tenement fact sheet

6 Solar water heating, photovoltaics, heat recovery ventilation, domestic wind turbines, ground and air source heat pumps and community energy solutions

6 ইনোভেটিভ সল্যুশনস

6 حلول مبتكرة و حديثة

6 創新的解決辦法

6 جدید طریقے

This is the last in a series of six fact sheets describing how to improve the energy efficiency of traditional stone-built tenemental property.

It describes how to improve the energy efficiency of tenemental property, beyond the range of more traditional insulation measures and the upgrading of heating systems. These traditional measures are described in other fact sheets in this series.

This fact sheet focuses on ways to use free energy from the sun, the recycling of warm air, heat pumps and wind power. It explains how groups of properties can be heated from a central boiler and could also generate their own electricity.

All energy efficiency measures help to reduce fuel use and improve comfort in the home. Innovative solutions reduce the use of fossil fuels (coal, oil and gas), and their environmental impact by either using natural solutions (renewables), or by using fossil fuels more productively and in a different way.

Renewable energy comes from unlimited sources – the sun, wind, flowing water and heat from the ground – and replaceable sources, for example trees (wood pellets).

Innovative solutions should always be used in conjunction with the practical energy efficiency measures such as insulation, which are described in the other fact sheets in this series.

Why install innovative technology and what are the benefits?

Innovative solutions are predominantly based on the use of renewable energy and have little environmental impact when compared to the use of fossil fuels.

Innovative technologies include:

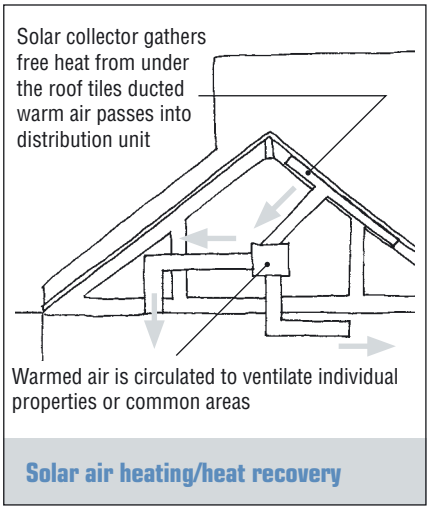
- Solar air heating/heat recovery ventilation
- Solar electricity
- Solar water heating
- Wind and wave power generation
- Biomass e.g. wood pellet/chip
- Ground/air source heat pumps

Only some of these technologies can be used in traditional tenements, because of issues relating to the building type, mixed ownership, and conservation, Planning and Building Control requirements.

Solar air heating/heat recovery ventilation

A solar air system collects solar energy to heat air. The air is then transported to the point of use or to a thermal store for later use. Solar heated air is normally used to heat spaces in buildings. However it can also be used to pre-heat ventilation air, so that ventilating a property does not expel heat. A common application is to use the warm air in the loft space behind a South facing roof. These applications require ducting (ventilation pipework) and are therefore most suited to upper floor properties.

It is possible to channel solar air heating into the space in a close, to partially heat the close, and reduce the rate of heat loss from properties on the stair. However the pipework requirements, particularly to tall closes makes this impractical, except where these space needs could be designed as part of whole building refurbishment. The alternative is to channel the warm air just into the top of the close. However the major benefits would be lost since this warm air would be trapped by colder air at the lower level.



Solar air heating/heat recovery

Solar electricity – Photovoltaics

Electricity can be generated by converting energy from the sun using photovoltaic cells. These cells consist of two layers of material. When light shines on the cell it creates an electric field between the layers, generating electricity. The greater the intensity of light, the greater the flow of electricity. These do not rely on the intensity of heat. Individual cells are connected together to form a module, and modules connected to form an 'array' which is sized to meet a particular need. The arrays come in various forms ranging from grey 'solar tiles' that look like roof tiles, to panels and transparent cells.

A typical domestic array of 1.5kWp, would produce about 1,200kWh pa (about one third of a typical household's annual usage) and cover 12-15m^2 of roof area.

These arrays are usually roof mounted on South facing roofspace, in areas that receive minimal shading during the main part of the day. Excess electricity may be sold on to the electricity distributing companies, or stored in batteries.

Photovoltaic panels

Depending on the property, installations may require Listed Building and Planning Consent and certainly a Building Warrant. Where Planning Consent is not required, the proposed installation will be defined as 'permitted development'. For the panels to be installed on the roof, it may be possible to use part of the roof which is not visible from the street. The panels may then be allowed under 'permitted development'.

The key issue for tenement properties is to get written consent from joint owners, and clarification about the responsibilities for on-going mutual repairs. A model agreement is available from Changeworks on FREEphone 0800 512 012.

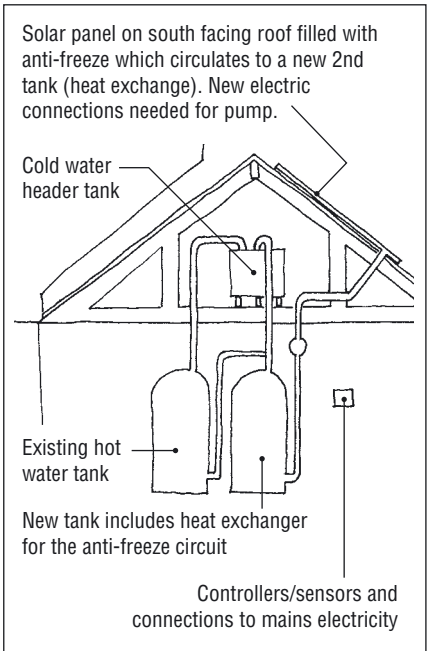
A particular photovoltaics application for tenemental property is to power lighting of common areas or heat recovery ventilation to partially heat the stair but the payback period is very long.

