

Candidate Handbook answers

Progress check 10.1, p. 483

1. What is the fundamental difference between solar thermal and solar photovoltaic systems?
Solar thermal produces heat energy while solar photovoltaic produces electrical energy.
2. What are the two types of solar thermal collector?
Flat plate and evacuated tube are the main types of solar thermal collector.
3. How might nearby tall buildings affect:
 - a solar photovoltaic installation
Nearby tall buildings will cause overshadowing and will reduce performance of a PV installation.
 - a wind turbine?
Nearby tall buildings will cause turbulent air flow, and will reduce output of a wind turbine as well as increasing maintenance requirements.
4. Describe the two main factors to be considered when reviewing a site for a micro-hydro system.
'Head' or 'drop' measured in metres and flow rate measured in litres/second or (m³)/second
5. In addition to generating heat, what waste product does an air source heat pump produce, and how should this waste product be managed?
An air source heat pump produces condensate (water) which should not be allowed to pool or freeze but should be drained away safely.
6. What component is used in a photovoltaic or wind installation to turn direct current into alternating current?
An inverter
7. What is the minimum coefficient of performance for a ground source heat pump which is considered viable?
2.5 to 3 is considered acceptable, while 4 and above is good.
8. What is the meaning of 'heat-led' in describing a heat-led co-generation installation?
The co-generation boiler principally produces heat, and electricity is a product of the waste heat.

Working practice 10.1, p. 489

A potential client has approached you with regard to a micro-hydro site. The site is across a fast-flowing stream on hilly ground and on their land but it is not close to any mains electrical supply. There is an old building on the site which was once a mill but has been disused for over 80 years. Your initial site survey indicated a head height of about 7 m across a length of 250 m and a flow rate of about 0.15m³/s.

1. What size system might be suitable for this site?
Table 10.1 indicates that a system of between 5–10kw would be the most suitable for the site conditions described.

2. How might output be increased?

Head may be increased by constructing a penstock to draw water from a greater height. Otherwise, alternative locations on the river may be analysed for increased flow rate or improved conditions.

3. Advise the client on the additional factors they will need to consider if they wish to make money by supplying electricity to the grid

In order to supply electricity to the national grid they will need a DNO (distribution network operator) approved connection to the grid supply. This will require permission and approval from the DNO, and a qualified electrician to supply and fit the required components, including a generation meter, and to make the connection to the grid.

4. An earlier micro-hydro consultant who was keen to impress the client insisted that, because there was an old building already present, they would not have to apply for planning permission. How would you advise the client on the matter of planning permission?

Any proposed micro-hydro site requires full planning permission, regardless of location or existing buildings. This is due to the potential effect the installation will have on the marine environment and water abstraction.

Progress check 10.2, p. 491

1. What is the ideal orientation for a roof slope for a proposed solar thermal installation?

Ideally due south, effective within 30° east or west of due south

2. How is solar (photovoltaic or thermal) collection optimised on a flat roof?

Panels are mounted on an angled frame designed to the optimum angle for the location.

3. How might a nearby large tree affect the design of a solar PV installation?

A nearby tree will cause overshadowing and will reduce performance of the solar PV installation.

4. What alternative installation technique is available for a ground source heat pump scheme in a tight urban site with very little available space for installation of pipework?

A vertical borehole collection type

5. State two locations where it would be inadvisable to place an air source heat pump.

In an attic or roof space; in an internal corner with poor air flow (close to obstructions preventing clear air flow through the intake)

6. Why does a biomass boiler system require additional space to that required to house only the boiler?

A biomass boiler system requires additional space for the storage of bulk fuel such as logs or bags of pellets.

7. What is laminar air flow?

Smooth, uninterrupted air flow

8. What is the minimum head value to make a micro-hydro scheme viable?

2 m

9. What factor may compensate for a low head value in a micro-hydro scheme?

Higher flow rate

10. What is the usual fuel source for a heat-led CHP boiler?

Natural gas

11. Describe a simple method of installing a basic rainwater harvesting system.

Fit a diverter to a rainwater downpipe and connect to a rainwater butt.

12. Roughly how much ground area is required by a ground source heat pump, in comparison with the building floor area it is required to heat?

Approximately 2.5 times the floor area

Progress check 10.3, p. 495

1. A developer wishes to construct a solar photovoltaic stand-alone array consisting of 8 m² of panels in a 2 x 4 m configuration.

- Will this scheme be permitted under the rules of lawful development?

No – a stand-alone array cannot have a dimension greater than 3 m.

- If not, what adjustments might you recommend to ensure the design meets the conditions of permitted development?

Redesign the array into a configuration not greater than 3 m long: suggest 3 x 2.66 m.

2. A developer wishes to construct a micro-hydro installation and believes that it will not require a planning application as there is already an old derelict mill on the site. Is this assumption correct?

No – all proposals for micro-hydro are subject to a full planning application due to the potential for high environmental impact.

3. State the piece of legislation which gave rise to the Building Regulations.

The Building Act 1984

4. Which Building Regulations Approved Document (AD) would an installer consult to aid with the electrical installation of a solar PV scheme?

Approved Document P – Electrical Safety

5. Which Building Regulations Approved Document (AD) would an installer consult to aid with the hot water provision of a solar thermal scheme?

Approved Document G – Sanitation, hot water safety and efficiency

6. Is working to Building Regulations Approved Documents a legal requirement?

No – the Approved Documents offer guidance on how to meet the requirements of the Act; there may be other ways to meet the requirements.

Progress check 10.4, p. 496

1. Which heat-producing technology will provide continual low-level heat with minimal noise disruption?

A ground source heat pump

2. What spatial factor is a disadvantage in planning for a biomass boiler?

It will require significant additional storage space for fuel.

3. Which energy-producing technology is often associated with remote, off-grid sites?

Micro-hydro, due to the prevalence of suitable sites in mountainous areas

4. Is a micro-CHP boiler similar in cost to a conventional boiler?

No, it is significantly more expensive.

5. Could a householder plan to source all the household's water supply, including drinking water, from a rainwater harvesting system?

No, it is not recommended that harvested rainwater is used for drinking, due to the potential for contamination during roof run-off and within collector pipework. However, the remainder of the household's water needs may well be met.

Knowledge check, p. 498

1. The ideal orientation for photovoltaic or solar thermal panels in the UK is:
b due south
2. Building Regulation Approved Document A relates to
d structural safety
3. The Building Regulation Approved Documents most applicable to the installation of a CHP boiler would be:
c J (Heat-producing appliances) and L (Conservation of fuel and power)
4. How many stand-alone solar photovoltaic installations are permitted within a domestic property, under lawful development rights?
a One
5. In considering the design and installation of wind turbines, what is meant by 'laminar flow'?
b Smooth, uninterrupted air flow
6. Which component turns direct current into alternating current?
d An inverter
7. Monocrystalline and polycrystalline silicon are the principal materials used in the manufacture of:
c photovoltaic panels
8. Embedded energy means the amount of energy required to manufacture a particular material. Embedded energy is often measured in:
b watts per kilogram
9. Glycol is an additive used in the collector systems of solar and heat pump systems. Its principal use is to:
a prevent freezing of the transfer fluid
10. In a micro-hydro system, what is a penstock?
b Pressurised pipe delivering water to the turbine