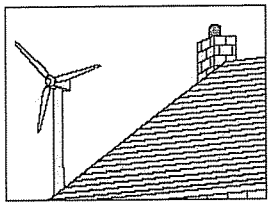
## Generating electricity

1. You can generate electricity for use in your own home using a wind turbine fixed above the roof.

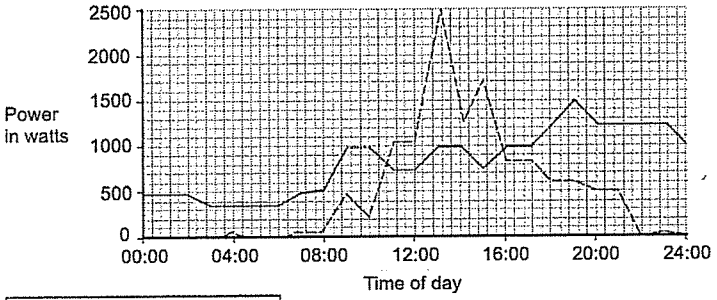


(a) Wind is a renewable energy source.

Which one of the following is **not** a renewable energy source?

1 biomass
2 nuclear
3 solar
4 wave

The graph shows how the power output from a small wind turbine changes during 24 hours. It also shows how the demand for power for one household changes during the same period.




(b) Which statement is correct for 12:00?

1 The demand is larger than the power output from the wind turbine.
2 The demand is a maximum.
3 The power output from the wind turbine is larger than the demand.
4 The power output from the wind turbine is the same as the demand.







(c) The maximum household demand during the 24-hour period is . . .

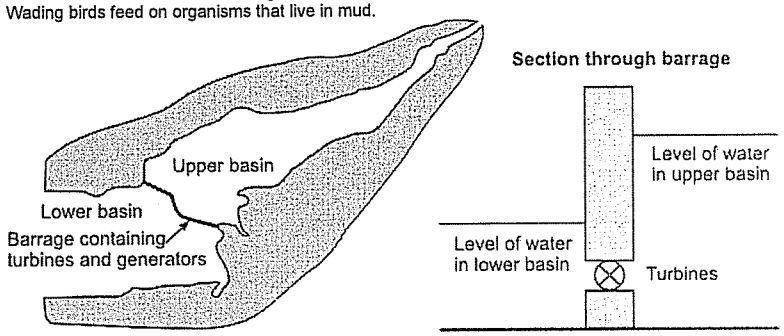
1 1000 W
2 1500 W
3 2000 W
4 2500 W

(d) For how long, approximately, during the 24-hour period, does the power output from the wind turbine exceed the household demand?

1 0 hours
2 5 hours
3 19 hours
4 24 hours

2. In each part choose only **one** answer.

The diagram shows a tidal barrage used to generate electricity.
Before the barrage was built, the mud flats on the estuary were repeatedly covered with sea water as the tide came in and went out again.
Wading birds feed on organisms that live in mud.




A As water moves from the lower basin into the upper basin it gains mainly . . .

1 electrical energy.
2 gravitational potential energy.
3 sound energy.
4 thermal energy.

B Which is the principal energy transfer as water flows from the upper basin through the turbine?

1 electrical energy to gravitational potential energy
2 electrical energy to kinetic energy
3 gravitational potential energy to kinetic energy
4 kinetic energy to gravitational potential energy

C Compared to a coal-fired power station with a similar generating capacity, a tidal barrage usually . . .

1 costs more to build.

2 has a more concentrated energy supply.

3 has higher fuel costs.

4 has higher maintenance costs.

D One disadvantage of this tidal barrage is that . . .

1 it cannot be used in summer.

2 it has high decommissioning costs.

3 its output depends on the weather.

4 wading birds lose a food source.

3. In each part choose only **one** answer.

An African village is many miles away from a supply of mains electricity.
The Sun shines for at least a few hours nearly every day.
The villagers want a supply of electricity to pump water up from the well for a few hours each day.

