communities that generate their own electricity from renewable or low cost carbon sources such as wind turbines. The scheme guarantees a minimum payment for all electricity generated, as well as a separate payment for electricity exported to the grid. These payments are in addition to the savings made by using the electricity generated on-site. For further information see –
www.gov.uk/feed-in-tariffs/overview and www.scotsrenewables.com/feedin.html

The bottom line

Although many of the measures outlined in this guideline could potentially save money and reduce the carbon footprint of your hut, in the end you must calculate the payback time before your investment breaks even, taking into account the expected lifetime of the hut (or the length of the lease) and the expected lifetime of the machinery that you propose to install and then decide whether it is really going to be cost effective. Refer to the information available on the website of the Energy Saving Trust (see below).

It is almost unnecessary to say that energy saving measures should be incorporated into the design of any new-build hut.

Useful links >

Useful links

Centre for Alternative Technology www.cat.org.uk
CAT information Service http://info.cat.org.uk
Community Energy Scotland www.communityenergyscotland.org.uk
Grants and loans available in Scotland www.energysavingtrust.org.uk/scotland/grants-loans
Microgeneration Certification Scheme www.microgenerationcertification.org
The Energy Saving Trust – best website for general info. www.energysavingtrust.org.uk
Windy Nation – useful technical articles www.windynation.com

Note: *If viewing this .pdf while online then clicking on any URL will take you to that website.*

About Hut Guidelines

These guidelines have been produced by the Huts Group of the British Mountaineering Council and the Huts Advisory Group of Mountaineering Scotland to assist those operating mountain huts in Britain.

Contact the BMC Huts Group by e-mail – huts@thebmc.co.uk or telephone 0161 445 6111.
Contact the MS Huts Advisory Group by e-mail – huts@mountaineering.scot

Websites: www.thebmc.co.uk and www.mountaineering.scot

URLs: If any of the URLs (web addresses) given on the preceding pages are found to be 'dead links' please notify huts@mountaineering.scot

Disclaimer: These guidelines were revised on the date shown below and the information herein is believed to be accurate at the time of writing. No responsibility can be accepted for any loss of benefit or entitlement arising through use of these guidelines – they are not intended to be definitive.

Version no. 3 - December 2016

These guidelines are updated periodically; to check on the currency of this version go to one of the websites above where the latest version will always be displayed.