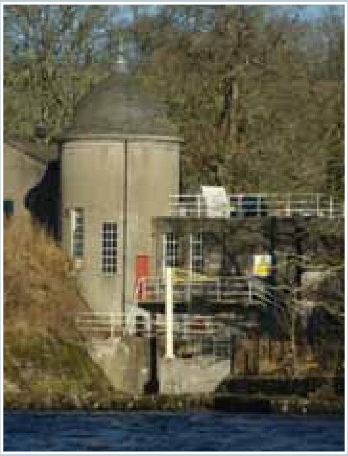
Managing Change in the Historic Environment

HISTORIC SCOTLAND

Micro-Renewables



Consultation draft
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Key Issues

1. Many historic buildings or places lend themselves well to some form of micro-renewable energy generation. The micro-renewable installation should be planned carefully to maintain the historic character of each site and to make best use of the available renewable energy sources.

2. Different types of micro-renewable technology suit different locations, and sometimes more than one type can be used in combination. When planning the introduction of micro-renewable technology, consider:

   - the interest and character of the historic building;
   - the setting of the historic building by assessing how its surroundings contribute to the ways in which it is understood, appreciated and experienced;
   - how the potential types of micro-renewable technology would impact in physical or visual terms on the building and its setting;
   - how to design and site the equipment to protect the character and appearance of the historic building or place. The cumulative effects of micro-renewable developments in proximity to historic buildings and their settings should also be considered.

3. Redundant equipment that is not of historic interest should be removed from buildings or their settings as soon as possible after it becomes inoperable or is superseded.

4. Other factors, such as environmental or ecological implications of the development, may also need to be considered.

5. Local authorities give advice on the requirement for listed building consent, conservation area consent and other permissions.

INTRODUCTION

This is one of a series of guidance notes on managing change in the historic environment. The series explains how to apply the policies contained in the *Scottish Historic Environment Policy* (SHEP, PDF 312K) and *Scottish Planning Policy 23: Planning and the Historic Environment* (SPP23, PDF 192K).

This note sets out the general principles on how to approach applications for micro-renewable energy developments affecting historic buildings, monuments and places. The use of renewable energy technology is strongly encouraged where the character of the historic building or place is protected through careful siting and design. The guidance makes no recommendation as to one type or brand of micro-renewable technology over another: the circumstances of each site need individual assessment. This guidance note should be afforded weight in drawing up planning policies and determining applications relating to the historic environment.

Monuments scheduled under the Ancient Monuments & Archaeological Areas Act 1979 require scheduled monument consent for any works. Where a structure is both scheduled and listed, the scheduling controls have precedence. Separate advice is available from Historic Scotland's website: Scheduled Monuments: Guidance for Owners, Occupiers & Land Managers (PDF 718K).

Above and below:
Part of a block of seven early 19th-century tenements in use by a housing association in Edinburgh. Solar water heating panels have been fitted to the inner south-facing slopes of the valley roofs to provide 50% of the hot water requirements of all the occupants. The new panels are not visible from the ground, or in views from higher vantage points. Energy conservation measures, such as secondary glazing, are also in place.

BACKGROUND

For the purpose of this guidance, 'renewables' are defined as energy forms that are essentially replenishable, unlike fossil fuel sources, which are finite. 'Micro-renewables' are small-scale non-commercial renewables using zero or low carbon technologies to provide heat and/ or electricity.

Increased use of renewable energy, including micro-renewables, can make an important contribution to efforts to reduce carbon emissions in support of climate change and renewable energy objectives. The Scottish Government has set a target to generate 50 per cent of Scotland's electricity from renewables by 2020, with an interim target of 31 per cent by 2011. Micro-renewables are expected to play an important role in meeting (or exceeding) these targets, and the historic environment will be a significant contributor.

Energy efficiency should be optimised before considering installation of micro-renewable technology. Various aspects of policy guidance on energy conservation measures for historic buildings are set out in other titles in this series, and Historic Scotland's Inform Guide: Energy Efficiency in Traditional Homes (PDF 715K) describes a number of ways to improve energy efficiency in traditional buildings.

Montgarrie Mills, Alford, Aberdeenshire, built on an older mill site in 1886. The five pairs of millstones continue to grind oats to oatmeal. © Crown copyright: RCAHMS. Licensor www.rcahms.gov.uk.

A repaired later 19th-century horizontal waterwheel, part of a corn mill in a series of nine such mills at Troswick, Shetland. © N Haynes.

A disused 18th-century windmill with a late 19th-century cap and an early 19th-century horsemill, Dumfriesshire.

