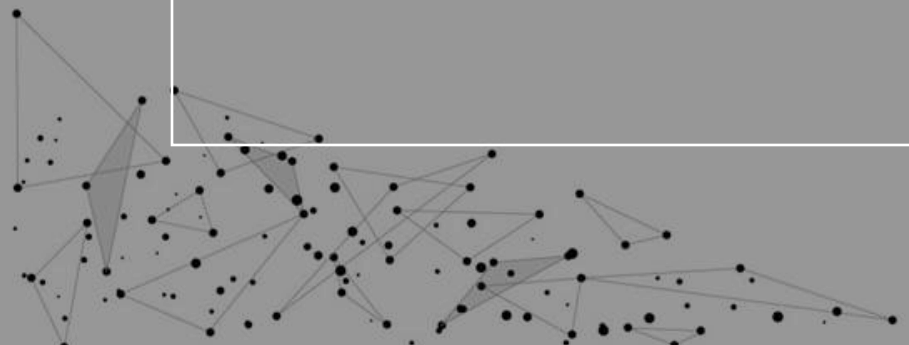
WINDMILLS AND MARBLE RUNS



IOP Institute of Physics

Fair Futures Community Interest Company

What are we going to do today?

- Find out about how we make electricity

- Build a windmill that can light a bulb

- Use the windmill to lift a marble from the floor

- Build a marble run and see how fast we can

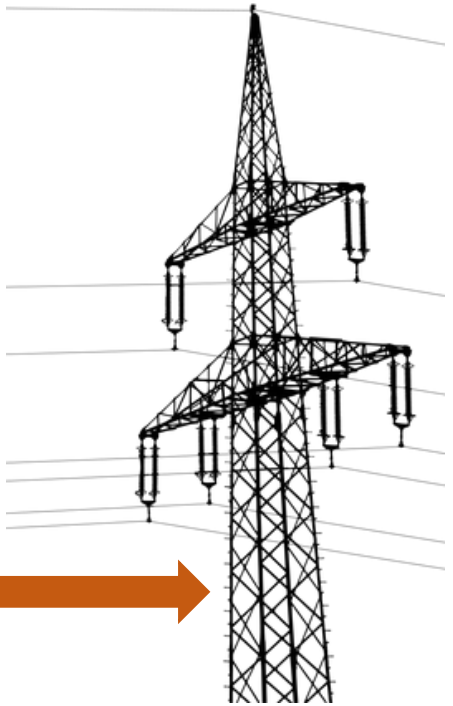
  make the marble go

How do we generate electricity?

To make electricity we need to change one type of energy into electrical energy.

Kinetic energy is the energy of movement. Most of our electricity comes from transferring kinetic energy into electrical energy.

Kinetic energy turns turbines, and this energy is transferred to electrical energy in a generator.



Look at the cards showing different types of electricity generation.

