HISTORIC ENVIRONMENT SCOTLAND
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Managing Change in the Historic Environment

Micro-renewables

Above: A small scale wind turbine in a domestic setting in Shetland. The small scale of the turbine allows it to fit unobtrusively into the surrounding landscape. © Pete Bevington/www.shetnews.co.uk

Cover image: Micro-renewables have been incorporated sensitively at category A listed Morgan Academy, Dundee. An example of photovoltaic panels located discreetly on hidden parts of the roof. The panels power a ground and air-source heat system.

Managing Change is a series of non-statutory guidance notes about managing change in the historic environment. They explain how to apply Government policies.

The aim of the series is to identify the main issues which can arise in different situations, to advise how best to deal with these, and to offer further sources of information. They are also intended to inform planning policies and the determination of applications relating to the historic environment.

Introduction

This note sets out the principles that apply to the use of micro-renewable technologies in historic buildings and sites. More detailed guidance and sources of information can be found in Historic Environment Scotland's Short Guide ***Micro-renewables in the Historic Environment (2014):***

The use of renewable energy technology in the historic environment is supported where the character of the historic building or place can be protected through careful siting and design. These guidance notes do not recommend one type or brand of micro-renewable technology over another: the circumstances of each site need individual assessment.

Key issues

1. Before considering micro-renewables, the energy efficiency of the building should be addressed through building maintenance, equipment upgrades and improvements to the fabric of the building.

2. Listed building consent is required for any works affecting the character of a listed building, and planning permission may be required in a conservation area. Prior to undertaking works you should ask your local planning authority if any consents are required. Scheduled monument consent is required for works to scheduled monuments.

3. Micro-renewable installations should be planned carefully to minimise intervention affecting historic character while balancing the potential of available renewable energy sources.

4. Many historic buildings or sites lend themselves well to some form of micro-renewable energy generation. Different types of micro-renewable technology suit different locations, and sometimes more than one type can be used in combination.

5. Community energy schemes that allow a renewable energy system to be used by a number of buildings or a local community can be highly successful.

1. What are 'micro-renewables'?

In this context, 'renewables' are replenishable zero- or low-carbon energy technologies, in contrast to fossil fuels, which are finite energy sources. Renewable energy sources include: solar, wind, hydro, thermal (ground, water, air), biomass and combined heat and power.

'Micro-renewables' are small-scale non-commercial renewables commonly using systems of up to 50kW in power.

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 Historic Environment Scotland. Licensor canmore.org.uk

2. Understanding the significance of historic buildings

Many historic buildings or places are suited to some form of micro-renewable energy generation. For buildings, the key is to establish at the outset the specific significance of the building, as well as the relative significance of its component parts. The renewables system should be carefully chosen to respect the building's historic character and significance.

The character and significance of a historic building can include factors such as original purpose, style, elevations, profile, materials and detailing, and where appropriate can be evaluated by a conservation statement or plan. A conservation statement identifies the cultural and historic significance of a property, while a conservation plan also includes a strategy for the management and conservation of the property. The size and complexity of the building or site, along with the level of intervention proposed, will help determine whether a conservation statement or plan is required before work is undertaken. Each approach aims to identify the more significant elements or spaces, where intervention demands greatest sensitivity. More information is available in Historic Environment Scotland's *A Guide to the Preparation of Conservation Plans:*

3. Reducing energy demand

Energy-saving measures and improvements to the building fabric are generally the most cost-effective means of reducing energy loss and lowering the carbon footprint. These should therefore be addressed before micro-renewable installations are planned. Improved insulation, draught prevention and upgrading existing heating and lighting systems can retain a building's character and ensure that traditional buildings are comfortable, functional structures that contribute positively to the environment for many years to come.

Guidance on fabric improvements to traditional buildings to increase thermal comfort and energy efficiency are provided in Historic Environment Scotland's conservation publications, including the Short Guide *Fabric Improvements for Energy Efficiency in Traditional Buildings:*

A full list of references is provided at the end of this document.

Sheep's wool insulation installed in a loft space which will help to reduce energy demand and improve thermal comfort.

4. Impact on the historic environment

Renewable energy systems will often have some visual or physical impact on the building or site they serve. It is important to minimise this impact to maintain the character and significance of the historic asset, whether it is a building, archaeological site, garden or designed landscape.