Solar water heating

Solar water heating systems gather heat from the sun and convert it into useful heat in the form of hot water. These systems operate alongside conventional water heaters to ensure hot water is available to the householder all year round. Most solar water systems meet all hot water needs during the summer, and on average across a year about half of total needs. They are particularly designed for use with heating systems which include a hot water storage tank, so are not suitable for use with combination 'combi' boilers, (see Fact Sheet 4).

Solar water heating

All systems are based on the use of solar collectors (e.g. flat panels or evacuated tubes) which heat up and connect to and circulate free heat into the main water heating system in the home. A typical household system covers 4m^2 of the roof area. The flat panels are usually roof mounted on South facing roofs, in areas that receive minimal shading during the main part of the day. Evacuated tube systems can be fitted on flat roofs and often take up less space.



Solar water heating

Solar water heating systems incorporate a pump which circulates the heat generated in the panel. This needs to be connected to the main electrical supply in the home. Some solar water heating systems incorporate a small photovoltaic panel which generates the necessary electricity to power the pump, thus avoiding the need to connect to the electricity source in the home.

Installations may require similar consents and agreements as for the installation of photovoltaic panels.

Solar water heating applications require plumbed in connections to the existing hot water system. The most likely application within tenemental properties will be to upper level properties, particularly top floor properties with roofspaces immediately above.

Other opportunities

Six other innovative solutions to help reduce energy use are:

- Air and ground source heat pumps
- Community Energy Solutions
- Micro CHP
- Passive solar gain
- Wind turbines
- Wood pellet burning stoves

Ground and air source heat pumps

Ground source heat pumps extract heat from the ground to heat a building. The typical constant ground temperature is 11-12˚C and this heat is distributed by a pump and compressor through a conventional radiator system or underfloor heating.

Air source heat pumps extract heat from surrounding air using a fan. They are packaged units, similar in size to a small chest freezer. Unlike ground source heat pumps, air source heat pumps, by drawing on the external air temperature, have seasonal variations in the amount

Hillcrest Grassmarket project

of back-up required using more electricity in the winter. In tenemental situations it is only practical to install these to ground floor properties.

Community Energy Solutions

Community Energy is the concept of heating groups of properties communally, based on the use of one boiler to serve several properties. These communal boilers can also include a power generation component producing some of the electricity required within the buildings.

The scale of these schemes can involve several hundred households. It would be feasible to design a community energy scheme involving whole streets of tenements.

Heating main used in community heating systems

The Edinburgh Standards for Sustainable Building refer to powering Edinburgh into the 21st Century, based on Combined Heat and Power (CHP) and decentralised energy.

Passive solar gain

This is the benefit derived naturally from the sun which supplements and reduces fuel use for heating. This is heat predominantly in rooms with South-East, South and South-West facing windows where the build up of heat is noticeable and the appropriate use of heating controls (see Fact Sheet 4) is important. New housing increasingly uses aspects of passive solar design. Some tenement refurbishment schemes include the addition of solar lobbies as glazed areas to collect passive solar warmth which benefits the whole home, and ensure that the rooms most frequently in use are South facing.

Example of passive solar/sun lobbies

Micro CHP

More recent developments include smallscale 'micro CHP', combined heat and power installations for individual domestic use. These units burn gas to produce heat and electricity. This technology is being field tested, and dates for its commercial availability are unclear.

Wind turbines

Small scale wind turbines are available for the domestic market. Wind tests must be done to check their suitability and siting. Other technical issues that need to be considered are structural stability, potential transmission of sound, and technical issues in relation to Planning Consents and Building Warrants.

Wind turbine

Wood pellet burning stoves

These burn processed wood in the form of pellets. Unlike wood burning in open fires, these stoves have a very high level of efficiency, comparable to that of an energy efficient boiler in a traditional central heating system, They require a flue, which in older property will necessitate the lining of existing chimneys, and may be subject to obtaining a Building Warrant. Part of the warrant requirements relate to identifying the fuel storage area. Purchasing arrangements for the wood pellets may only make this economic where there is sufficient storage capacity. Tenemental applications may therefore be limited particularly where back green space is mutually owned.

Sources of funding/grants for innovative solutions and sources of advice

There are grants which will pay a percentage of the cost of installing renewables.

Individual householders should contact the Energy Efficiency Advice Centre on 0800 512 012. Where households in a close are interested in working together, developing a shared project as a 'community', they should contact the local Scottish Community and Householder Renewables Initiative (SCHRI) development officer on 0800 512 012.

Grants are available through the Low Carbon Buildings Programme, including funding for photovoltaics (which are not funded under SCHRI). For more information visit the website at www.lowcarbonbuildings.org.uk/home

For information on other renewables initiatives contact your local Energy Efficiency Advice Centre on 0800 512 012.