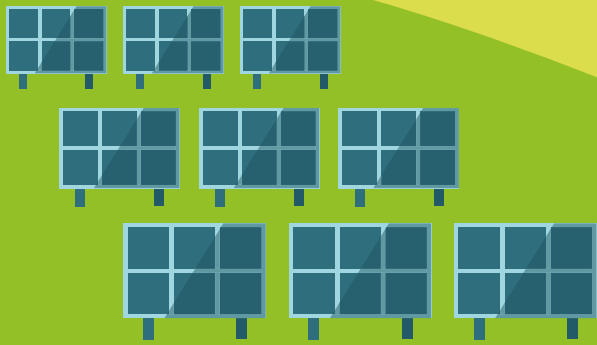


All about energy



A fun way to learn
about renewable energy
for 8-11 year olds



Facts about electricity and renewables



Hello! I'm Sara. I'm an engineer and I work on a wind farm, operating and maintaining the turbines. I know a lot about electricity.

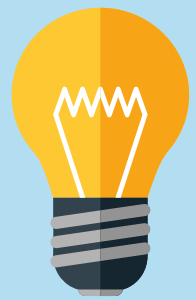
Let me tell you what we use electricity for, how it is made, and why it's important to produce it in a way that doesn't harm our planet.

Electricity is a type of energy. We need electricity for our homes, schools, businesses and factories. Electricity powers our TVs, computers, mobile phones, games consoles, washing machines and much more. Electricity makes the lights work, keeps the food in our fridges cold, and boils the water in the kettle.

What other things in your house are powered by electricity?

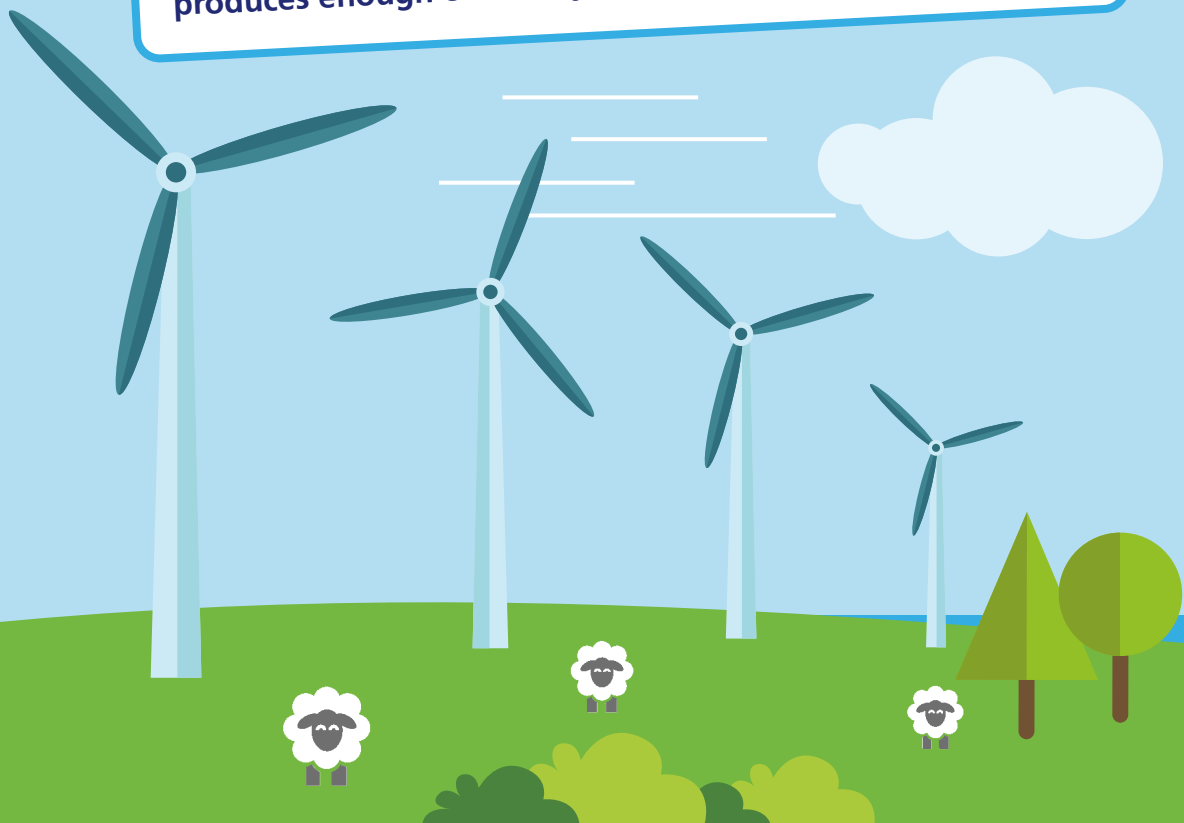
Can you imagine being without these things and the electricity that makes them work?