TYPES OF MICRO-RENEWABLE ENERGY

The principal renewable energy sources currently suitable for widespread microgeneration include thermal (ground, water, air), hydro, biomass, solar and wind. There are a number of different technologies and types of equipment available for exploiting each energy source. Sometimes two or more different energy sources and technologies can operate together to maximise renewable energy (e.g. photovoltaic panels can provide the energy to power a ground or air source heat pump). Domestic combined heat and power (microCHP) systems require a separate renewable or fossil power source, but can substantially improve energy efficiency. Hydrogen and fuel cell technologies are not yet widely available, but offer significant potential for future use.

Each type of equipment has specific site requirements, and not all equipment is suitable in technical terms for every location.

HISTORIC RENEWABLE ENERGY TECHNOLOGY

Scotland has a long history of renewable energy generation that is reflected in the historic environment. Whilst few historic generators remain in use, former hydro sites, and occasionally parts of the equipment, offer potential for reuse in modern microgeneration.

Although there are earlier isolated examples, widespread use of the wind for milling, pumping and sawing began in the late 17th century. No early windmills remain in use, but many of the masonry towers survive.

Small-scale water power was a very significant source of energy from the 12th century until the early 20th century. From the late 18th century whole communities were developed around major water-powered mills such as New Lanark. The mid 20th century saw construction of large-scale hydro-electricity plants and associated dams/reservoirs in the central highlands. Large numbers of watermills and other small hydro developments and associated engineering survive throughout the country.

PRINCIPLES FOR NEW MICRO-RENEWABLE DEVELOPMENT AFFECTING HISTORIC BUILDINGS AND THEIR SETTINGS

Establish what is significant about the building and its setting

In planning micro-renewable developments, it is important to start by identifying the interest and character of the historic building and its setting.

The original purpose, style, height, profile, materials and details of the building can all be factors in defining its character. Whilst some buildings are designed to be seen from all directions, other buildings may have parts of lesser interest or less visible elevations.

In general terms 'setting' can be thought of as the way in which a historic building's surroundings contribute to how it is experienced, understood and appreciated, and it can extend beyond the immediate property ownership and also include archaeology. Further advice on defining the setting of a historic building is set out in a separate guidance note in this series.

Identify potential physical impacts

Physical impacts on a historic building can include the removal of historic fabric, the attachment of fixtures, or the operational effects of equipment (vibration, emissions etc.). The physical impacts on the setting of the building should also be considered. The formation of trenches, boreholes or foundations can damage the underground archaeology that sometimes surrounds historic buildings.

Identify potential sensory impacts

In relation to the interest of the historic building the most significant sensory impacts are likely to be visual. Equipment that covers over or replaces historic fabric in obtrusive locations, or is visible in the profile of the building, is likely to have an adverse effect on the historic character of the building. Free standing equipment may also impact on the setting of a historic building if it is located in principal views to or from the building, or interrupts designed spatial relationships with other buildings or natural features. Noise, emissions and vibration are other sensory factors that are considered as amenity issues in relation to planning permission, but which can also impact on the character of a historic building or place.

Seek to protect the character by careful siting and design of equipment

Most micro-renewable developments require a generator and associated equipment and cabling for transforming and distributing heat/electricity. Some equipment can be housed internally, and some requires an external location. External equipment should be sited in the least conspicuous location available and any protective housing designed to be as unobtrusive as possible. Existing outbuildings should be considered for housing or mounting equipment. Careful planning of cabling and pipework can also minimise impact by specifying the minimum necessary diameter and length, and by routing to avoid principal elevations. Interior equipment and cabling/pipework should similarly be located to avoid damage to significant historic spaces. New extensions to listed buildings can often be designed from the outset to incorporate micro-renewable technology to provide energy for the historic building.

Where a building, or complex of buildings, is in multiple ownership or occupation, the visual impact of micro-renewable equipment can be minimised and the installation costs reduced by design of a single system to service the whole building or complex.

Blackhouses at Gearrannan, Isle of Lewis, refurbished for self-catering holiday and hostel accommodation. Three ground-source pumps totalling 51kW output were installed at one central location to service seven cottages. The effect on the character of the buildings is minimal. © Crown copyright: RCAHMS. Licensor www.rcahms.gov.uk.

1921 turbine house, Stanley Mills, Perth & Kinross, recently refurbished as part of a new hydro-electricity scheme to supply power to the grid. At 840 kilowatts the scheme is significantly larger than a standard micro-renewable development, but it demonstrates the potential for reuse of an existing historic hydro site.

