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

Worksheet 2: Ground source heat pump (Tutor)

Using your notes and the internet (refer to Resource 1, 'Micro-renewable energies') answer the following questions:

1. Describe the principle of operation of a ground source heat pump system.

Ground source heat pumps produce domestic hot water from heat from the ground.

A pump circulates water through pipes buried in the ground and this is warmed by the heat in the soil which in the UK is usually a constant 10°C at a depth of 2 metres or more.

Cold liquid refrigerant passes through a heat exchanger (evaporator) that absorbs the heat from the water circulated through the ground and evaporates into gas. The gas is then compressed raising it to a higher temperature.

This hot gas then passes through a second heat exchanger (condenser) and gives up its heat to the surrounding atmosphere (a water or air heating circuit) before it is condensed into liquid.

The condensed refrigerant liquid still at high pressure and still hot, is then forced through an expansion valve which causes it to rapidly cool through evaporation. The now cool refrigerant liquid is ready to absorb more heat from the evaporator causing the liquid refrigerant to evaporate into gas.

The ground source heat pump turns a large amount of slightly hot liquid into a small amount of very hot liquid.

Whilst energy is used (electricity) to power the circulating pump and compressor, about four times the energy is produced in the form of hot water for heating.

2. In small groups, discuss the planning permission requirements for ground source heat pumps including whether installation is covered by permitted development and write down your findings below.

Most householders can carry out small extensions or additions to their homes permitted development

Fitting a ground source heat pump in a house or a block of flats is classed as permitted development.

Whilst planning permission is unlikely to be needed for excavations or drilling, provided the ground coil is installed under your own land, in sensitive areas such as Areas of Outstanding Natural Beauty (AONBs), planning permission may be required for the excavation works to lay the coils.

3. List **six** advantages of ground source heat pumps.