Electricity is made or generated in different ways.



Write down as many things you can think of in your home that uses electricity. Time yourself for one minute!

Wind power is a form of renewable energy and is captured by wind turbines - tall towers topped with blades. One small wind turbine could provide electricity for a little school. Lots of big wind turbines in one place is called a wind farm and produces enough electricity to power a whole community.



Climate change

Climate change describes the big difference in normal climate and weather patterns over a long period of time.

This is causing extreme weather such as very heavy rainfall or very hot summers, rising sea levels and warming seas, which is a threat to plants, animals, and people.



Very hot weather causes forest fires, dries up lakes and rivers, and melts the ice caps. Heavy rain causes flooding and landslides.

Scientists agree that many things that human beings do contribute to climate change.

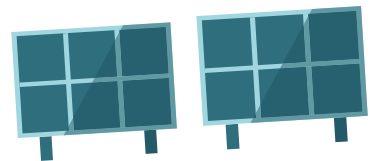
Some methods of generating electricity involve burning fuels like coal and gas. These sorts of fuels are called fossil fuels. There is only a certain quantity of fossil fuels on our planet, and if we continue to use them, they will run out. Generating electricity from fossil fuels also creates greenhouse gases, including carbon dioxide, which is one of the main causes of climate change.



That is why we now prefer to generate electricity in other ways. Renewable energy comes from natural sources that won't run out. Renewable electricity generation doesn't emit carbon dioxide, so it doesn't cause climate change.

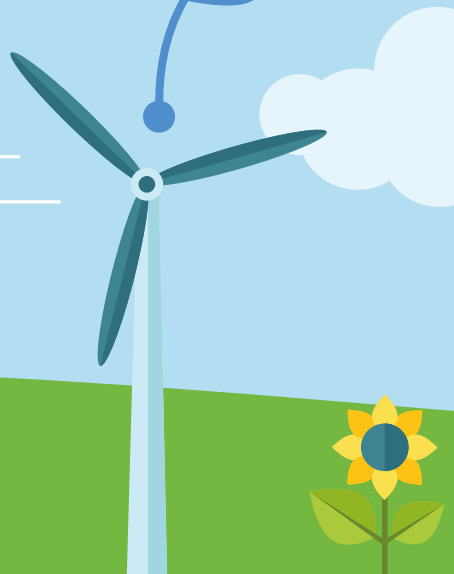
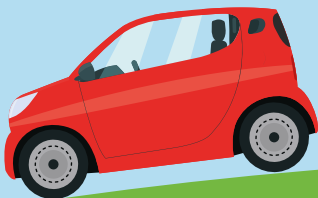
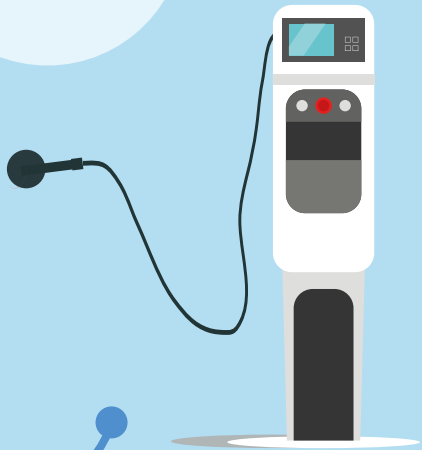
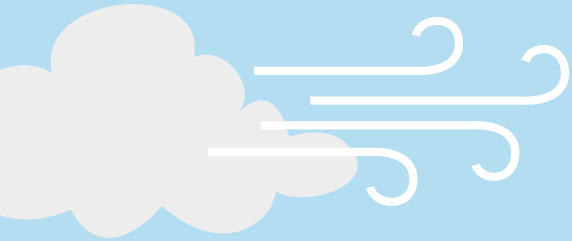
Renewable electricity can be made from all sorts of natural energy sources, including:

- > the heat and light of the sun
- > the wind
- > waves and tides in the sea



Match them up!