Morgan Academy, Dundee, where micro-renewables have been incorporated sensitively. Ground- and air-source heat pumps are powered by photovoltaic panels located in the hidden valleys of the roof.

New Lanark mill lade. Receptor panels during installation for two 44kW water-source heat pumps. After installation the lade levels were returned to normal - the panels are not normally visible. © New Lanark Trust.

A former corn mill in the Scottish Borders, where a waterwheel was re-introduced to power a pump for a ground-source heat system. The historic mill pond, cauld, lade and wooden launder (trough) were all reused to drive the new wheel.

CONSIDERATION OF THE REQUIREMENTS FOR EACH MAIN TYPE OF MICRO-RENEWABLE TECHNOLOGY

Heat pumps

Heat pumps exploit the variation on temperature between one place and another. There are three energy sources on which heat pumps rely: ground, water and air. The principle of heat transfer is similar in each case, but the equipment required is different for each energy source and varies between manufacturers. Electricity, which can also be generated renewably, is required to run the pumps.

Ground-source heat pumps require long lengths or coils of special-grade pipe to be laid in either a horizontal trench or a vertical borehole. Once installed, the pipework can be covered over with soft or hard surfaces. The pump equipment generally comes in one or two units and needs to be housed within and/or adjacent to the building to be heated. The principal considerations for historic features are the need to avoid damage to underground archaeology and to find an unobtrusive location for the pump equipment and any surface pipework.

Water-source heat pumps have similar requirements to ground-source pumps, but must be located close to a river, canal, loch or pond. Careful design and siting of the equipment and its housing can usually minimise the effects on a historic site. In many cases historic millponds can be suitable locations for water-source heat pumps.

Air-source heat pumps normally have two main parts split between indoors and outdoors. The outdoor unit includes the outdoor heat exchanger, the compressor and a fan. The indoor unit contains the indoor heat exchanger and the fan that distributes heated or cooled air to the distribution system of the house. Some systems have a second indoor cabinet that contains the compressor. More recent developments in this technology include internal roof-space heat exchangers that utilise the heat generated from solar gain of the existing roof covering. Again the sensitive design and siting of the pump equipment and its housing are the principal considerations.

Hydro

Most modern small-scale hydropower systems use the kinetic energy of flowing water to power a turbine. An intake, usually beside a cauld (weir), diverts water through a pipeline to a turbine house, in which water falls over a turbine and drives a generator to produce electricity. Depending on the site, such schemes typically require the construction of a small weir, a pipeline, turbine house, and transmission infrastructure. Where these works affect a historic building or its setting, impacts can normally be minimised by careful selection of sites, equipment, building designs, materials, colours, and routing of pipes and cables.

There is increasing interest in the potential for reuse of old mill sites and waterwheel technology to generate electricity or to drive pumps. Where possible, the repair and reuse of historic caulds, mill lades (feeder channels), turbines and waterwheels is encouraged. Electricity generation requires the installation of an induction motor/generator to replace the direct mechanical gearing. Recording and retention of any existing historic mechanism is recommended.

Biomass

A wide variety of biomass energy sources derive from energy crops or agricultural/municipal/industrial wastes. Small-scale biomass developments are predominantly based on various types of wood fuel. Typically these developments require wood-burning equipment, a boiler house, fuel storage, pipework, and chimneys/flues. In some cases additional accumulator tanks can improve the efficiency of the system.

The general principles of careful siting and design apply to this type of development. Particular care should be given to the location of chimneys/flues and the fuel storage facility. Where possible the reuse of existing chimneys is encouraged. If a new chimney or flue is required, it should be designed and located to be unobtrusive in views of the building.

Solar

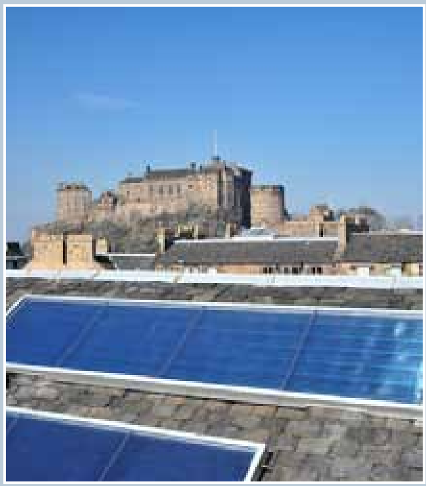
The main types of solar micro-renewable development are solar thermal heating (for water and/or spaces) and photovoltaic electricity generation. Solar thermal heat is usually derived from panels, either set on roofs or freestanding. Photovoltaic technology is also available in panels, but is increasingly incorporated into building materials such as roof tiles. Both types of development require pipework/cabling and distribution equipment.