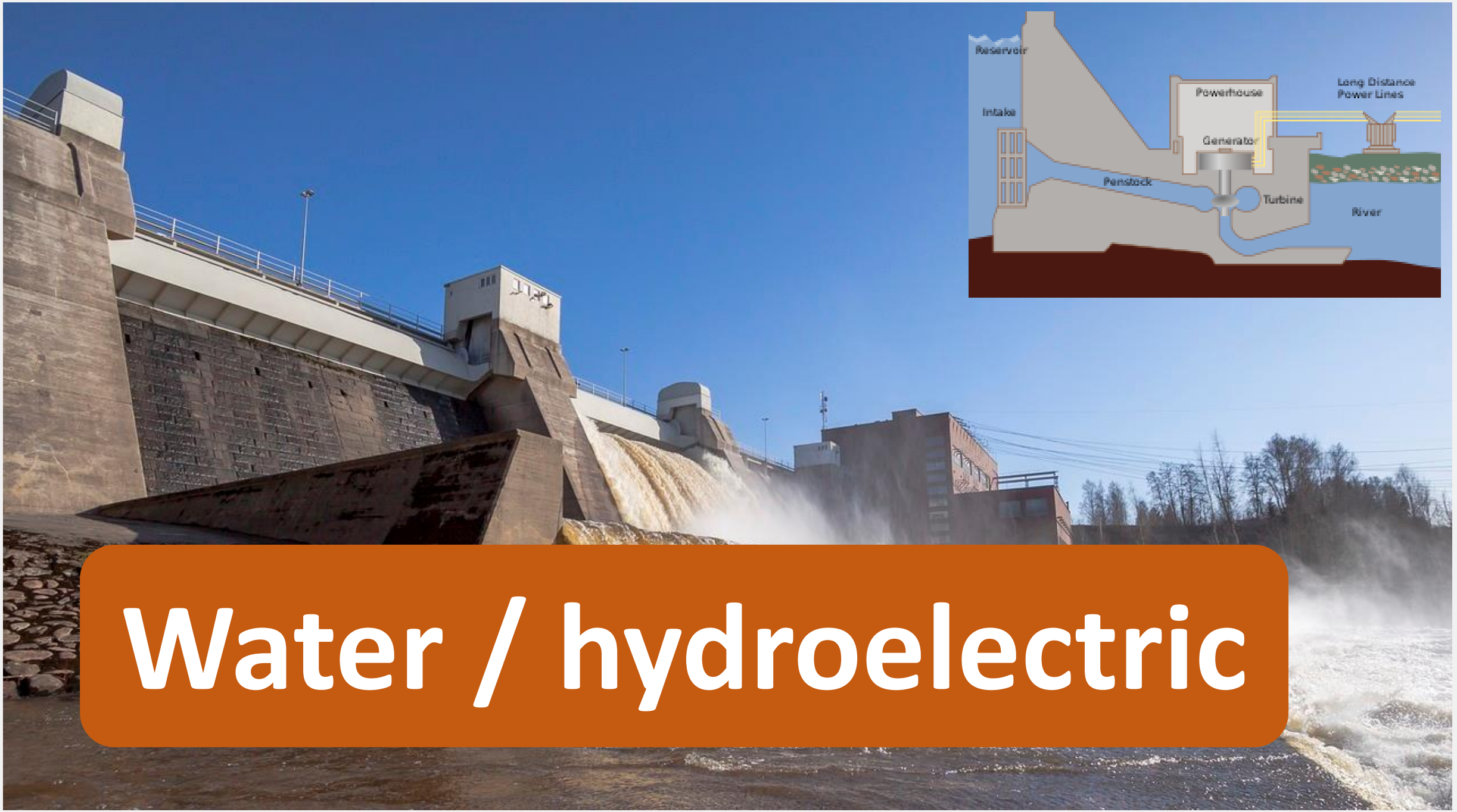
Which is the only one that does not use kinetic energy?

Which are **renewable** and which are **non-renewable?**

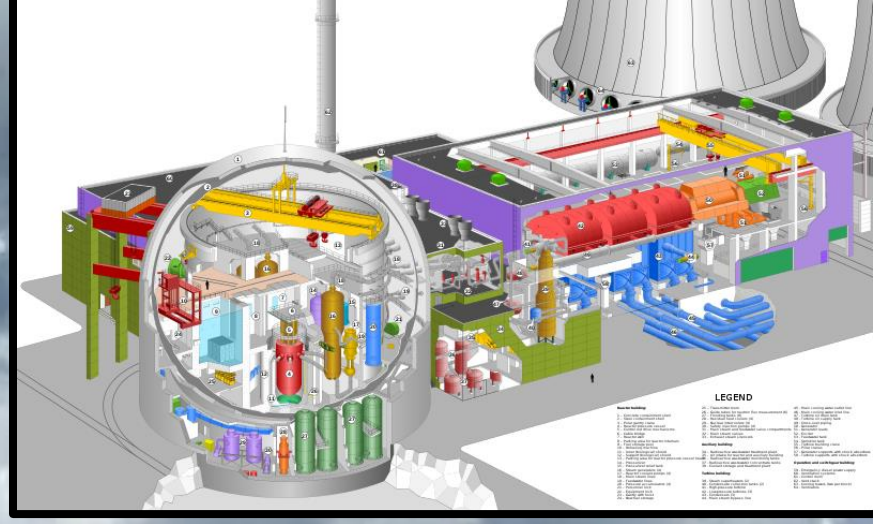
Renewable resources can be used again and again

