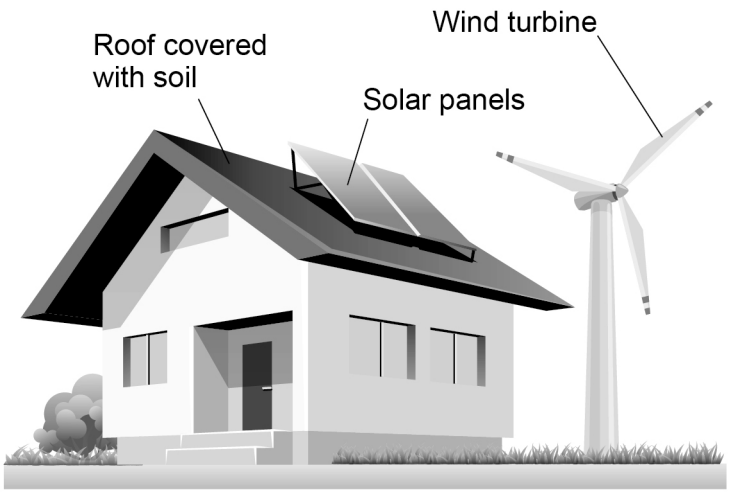
Do not write outside the box

0 3 An eco-house is designed to be environmentally friendly.

Figure 4 shows a picture of an eco-house.

Figure 4



0 3 . 1 The solar panels and a wind turbine are used to generate electricity for the eco-house.

Solar and wind are both renewable energy resources.

What does renewable energy resource mean?

[1 mark]

Tick (✓) **one** box.

It can be replenished as it is used. ☐

It is unreliable. ☐

It has no fuel costs. ☐

It produces no greenhouse gases. ☐

Do not write outside the box

0 3 . 2 Biomass, nuclear and natural gas are three other energy resources.

Complete the table to show whether each energy resource is renewable or non-renewable.

[2 marks]

Tick (✓) **one** box for **each** energy resource.

Energy resource	Renewable	Non-renewable
Biomass		
Nuclear		
Natural gas		

0 3 . 3 Moving air makes the wind turbine spin.

The wind turbine generates electricity which is used to charge a battery.

Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**electrical**	**gravitational**	**kinetic**

When the wind turbine spins faster there is an increase in its _____ energy.

Charging the battery increases the _____ store of energy of the battery.

Question 3 continues on the next page

Do not write outside the box

0 3 . 4 The roof of the eco-house is covered with soil.

Covering the roof with soil decreases the thermal conductivity of the roof.

What are the advantages of having a roof with a lower thermal conductivity?

[2 marks]

Tick (✓) **two** boxes.

Less energy is needed to heat the house. ☐

The rate of energy transfer by conduction is greater. ☐

The roof is a better insulator. ☐

The roof is less likely to leak. ☐

Weather will have a greater effect on the temperature of the house. ☐

0 3 . 5 The average power transferred to the solar panels by sunlight is 26 000 W

Calculate the average energy transferred to the solar panels in 30 seconds.

Use the equation:

energy transferred = power × time

[2 marks]

Average energy transferred to solar panels = _____ J

Do not write outside the box

0 3 . 6 Write down the equation that links efficiency, total power input and useful power output.

[1 mark]

0 3 . 7 The solar panels on the roof of the eco-house have an efficiency of 0.15

The average power input to the solar panels is 26 000 W

Calculate the average useful power output from the solar panels.

[3 marks]

Average useful power output = _____ W

0 3 . 8 Explain why it is a good idea for the eco-house to have both a wind turbine and solar panels.

[2 marks]

15

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>03.1</td><td>it can be replenished as it is used</td><td></td><td>1</td><td>AO1
6.1.3</td></tr>
<tr><td>03.2</td><td>biomass – renewable
nuclear – Non-renewable
natural gas – Non-renewable

<table><tr><th>Energy resource</th><th>Renewable</th><th>Non-renewable</th></tr><tr><td>Biomass</td><td>✓</td><td></td></tr><tr><td>Nuclear</td><td></td><td>✓</td></tr><tr><td>Natural gas</td><td></td><td>✓</td></tr></table></td><td>all 3 correct

allow 1 mark for two correct answers</td><td>2</td><td>AO1
6.1.3</td></tr>
<tr><td>03.3</td><td>kinetic

chemical</td><td>answers must be in the correct order</td><td>1

1</td><td>AO2
6.1.1.1</td></tr>
<tr><td>03.4</td><td>less energy is needed to heat the house

the roof is a better insulator</td><td></td><td>1

1</td><td>AO3
6.1.2.1</td></tr>
<tr><td>03.5</td><td>E = 26 000 × 30

780 000 (J)</td><td></td><td>1

1</td><td>AO2
6.1.1.4
6.2.4.2</td></tr>
<tr><td>03.6</td><td>$\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$</td><td></td><td>1</td><td>AO1
6.1.2.2</td></tr>
</table>

03.7	$0.15 = \frac{\text{useful power output}}{26000}$ useful power output = 26000 × 0.15 useful power output = 3900 (W)		1 1 1	AO2 6.1.2.2
03.8	sometimes it is not sunny/windy so there's more chance of electricity being generated at any time **OR** more electricity is generated (1) which reduces the running costs (of the eco-home) (1)	if no other mark scored, allow a reference to reduced greenhouse gas emissions or reduced global warming for 1 mark	1 1	AO3 6.1.3
Total			**15**	