Wherever possible, solar micro-renewable developments should be installed on inconspicuous areas of a roof, such as the inner slopes of a roof valley, or where a flat roof is obscured by a parapet. Principal elevations should always be avoided, and consideration given to the appearance of the development in views of the building from higher vantage points. For the integrity of the building it is usually desirable to mount photovoltaic modules as panels over existing slates, rather than replace historic fabric with look-alike photovoltaic materials in the form of slates.

Wind

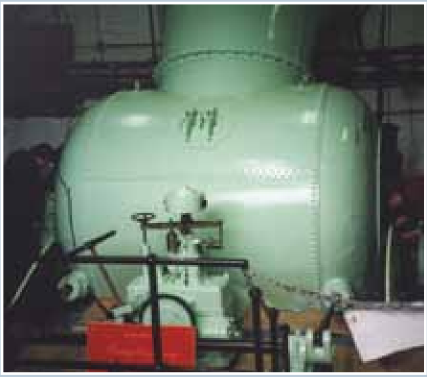
Wind turbines are either building-mounted or freestanding. The operational requirement for an exposed location means that building-mounted turbines will usually break the profile of the building and be widely visible. Turbines also have the potential to cause vibrations damaging to historic fabric. For these reasons it is usually better to seek a freestanding location for a wind turbine. The general principles for development affecting the setting of a historic building should be taken into consideration in choosing a site (see 'Setting' in this series).

Above and below: an ancillary building at Arniston House, Midlothian, was converted to a boiler room and fuel storage for a 460kW wood-chip biomass system. The new flue is detailed to match the existing chimneys. Wood-chip fuel is sourced locally and fed into the store using a moveable agricultural conveyor. © N Haynes.



Solar heating panels located in a roof valley. The panels are set on top of the existing slates. They are invisible from the ground and from the higher vantage point of Edinburgh Castle.

Photovoltaic panels located discreetly on hidden parts of the roof at Morgan Academy, Dundee. The panels power a ground-source heat system.



The refurbished Boving turbine (1930) at New Lanark World Heritage Site has 500 kW generating capacity. © New Lanark Trust.

CUMULATIVE EFFECTS

Local authorities may consider the potential cumulative effects of micro-renewable developments through specific policies or guidance for significant groups of historic buildings or places.

CONSENTS

Consent is required for any work to a listed building that affects its character. The need for consent or any other permission is determined by the relevant local authority.

Although permitted development rights in respect of planning permission apply to some types of micro-renewable development, listed building consent is normally required for most works to listed buildings and scheduled monument consent is required for all works to scheduled monuments. Other permitted development restrictions apply to some types of microgeneration in conservation areas and World Heritage Sites. Advice is available from local authorities.

Where listed building consent is required, an application must be made to the local authority. It should include accurate scale drawings showing both the existing situation and the proposed scheme with its associated equipment in context. It is always helpful to provide detailed technical information and photographs.

Below: Westray Parish Church in Orkney became self-sufficient in energy with a 6KW wind turbine, ground-source heat pump and back-up diesel generator. The turbine is far enough (80m) from the building to avoid turbulence or, from some viewpoints, intrusion into setting. © EASE Archaeology.

FURTHER INFORMATION AND ADVICE

Details of all individual scheduled monuments, listed buildings, designated gardens and designed landscapes, and designated wrecks can be obtained from Historic Scotland (see contact details below) or at: www.pastmap.org.uk. Details of listed buildings can also be obtained from the relevant local authority for the area.

Advice on the requirement for listed building consent, conservation area consent, building warrants, and other permissions/consents should be sought from local authorities.

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Cover images

Solar panel installation in a tenement roof valley, City of Edinburgh.

Wood-chip biomass boiler, Arniston House, Midlothian. © N Haynes, by kind permission of the Arniston Estate.

Water turbine, Stanley Mills, Perth & Kinross.

Other selected Historic Scotland publications and links

Inform Guide: Energy Efficiency in Traditional Homes (2008) (PDF 715K)

Other selected publications and links

Scottish Government, Planning Advice Note (PAN) 45: Renewable Technologies (revised 2002)

Scottish Government, PAN 45 Annex 1: Planning for Micro-Renewables (2006)

Selected contacts

Scottish Community & Householder Renewables Initiative (SCHRI)
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