There is a limited supply of non-renewable resources


Wind



Water / hydroelectric



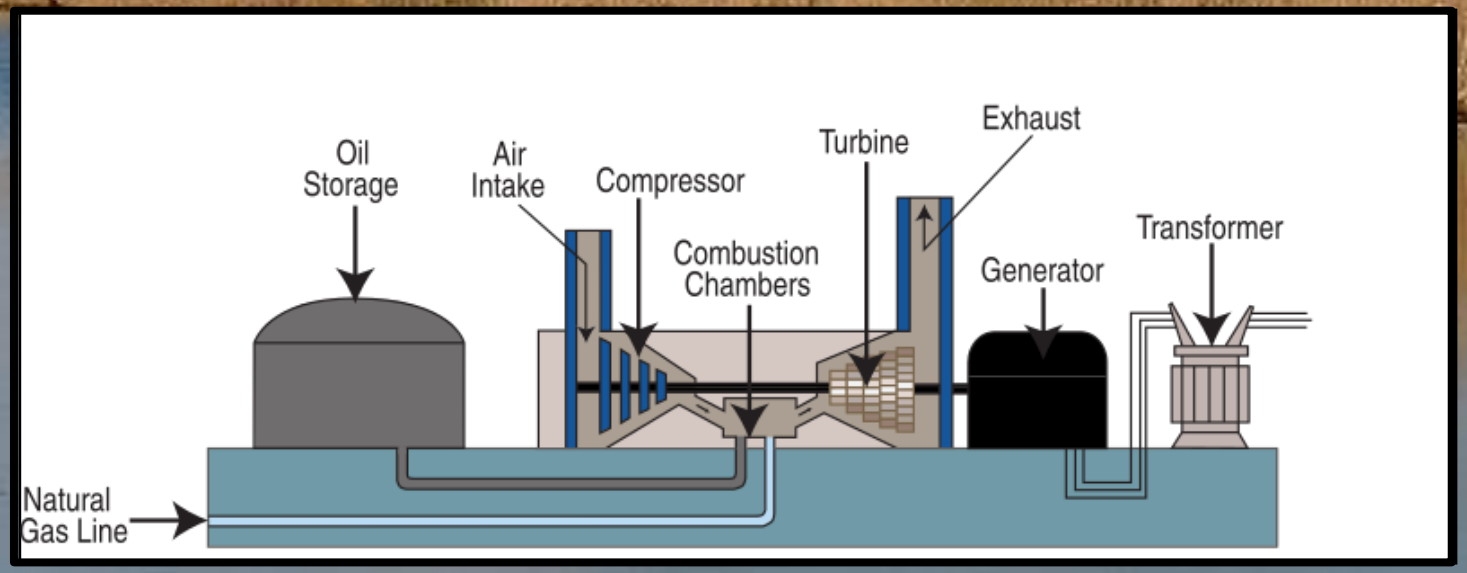
Nuclear

Solar / photovoltaic

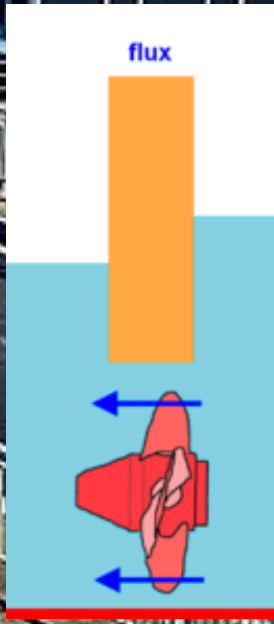

Boiler
(furnace)
Turbine
Steam
Transmission
Lines
Coal
Water
Generator
Transformer
River
Condenser Cooling Water
Condenser

