Unit 301: Understand the fundamental principles and requirements of environmental technology systems

# Handout 1: Solar thermal (hot water)

## Learning outcomes

The learner will:

1. Know the fundamental working principles of micro-renewable energy and water conservation technologies.
2. Know the fundamental requirements of building location/building features for the potential to install micro-renewable energy and water conservation systems to exist.
3. Know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies.
4. Know the typical advantages and disadvantages associated with micro-renewable energy and water conservation technologies.

## Assessment criteria

The learner can:

* 1. Identify the fundamental working principles for each of the following heat producing micro-renewable energy technologies, such as solar thermal (hot water).

2.1 Clarify the fundamental requirements for the potential to install a solar water heating system to exist.

* 1. Confirm what would be typically classified as ‘permitted development’ under town and country planning regulations in relation to the deployment of the following technologies: solar thermal (hot water).
  2. Confirm which sections of the current building regulations/building standards apply in relation to the deployment of the following technologies: solar thermal (hot water).
  3. Identify typical advantages associated with each of the following technologies: solar thermal (hot water).
     1. Identify typical disadvantages associated with each of the following technologies: solar thermal (hot water).

## Description: 01 renewable energy.jpgRenewable energy

### What is renewable energy?

We've all heard of solar panels and wind turbines, but renewable energy covers more than that. It is energy from any source that is naturally replenished when used. Often called ‘renewables’, ‘green energy’,

‘microgeneration’, or ‘sustainable energy’. The main sources of renewable energy for the home are:

* energy from sunlight
* heat from the earth, the air or water sources
* plants grown for fuel (biomass or biofuels)
* waste
* the movement of water (known as hydro) and wind.

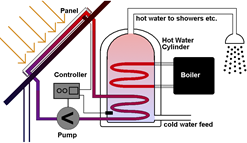
There are lots of different technologies available – usually used to produce electricity or to generate heat.

### Description: 02 renewable energy.jpgWhy use renewables?

There are lots of good reasons to use renewable including:

* making use of secure, local resources
* reducing the dependence on non-renewable energy
* helping to keep the air clean
* helping to reduce the production of carbon dioxide and other greenhouse gases
* creating new jobs in renewable energy industries
* saving and even earning money.

## Solar thermal (hot water)

Solar thermal (hot water) is a renewable energy system for generating domestic hot water using solar panels (known as ‘collectors’) fitted at an optimal angle on a south‑facing roof or other suitable surface.

Roof-mounted solar collectors with high transmission and absorption efficiencies typically capture energy from incident solar irradiation, passing the heat into a transfer fluid – usually a pre-prepared mixture of 60% water and 40% glycol to prevent freezing during periods of low outdoor air temperatures.

The heat transfer fluid is usually pumped through a coil located in the lower section of an unvented indirect cylinder and, in so doing, heats the stored water that would normally be used for domestic hot water.

A well-designed commercial solar thermal system may be able to satisfy around 30 to 40% of the annual hot water load, known as the solar fraction (SF). To try and achieve a higher solar fraction may lead to solar thermal system operational issues. In the summer months, an appropriately designed solar thermal system should be able to satisfy almost all of the hot water demand in many cases.

The SF is much lower during the colder winter months, when the available solar irradiation is a lot lower, resulting in SF levels of around 20%. To increase the annual average SF in the winter months, a larger number of solar collectors would be needed – but the array would be oversized for the summer period and this could lead to stagnation resulting in possible long-term, irreparable damage to the solar collectors.

A boiler or immersion heater tops up the water to the temperature set by the cylinder's thermostat (>60°C).

## Installation location

The first consideration, is there a suitable place for the panels?

Usually these are fitted to the roof but they can be fitted to a wall or anywhere else where they can be supported, providing they face between south east and south-west at an appropriate angle.

If fitting them to a roof, then a check will need to be made to ensure that it can support the panels' weight. A structural survey would be a good idea, particularly as the entire project, including the water storage unit, will be subject to building regulations.

Is there anything that will substantially shade the panels, eg overhanging trees, large neighbouring buildings? These will influence the effectiveness of the panels.

## Planning requirements

Since April 2008 in England the installation of solar thermal panels is classed as ‘permitted development’ in most cases and thus planning permission is not required. The requirements for this include:

* panel coverage less than 9m2
* panels must not extend beyond the ridgeline
* panels must not project more than 200mm from the roof or wall surface
* not fixed to a listed building
* not fixed to a building in a conservation area
* not fixed to a building in a World Heritage area
* not fixed to a building close to a monument.

In Wales, Scotland and Northern Ireland, the devolved governments are currently all considering changes to their legislation on permitted developments, to facilitate installation of microgeneration technologies, including solar water heating. Legislation is expected in all three countries this year. Until then, householders in Wales, Scotland and Northern Ireland must consult with their local authority regarding planning permission.

## Building Regulations requirements

In most cases it will be necessary to give notification of the proposed works to the Council under the Building Regulations.

In addition, in most cases involving the installation of solar thermal panels on or within a dwelling house, it will be necessary to obtain Building Regulation Approval. Relevant factors that will be considered involve size, weight and forces exerted on fixing points, fixing points themselves, safety issues, noise, ventilation, and related electrical installation and plumbing issues.

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| Description: 04 Solar thermal specific.png |

## Description: solar-roof-hook-on-pantile.jpgAdvantages of solar thermal (hot water)

* Cut carbon footprint
* Cut bills
* Hot water all year round

## Description: PICT0067_JPG.jpgDisadvantages of solar thermal (hot water)

* Only available during daytime
* Subject to the effects of climatic changes
* Dependant on geographical location
* Energy conversion rates or efficiencies are low compared to other energy sources
* High capital cost