How do solar panels
like their eggs?
Sunny-side up!

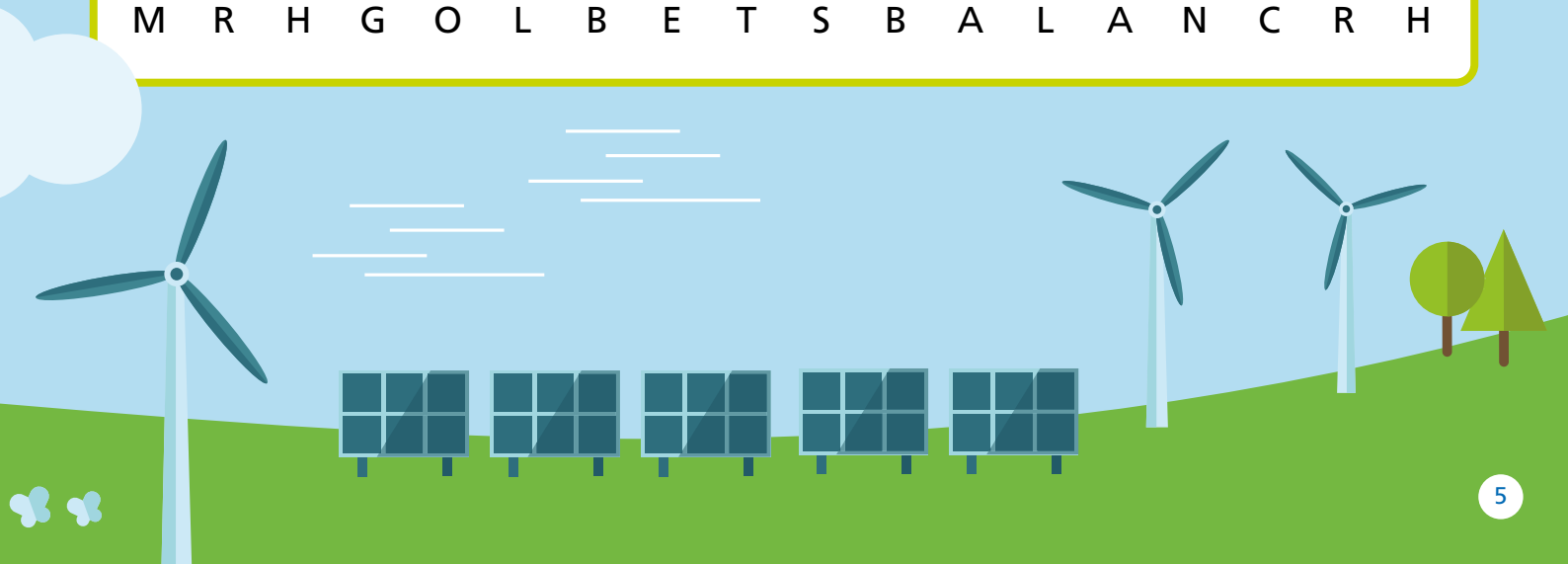


Word search

Why did the electrical
cables break up?
There was no spark
between them!

Wind	Sun	Charge	Cable
Energy	Heat	Hill	Electricity
Power	Climate	Blade	Green
Turbine	Rain	Tower	