Coal

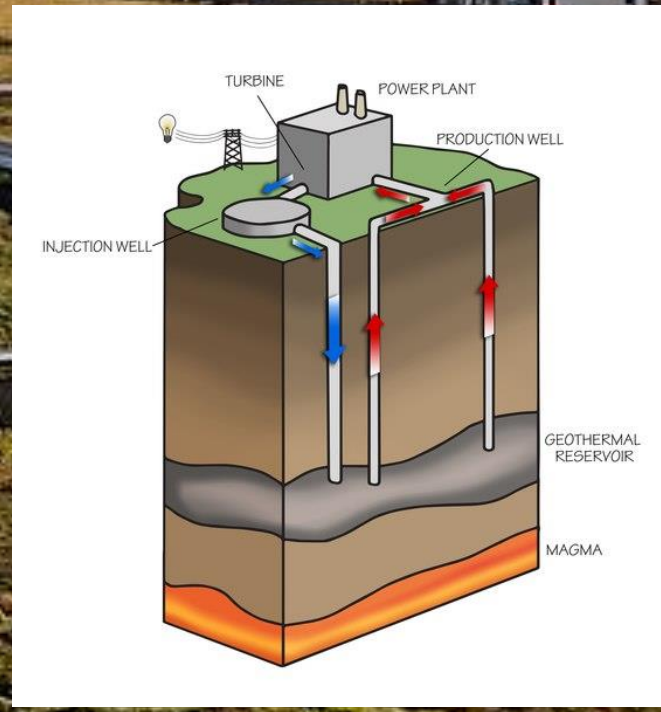
Gas / oil


Oil
Storage
Air
Intake
Compressor
Combustion
Chambers
Turbine
Exhaust
Generator
Transformer
Natural
Gas Line

Tidal

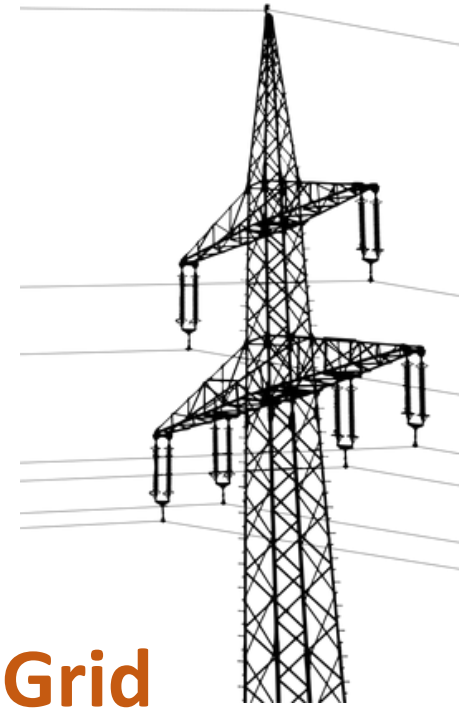


Geothermal


TURBINE
POWER PLANT
PRODUCTION WELL
INJECTION WELL
GEOTHERMAL RESERVOIR
MAGMA

How do we generate electricity?

Electricity is generated at a power station. Then it is carried in power lines and cables to our houses. Pylons in fields carry the cables. This system is called the National Grid.



Answer the questions about the National Grid

Answers

practicalaction.org/schools/wind-power-challenge

Practical ACTION

1. At what time in the morning does the power start to go up in winter?

   03.30 – and it goes up quickly at 7.30

2. Why do you think a lot of power is needed then?

   People are getting up and turning on the heating.

3. What is the highest amount of power that we use in winter?

   58GW (1 gigawatt = 1 billion watts. A lightbulb is 60-100 watts)

4. Why do you think we use more power in the winter than in the summer?

   We are indoors more. It gets dark earlier. We use more heating.

Answers

practicalaction.org/schools/wind-power-challenge

Practical ACTION

5. What is the difference between the amount of power used in winter and summer at 16.00?

15GW

6. Why do you think there is a big increase in power use from about 16.00 to 17.00 in the winter that doesn't happen in the summer?

It is dark so people need to turn on the lights.