The table shows the costs of two different ways of providing the electricity.

| | Capital cost | Capital cost (per kWh*) | Fuel cost (per kWh*) | Maintenance cost (per kWh*) |
|---|---|---|---|---|
| Solar cells | £1000 | 20p | zero | zero |
| Petrol generator | £250 | 10p | 20p | 10p |

[*These costs are averaged out over the 20 years that the equipment is expected to last.]

A Which of the following statements is true?

1 A petrol generator has a higher capital cost per kWh.

2 A petrol generator has a higher initial capital cost.

3 A petrol generator has a higher overall cost per kWh.

4 A petrol generator needs less maintenance.

B An advantage of the petrol generator is . . .

1 that it has no moving parts.

2 that it is cheaper to set up the system in the first place.

3 that it will cause less air pollution.

4 that it will cost less over a 20 year period.

C A disadvantage of the solar cells for pumping water in the African village is . . .

1 that they can work out cheaper over a 20 year period.

2 that they have a high initial capital cost.

3 that they require no maintenance.

4 that they will not work during the night.







D If the solar cells are used in the UK, they will produce only one fifth as much electricity during a 20-year period as they do in the African village.

How much more expensive would each kilowatt hour of electricity from the solar cells then be compared to mains electricity at 8 p per kilowatt hour?

1 2.5 times more expensive

2 5 times more expensive

3 10 times more expensive

4 12.5 times more expensive

4. In each part choose only **one** answer.

Electricity can be generated in various ways.
The main power stations use fossil fuels (coal, oil and gas) or nuclear fuels.
No nuclear power stations have been built in the UK for some years.

A Which one of the following is a valid argument against nuclear power stations?

1 For maximum efficiency, they have to be in nearly constant use.

2 They have high decommissioning costs.

3 They have high fuel costs.

4 They produce gases that pollute the atmosphere.

B Some people argue that we should make more use of wind power instead of nuclear or fossil fuel power stations.

Which statement supports this view?

1 Fossil fuel and nuclear power stations are needed when the wind drops.

2 Large wind farms can be unsightly and noisy.

3 Wind farms have zero fuel costs to offset high capital cost.

4 Wind farms use large areas of land.

C

$$\text{energy transferred (kilowatt-hour, kWh)} = \text{power (kilowatt, kW)} \times \text{time (hour, h)}$$

A nuclear power station produces 1600 000 000 kWh of energy from 1 tonne of nuclear fuel.

How much nuclear fuel would be used by a 2400 MW nuclear power station for 24 hours?
(1 MW = 1000 kW)

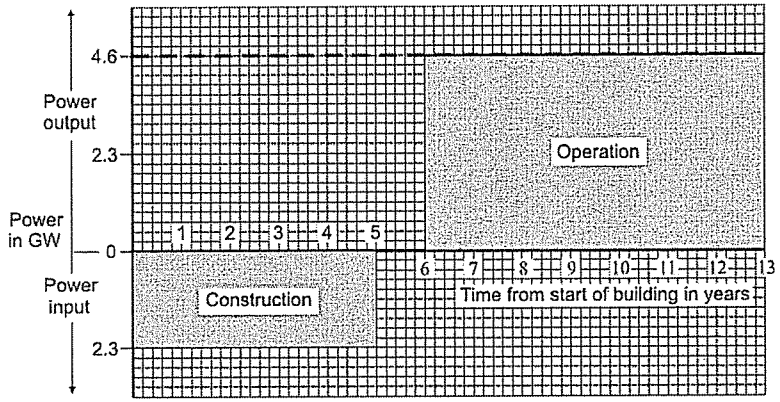
1 0.00036 tonnes

2 0.000625 tonnes

3 0.036 tonnes

4 2.78 tonnes

D Nuclear power stations take a long time to build. Power is used in their construction and initial fuel processing. This, and the power produced by the station, are shown in the graph. The area under the graph represents the energy used or produced in GWh (1 GWh = 1 million kWh).




How many years will pass from the start of building before the power station produces more energy than was used to build it?

1 7 years

2 7.5 years

3 8 years

4 8.5 years