L J B H L G D G Z R E G R T B Q R O
A H L E E R H S L E W T F U M K H B
C H A R G E P H N B R H D R W G E M
I N D K T E H K E H W T V B S J A Y
H S E E I N N E L E C T R I C I T Y
P N T B A S V E F T V I G N T C T T
A B E A G Q R W C L N S X E R S N L
R F T B X M L X A U L D B Y S K F A
G S L H M Z D P B T C I W G U I L E
O L U I H N R F L E L S W I N D B H
E W C L I M A T E G L T W T R S T J
G J Q L I T I J K D W H L P K G O Q
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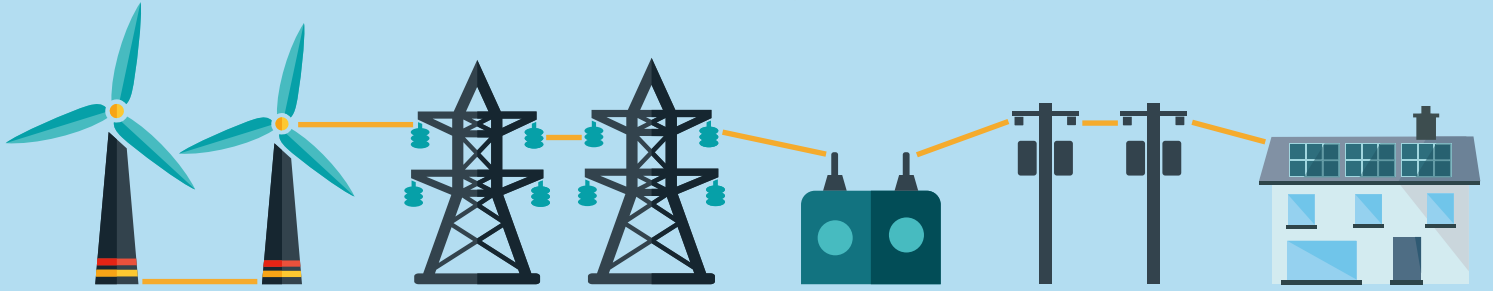
The electricity grid

The electricity grid is a system of cables and equipment linking the place where power is generated – like a wind or solar farm – to streets, homes and buildings.

Why did the tornado
take a break?
It was out of wind!



ELECTRICITY GRID



Hello! I'm Dylan.
I'm an engineer and I
work on a solar farm.
I know a lot about
electricity.



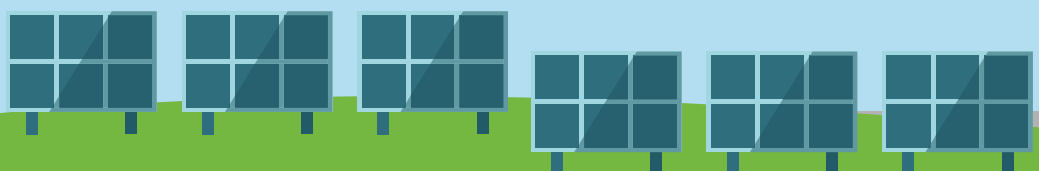
How is electricity generated from the sun?

Solar energy comes from the sunlight that reaches earth.

Solar cells turn light from the sun into electricity. Solar cells are put together to make solar panels, which can be placed on the roof to provide electricity to homes and buildings. Solar panels also power other things. Have you noticed how some streetlights and road traffic signs are connected to a solar panel, and even the calculator you use to do sums has a tiny solar panel in it!

A solar farm is where there are lots of solar panels close by in rows across a field, generating lots of electricity that is fed into the electricity grid.

Sometimes the electricity grid is called the electricity network.



Using batteries to store renewable electricity

The amount of energy generated by solar panels and wind turbines can vary depending on the weather and time of year. We tend to use more electricity in our homes in the evening, and less during the day when we're out at school and work.

Scientists have invented a new kind of battery to store the energy generated from renewable sources. Then, when people need more electricity, the energy is sent to the electricity grid. No electricity is wasted, so we use more renewable energy, and less fossil fuels.

Homes with solar panels can use smaller batteries, storing energy generated during the day to use in the evening.



What kind of car does an electrician drive?
A Volts-wagon!

Powering cars with electricity

Cars, buses and lorries all have an engine. The engine is what makes the car move. Most car engines use petrol or diesel to power them. However this fuel is a fossil fuel, which is taken out of the ground, is harmful to the planet and one of the causes of climate change.

There are now more and more electric vehicles or EVs. The electricity charges a battery which then powers the electric motor of the car. The car is 'plugged in', just like you would plug in your mobile phone or a vacuum cleaner, but with a far thicker cable!

There are more electric vehicle charging units than ever before, at supermarkets, shops, motorway service stations and people's homes. Using renewable electricity to charge cars and other transport is better for the environment and a lot cheaper than filling up with fossil fuels!



How a wind turbine works

Wind power is captured by a machine called a wind turbine.

Why can't wind turbines ever make plans?
They're always up in the air!