When renewable systems subsequently become obsolete, it should be possible to remove them without causing harm to the building or site, or exposing unnecessary damage caused by installation.

It is sometimes difficult to balance the priorities of maximising energy efficiency and protecting a historic building or site's appearance and integrity. This means that each case has to be assessed individually on its own merits.

The following should be considered when thinking about installing any micro-renewable system:

- Where possible, installations on a building should avoid its main and visible elevations. For instance, it may be possible to place installations on secondary parts of the building, adjacent outbuildings or on the ground nearby.

- Renewables may have a visual impact beyond that of a single building or site; entire streetscapes or landscapes may be affected. In such cases the setting of a site should be carefully assessed. Consideration of a communal system may avoid unnecessary cumulative effects of multiple single installations.

- Physical impacts include those affecting structural, archaeological, fabric and environmental aspects of the site. During installation, it may be necessary to alter or remove historic building fabric, which can include attaching frames or fixtures to roofs, passing pipes and wires over facades and through the building interiors, and integrating pumps, boilers and storage tanks into existing conventional systems. Any intervention to historic fabric should be minimised and undertaken only after careful analysis and design of the system.

- Installation of renewable systems can damage or destroy archaeological deposits. Ground-breaking works for elements such as pipes and foundations need to be carefully planned to avoid disturbing known archaeological deposits and monitored to ensure unknown archaeology is not being damaged during installation.

- Issues such as vibrations, emissions and noise during the system's use also have the potential to disturb or impact on the building or site.

- It may be necessary to devise access to the systems for fuel delivery (biomass systems), repair and maintenance.

- The installation and use of a micro-renewable system or energy efficiency measures may affect the fabric of a historic building in terms of air-tightness, breathability, ventilation and condensation. Historic buildings were often constructed of materials that require a degree of ventilation and breathability to perform to their best ability. This should be taken into account when identifying the most appropriate energy solutions.

Dod Mill, a category B listed 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 (weir), lade and wooden launder (trough) were all re-used to drive the new wheel.'

5. Types of renewable energy sources

The renewable system(s) chosen should be the most suitable for the historic site while also improving energy efficiency and delivering carbon and cost savings.

Two or more different energy sources or technologies can operate together to maximise energy use: for example, solar photovoltaic panels might power a heat pump; or conventional systems might be used in parallel where that can improve energy efficiency. Each micro-renewable technology has specific site requirements, and not all equipment is suitable in every case.

Solar power

Solar power systems require solar collectors or panels. For maximum efficiency, they need to face south, in an unshaded area.

Solar collectors can be installed on pitched or flat roofs, or may be integrated into the roof so that they are flush with its surface. Collectors are also available as tiles, which can mimic slate and be integrated within the roof. For the integrity of the building, it is usually desirable to mount panels over existing slates, rather than replace historic fabric with look-alike materials. However, look-alike materials may be considered when a roof is in need of replacement and the historic building fabric will not be inappropriately altered. Removal of solar collectors may also require minor roof works to replace any slates that were removed when the panels were installed.

Installation of solar panels on the principal elevation of a historic building should be avoided because of the detrimental visual impact. Therefore, if historic buildings face south, their main roof slopes may be inappropriate as locations for solar panels. Alternative solutions should be explored, such as installation on secondary roof slopes, on locations hidden from main views, or on surrounding areas such as sheds, gardens or fields. Panels have been successfully installed behind parapet walls or on the south-facing inside rise of M-shaped roofs.

Solar systems installed on roofs can be heavy, and an appropriate survey should be carried out to determine the structural impact and safety of such systems. It is important to consider archaeological resources if ground disturbance is necessary to connect cables to free-standing collectors.

The Energy Savings Trust has created a *solar energy calculator* to help calculate the potential energy that solar panels will generate in a specific location:

Wind power

Wind turbines are either building-mounted or free-standing. Free-standing mast-mounted turbines require fewer works to a historic building and can generate power from a nearby location. An understanding of the setting of the historic building, streetscape or landscape is paramount in deciding on the appropriate positioning of a turbine. For advice on this, see the *setting guidance* in this Managing Change series.

Above and below: Part of a block of seven Category B listed early 19th century tenements in use by a housing association at Lauriston Place in Edinburgh.Part of a block of seven Category B listed early 19th century tenements in use by a housing association at Lauriston Place in Edinburgh. As part of the Renewable Heritage Project, led by Changeworks in partnership with Lister Housing Co-operative and Edinburgh World Heritage, 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.

