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

# Handout 6: Micro wind

## 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: micro wind.

2.6 Clarify the fundamental requirements for the potential to install a micro wind system to exist.

3.1 Confirm what would be typically classified as ‘permitted development’ under town and country planning regulations in relation to the deployment of the following technologies: micro wind.

3.2 Confirm which sections of the current building regulations/building standards apply in relation to the deployment of the following technologies: micro wind.

4.1 Identify typical advantages associated with each of the following technologies: micro wind.

4.2 Identify typical disadvantages associated with each of the following technologies: micro wind.

## Micro wind

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| Wind turbines harness the power of the wind and use it to generate electricity.  Forty percent of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines (known as 'micro wind' or 'small-wind' turbines).  A typical system in an exposed site could easily generate more power than your lights and electrical appliances use.  Wind turbines use large blades to catch the wind. When the wind blows, the blades are forced round, driving a turbine which generates electricity. The stronger the wind, the more electricity produced.  There are two types of domestic-sized wind turbine:   * Pole mounted: these are free standing and are erected in a suitably exposed position, often around 5kW to 6kW. |  |

* Building mounted: these are smaller than mast mounted systems and can be installed on the roof or wall of a home where there is a suitable wind resource. Often these are around 1kW to 2kW in size.

## How wind turbines work

Most wind turbines use blades that are shaped similar to aircraft wings to harness the energy in the wind.

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| **Horizontal axis wind turbines**: have their blades attached to a central hub that is free to rotate. As the hub rotates it drives an electricity generator. The stronger the wind the faster the hub rotates and the greater the amount of electricity that is generated. Usually the blades, hub and generator sit at the top of a mast where they are free to rotate through 360°. A ‘tail-vane’ moves the unit so that the hub is always facing into wind.  With the hub facing into wind the blades are positioned to best harness the energy from the wind. As the wind passes over the blades lift is generated in the same way that an aircraft wing generates lift. Lift is an energy force and this causes the blades to move. The hub that the blades are connected to rotates, providing power to drive the generator which then generates electricity. |  |
| **Vertical axis wind turbines**: have their main rotor shaft set vertically. The generator and gearbox are usually set on the ground and the rotor blades rotate around the shaft. As wind blows over the rotor blades lift is generated and the blades spin around the main shaft. The spinning shaft drives the generator and electricity is generated. With this type of unit the turbine blades do not have to be pointed into wind. Vertical axis wind turbines while generally being compact compared to the horizontal axis wind turbines are not as efficient. |  |
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Inverters convert the direct current (d.c.) electricity produced by the wind turbine to alternating current (a.c.) electricity that can be used in the home and exported back to the grid.

Invertors also:

* ensure compliance with regulations about feeding electricity into the grid, for example by immediately disconnecting if there is a power cut
* maximise electricity production by constantly varying its resistance (load).

Inverters are very efficient, usually 93–96% depending on the make and model – never 100% because they use some of the input d.c. power to run, generally around 10–25W.

## Installation location

Wind turbines are eligible for the UK government’s feed-in-tariffs which means the consumer can earn money from the electricity generated by the turbine. Payments can also be received for the electricity not used by the consumer and exported to the local grid.

To be eligible, the installer and wind turbine product must be certified under the Microgeneration Certification Scheme (MCS).

If the turbine is not connected to the local electricity grid (known as off grid), unused electricity can be stored in a battery for use when there is no wind. **NB**: the feed-in tariffs scheme is not available in Northern Ireland.

## Planning requirements

Planning permission is required to install a wind turbine in Wales or Northern Ireland. Contact your local authority for details.

In England and Scotland, a domestic wind turbine may be classified as Permitted Development, in which case planning permission will not be needed. However, the criteria are complex, and very different in England and Scotland, so we recommend that you contact your local planning office at an early stage to check whether planning is required.

For **building-mounted turbines**, the criteria include:

* the house is detached
* the top of the turbine blades is no more than three metres above the top of the house, or 15 metres above the ground
* all of the turbine is at least five metres from the edge of the householder's property.

For **pole-mounted turbines**, the criteria include:

the top of the turbine is no more than 11.1 metres above ground

all of the turbine is at least 1.1 times the height of the turbine away from the edge of the householder's property.

And for **both types of turbine**:

* there is no other wind turbine and no air source heat pump on the site
* the bottom of the blades is at least five metres above ground
* the turbine's swept area is no more than 3.8m2
* the site is not on land safeguarded for aviation or defence purpose.

## Building Regulations requirements

If the wind turbine is attached to the building it needs to comply with Building Regulations including Part A on Structural Safety.

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| Advantages of micro wind  * The wind is free and genuinely renewable and with modern technology it can be captured efficiently. * Benefit from the Governments feed‑in tariff, which pays a set rate per kWh of electricity generated and an additional rate for any exported back to the national grid. * The feed-in tariff is guaranteed by the Government for 20 years. * Producing your own power protects against rising energy prices. * Once the wind turbine is built the energy it produces does not cause green house gases or other pollutants. * Although wind turbines can be very tall each takes up only a small plot of land. * Remote areas that are not connected to the electricity power grid can use wind turbines to produce their own supply. | Description: 05 micro wind.jpg |
| Disadvantages of micro wind  * The strength of the wind is not constant and it varies from zero to storm force. This means that wind turbines do not produce the same amount of electricity all the time. There will be times when they produce no electricity at all. * Wind turbines can be noisy and building mounted ones can cause vibration. * When wind turbines are being manufactured some pollution is produced. Therefore wind power does produce some pollution. * It may be beneficial to replace the inverter after 10 years to optimise power generation, although this is not essential. | Description: 06 micro wind.jpg |