Answers

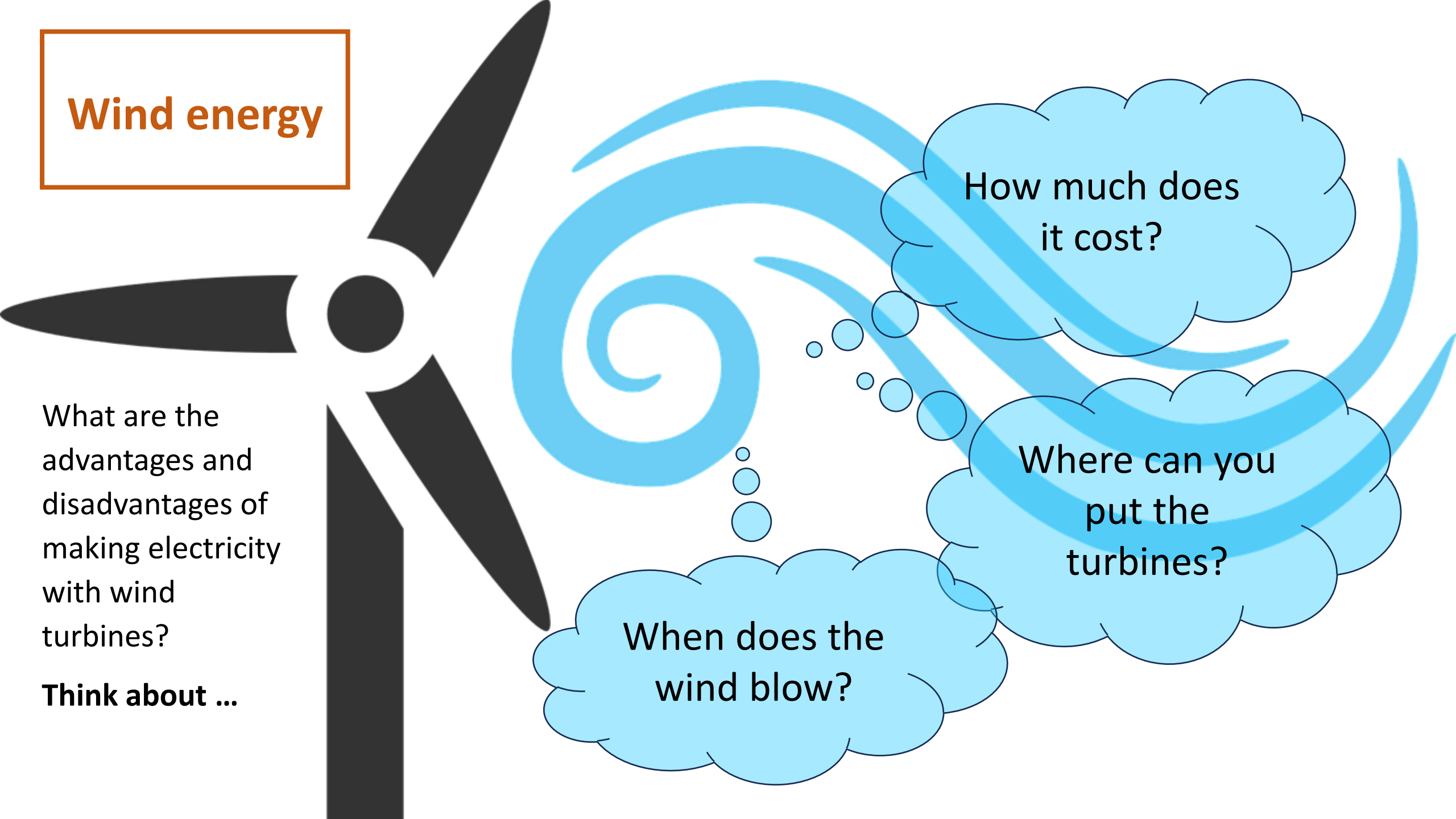
7. 1MW can power 700 houses in the UK. If a house in Peru only uses about 10% of the power used in the UK, how many houses could 1MW power in Peru?

10% = 1/10 700 x 10 = 7000

8. If a large wind turbine can produce 2MW, how many houses could it power: a) in the UK? b) in Peru

700 x 2 = 1400 7000 x 2 = 14,000

Wind energy



What are the advantages and disadvantages of making electricity with wind turbines?

Think about …

How much does it cost?

Where can you put the turbines?

When does the wind blow?

Now it’s your turn

You are going to make a wind turbine.

Work in your group.

You have two goals:

1. Your wind turbine needs to light a bulb
2. The turbine needs to lift up a marble.

Feedback

Complete the worksheet.

Marble run

Make a marble run in your group.

How fast can you make your marble go?

Imagine we lifted water instead of a marble.

How could we use the water to generate electricity?