Where a building's structure permits the added weight and vibration, turbines can be mounted discretely, for instance on flat roofs or gables. However, generally, these turbines are unlikely to perform well as such locations tend to receive weak and irregular winds. The visual impact on the building also needs to be appraised: turbines can break the building profile, and the movement of the blades can also have an adverse visual impact.

Hydropower

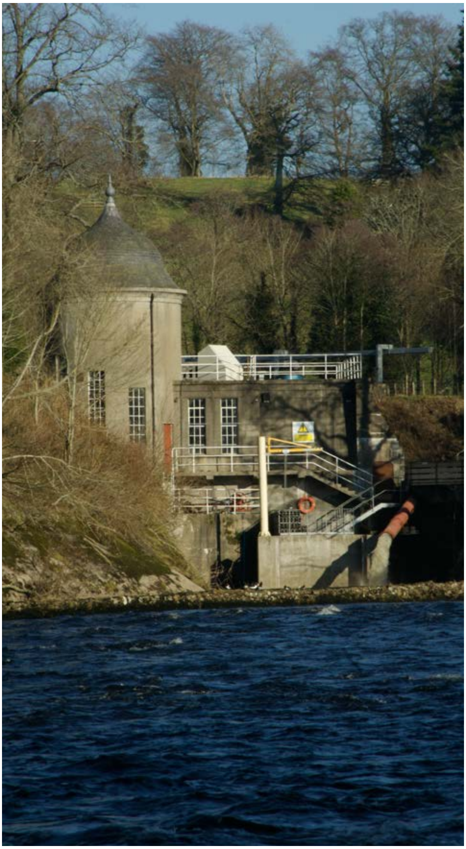
Hydro systems use the kinetic energy of flowing water to turn a turbine, producing electricity for a site or for export to the National Grid. In most systems, water is piped to a turbine which drives a generator to produce electricity. Such systems can be very successful, robust and long lasting. However, they often require considerable construction works, and it is important to minimise impact on the historic environment by careful selection of sites, equipment, design and routing of pipes and cables.

There has been increasing interest in re-using redundant mill lades and historic hydro schemes, including historic weirs, turbines and waterwheels. Recording and retention of any historic mechanism is recommended. Further information on hydro schemes can be found at *here*.

Before considering the re-use of a historic cauld/weir or dam it may be necessary to consult with the Scottish Environment Protection Agency (SEPA) regarding potential requirements for consent relating to fish migration and other environmental issues. Further information can be found on *SEPA's website.*

New hydro systems should be designed with regard to physical impact on historic buildings, archaeology and setting.

Category C listed 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. © Ease Archaeology



The category B listed 1921 turbine house at Stanley Mills, Perth & Kinross, refurbished as part of a new hydro-electricity scheme to supply power to the grid. At 840kW the scheme is significantly larger than the standard micro-renewable development, but it demonstrates the potential for re-use of an existing hydro site.

Heat pumps

Heat pump systems provide energy by moving heat from one place to another. Heat at lower temperatures is collected from the air, ground or water and is raised using compression techniques to provide a more usable, constant heat for a building. These systems are often best used with underfloor heating. Their efficiency can be severely reduced as temperatures drop, so there may still be some reliance on traditional systems for heat.

Ground-source heat pumps (GSHPs) tend to achieve higher efficiency but require long lengths or coils of pipe in either a trench or vertical borehole. This means careful attention has to be given to potential damage to archaeology. Water-source heat pumps are less common but can be as efficient as ground-source heat pumps, provided the water source does not freeze. Air-source heat pumps are also available; these require internal and external units and therefore need to be located as unobtrusively as possible.

All heat pump systems require careful design to minimise impacts to the historic environment. Pipework and pump equipment (often in one or two units, some indoors, some outdoors) need to be carefully located to avoid both physical and visual impacts. Underfloor heating often requires setting heating coils in a concrete floor slab, which can damage historic floors or archaeology.

Because of the damage that trenches and boreholes can cause, where archaeological sites are known to be present or likely, a different form of renewable energy system may be more appropriate, or an archaeological watching brief may be necessary to monitor the works. The local authority archaeology service will be able to provide advice.