Wind turbines have tall towers topped with blades.

The wind turns the blades, which are connected to a shaft, which spins a generator to produce electricity.

We measure the installed capacity of a turbine in megawatts (MW). This is the maximum possible power that can be generated. The amount a turbine actually generates depends on how often the blades turn. This is measured in megawatt hours (MWh).

The electricity is carried in cables from the generator, down the inside of the tower, into the electricity network, which eventually comes into your home and school to power the lights, computers, mobile phones, the kettle and much more.

Turbines come in different sizes and generate different amounts of electricity. The bigger the turbine, the more wind is captured, and the more electricity that can be generated!



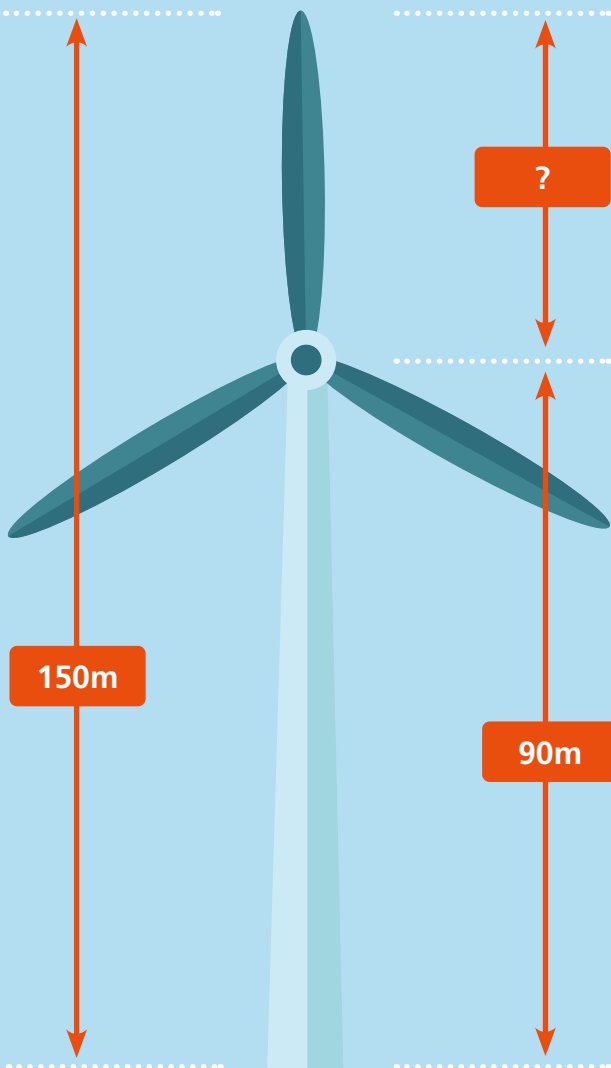
Energetic maths!

Don't forget to show how you worked it out!

1

This wind turbine is **150m** tall from the ground to the tip of the blade. The tower is **90m** tall.

How long is the blade?



One turbine asked another turbine, 'what's your favourite type of music?' the other one replied, 'I'm a big heavy metal **FAN!**'

2

If **3 turbines** generated enough electricity for **9,000 homes**, how many homes could:

11 turbines power?

7 turbines power?

2 turbines power?

3

If a wind farm has an installed capacity of **100 MW** and each turbine is **5 MW**.

How many turbines are there?

4

The wind farm has **16 turbines** and each one is **4 MW**.

What is the installed capacity of the wind farm?

And if each turbine is **5 MW**, what is the installed capacity?

5

The wind farm has an installed capacity of **48 MW** and there are **12 turbines**.

What is the installed capacity of each turbine?



Offshore wind farms

Out at sea the wind is much stronger and has more energy. Larger turbines out in the windy sea can produce more electricity.

Closer to shore where the sea is shallower, the wind turbine can be fixed to a foundation on the seabed. Further out to sea where the water is much deeper, the wind turbine sits on a floating platform which is tied to the seabed with strong cables.

The size of an offshore wind farm is far bigger than a wind farm on the land, and it can produce a lot more electricity – sometimes more than 1 gigawatt (that's 1000 megawatts). An offshore wind farm of 1 gigawatt in capacity would provide enough electricity to power about 930,000 homes.

