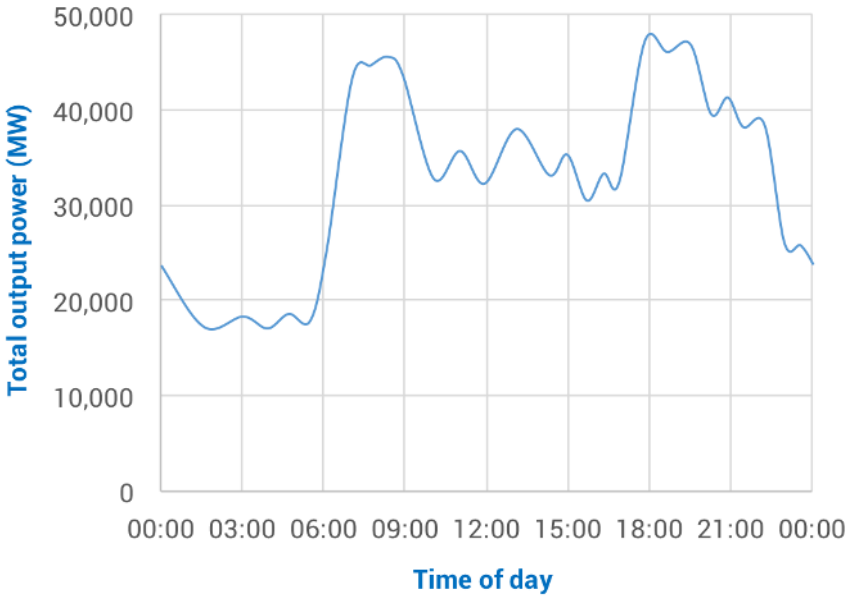
0 1 The way in which the total amount of electrical power produced in the UK varies over the course of a typical day is described by the below graph.



0 1 . 1 Describe the trend in the above data.

Any TWO of: the total power varies/changes/fluctuates throughout the day; it is lower during the night; it is higher in the morning (at breakfast time) and in the evening (at dinner time).

0 1 . 2 At present, just a small amount of UK electricity is produced by hydroelectric power. Many hydroelectric power schemes use a technique known as pumped storage. Explain what is meant by **pumped storage**.

When the demand for electricity is low, excess ('leftover') electrical energy which has been generated elsewhere [1] is used to pump water back into the reservoir ('lake') above a hydroelectric power station [1]. This water can be released back through the turbines as an when extra electrical energy is required elsewhere [1].

0 1 . 3 Using information from the above graph, suggest a time at which UK hydroelectric power stations could operate in pumped storage mode. Explain your answer.

During the night / between midnight (0:00) and 6 am (6:00 [1] as this is when the demand for electricity is lower (which means that it will be easier for other power stations to provide the necessary energy for water to be pumped back up into the reservoir/dam of the hydroelectric power station) [1].

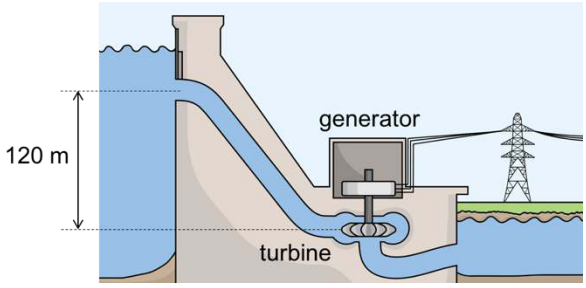
0 1 . 4

At present, roughly half of our electricity is generated through the burning of fossil fuels, but this figure is likely to decrease over the coming decades as the government has committed itself to reducing UK carbon dioxide emissions by 80% by the year 2050. Write down one **advantage** of using fossil fuels for the generation of electricity, then explain why the government is keen to **reduce their usage**.

Burning fossil fuels is a *reliable* way of generating electricity OR they are relatively cheap [1]. However, it leads to the release of carbon dioxide into the atmosphere which contributes to the greenhouse effect/global warming/climate change OR it leads to the production of acid rain which can damage plants and buildings OR our reserves of fossil fuels are running out (and so we will have to use alternative energy resources for the generation of electricity) [1].

0 2

In a particular hydroelectric power station, 500,000 kg of water passes through a turbine per minute. Before doing so, this water falls through a height of 120 m, as shown in the below diagram.



0 2 . 1

Calculate the amount of gravitational potential energy lost by this amount of water as it flows towards the turbine. Take g = 9.8 N/kg.

$E_p = m\ g\ h = 500{,}000 \times 9.8 \times 120 =$ **588,000,000 J** (5.88×10^8 J)

0 2 . 2

Hence calculate the maximum power output of the generator. Write your answer in megawatts, remembering that 1 MW = 10^6 W.

$P = E \div t = 588{,}000{,}000 \div 60 = 9{,}800{,}000$ W $= 9.8 \times 10^6$ W = **9.8 MW**

0 2 . 3

In practice, the amount of electrical power generated by the power station will be less than the value you calculated in the previous question. Write down **one** reason for this.

Some of the GPE lost by the water will be dissipated in the form of heat energy due to: friction between the water and inside of the dam / the viscosity of the water / friction between the water and the blades of the turbine / electrical resistance in the (coils of the) generator. Any ONE.