Biomass

Small-scale biomass developments are based predominantly on wood fuel products. These products are carbon neutral because they absorb carbon when alive before releasing it when burned, and trees can of course be re-planted. The system requires a boiler or stove, storage, pipework, chimneys/flues, perhaps a boiler house and other variables such as delivery access. The full system for a biomass development will require careful planning and it may be possible to integrate it into existing buildings. Particular care should be given to the location of chimneys/flues and the fuel storage facility to ensure the system is unobtrusive and avoids visual impacts.

Fuel store for a biomass boiler serving category B listed Kincardine Castle, Aberdeenshire. This small storage facility is refilled from a larger shed located further away. This storage shed has been built discreetly behind a timber dog kennel.

6. Renewables at a community scale

Community energy schemes allow a renewable energy system to be used by a number of buildings or a local community and can be highly successful and cost-effective. District energy makes use of a number of energy sources to provide heating, hot water and electricity to many users. Schemes can use combined heat and power (CHP), biomass, energy from waste, heat pumps, wind turbines and hydropower, as well as fossil fuels.

Benefits of district schemes include increased efficiency through diversification of peak load times and economies of scale, and reduced susceptibility to future changes in energy availability and cost. In addition, district energy may be less intrusive to historic buildings or sites as the amount of on-site equipment is typically less than for a system on an individual site.

For further information visit the *Community Energy Scotland website* or the *UK District Energy Association website*.

7. Cumulative effects

Local authorities should consider the potential incremental and cumulative effects of micro-renewable development on the historic environment. They may consider it appropriate to produce specific policies or guidance for significant groups of historic buildings or places.

The district energy combined heat and power (CHP) in Falkirk produces 3,093MWh of electricity, which is distributed to the National Grid. The re-captured heat is enough to heat six high-rise towers and the category A listed Callendar House.

8. Archaeology

Archaeological resources may survive within or beneath a historic building or place. Planning authorities should seek to manage archaeological issues such as recording or preservation in situ.

Installation of a ground-source heat pump (GSHP) at Assynt Church, Inchnadamph (Category B-listed). The coils for the system were installed in trenches behind the church. © LDN Architects

9. Consents

You may require planning permission, building warrant(s) and other permissions or consents for any proposed scheme. The granting of scheduled monument consent or listed building consent does not negate this requirement, and you should contact your planning authority for advice.

Listed building consent

Listed building consent is required for any work to a listed building which will affect its character (see the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997). The planning authority is the main point of contact for all applications for listed building consent. They decide whether consent is required, and they can also offer advice on applications.

The planning authority will consider applications using guidance such as Historic Environment Scotland's managing change guidance notes and other national policy documents including SHEP, SPP and their own policies.

Scheduled monument consent

Scheduled monument consent is required for any works to a monument scheduled under the Ancient Monuments and Archaeological Areas Act 1979. Scheduled monument consent is determined by Historic Environment Scotland. We offer a free pre-application discussion and checking service for scheduled monument consent applications. You can find out more about this on our *website.*

10. Further information and advice

Historic Environment Scotland is charged with ensuring that our historic environment provides a strong foundation in building a successful future for Scotland. One of its roles is to provide advice about managing change in the historic environment.

Legislation and policy

Building (Scotland) Act 2003

Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997

Ancient Monuments and Archaeological Areas Act 1979

Scottish Planning Policy (2014)

Scottish Historic Environment Policy (2011)

Other selected Historic Environment Scotland publications and links

All publications are available at Historic Environment Scotland's *Technical Conservation website*:

Inform Guide: Energy Efficiency in Traditional Homes (2011)

Maintaining Your Home: A Short Guide for Homeowners (2007)

Short Guide – Fabric Improvements for Energy Efficiency in Traditional Buildings (2012)

Short Guide – Micro-renewables in the Historic Environment (2014)

The Energy House (computer based interactive tool, 2012)

Managing Change in the Historic Environment Guidance Notes

Other selected publications and links

CADW, Renewable Energy and your Historic Building – Installing Micro-Generation Systems: A Guide to Best Practice

Changeworks, Renewable Heritage

Historic England, Saving Energy and Generating Energy

National Trust, Green Energy Building Design Guides guides

Selected contacts

Carbon Trust: Tools, Guides and Reports

Centre for Alternative Technology

Community Energy Scotland

Energy Saving Trust

EFFESUS, Energy Efficiency for EU Historic District's Sustainability

Historic Environment Scotland
Heritage Management Directorate
Longmore House
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