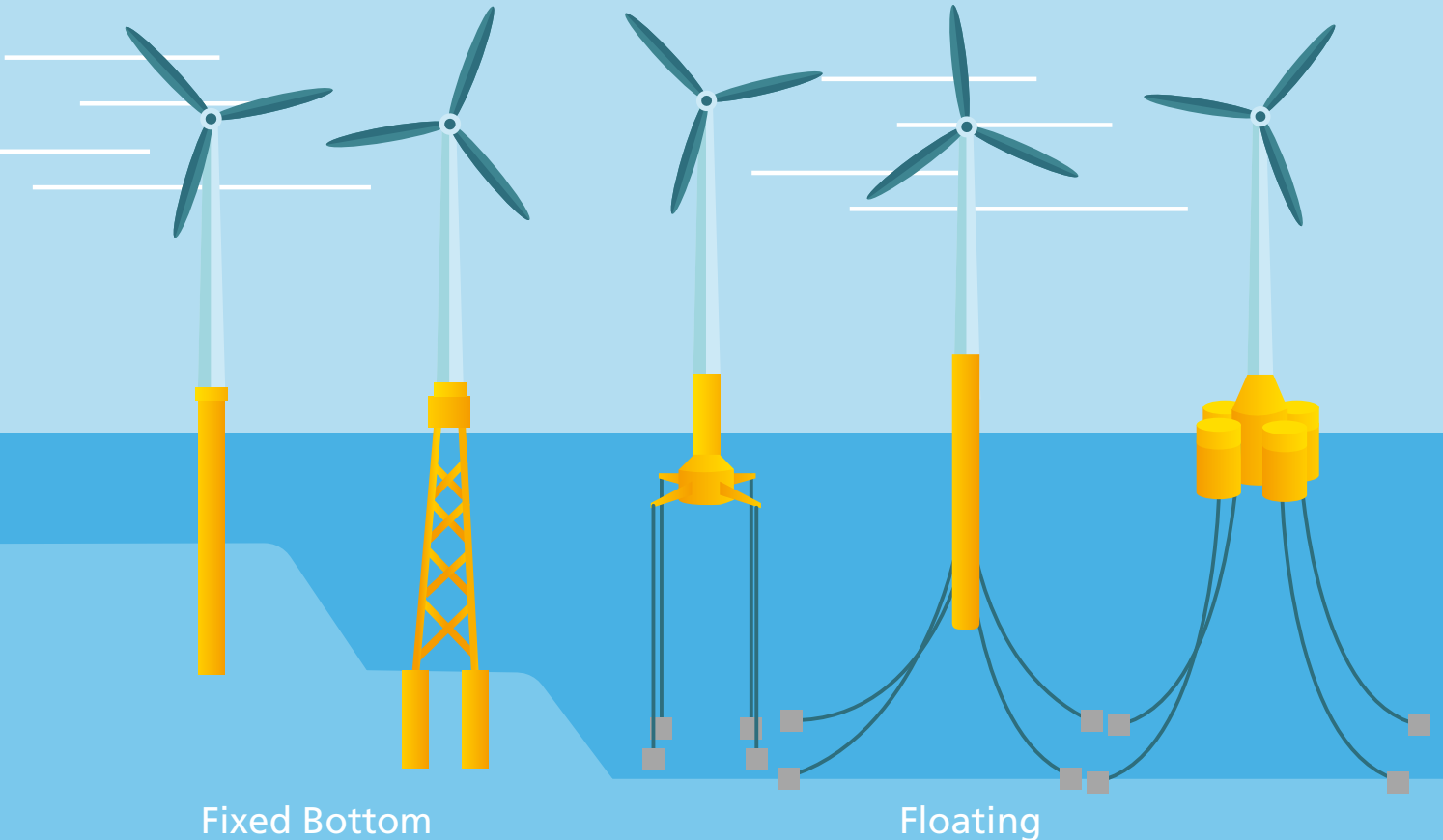
What is a wind turbine's favourite colour?
Blew!!

The biggest turbines are out at sea, these are called offshore wind turbines.

The UK is an island which means we have a very long coastline and great places for offshore windfarms.

0 to 60 metres depth

Above 60 metres depth



Offshore turbines are the **biggest fans** of renewable energy!
 (get it?) 😄

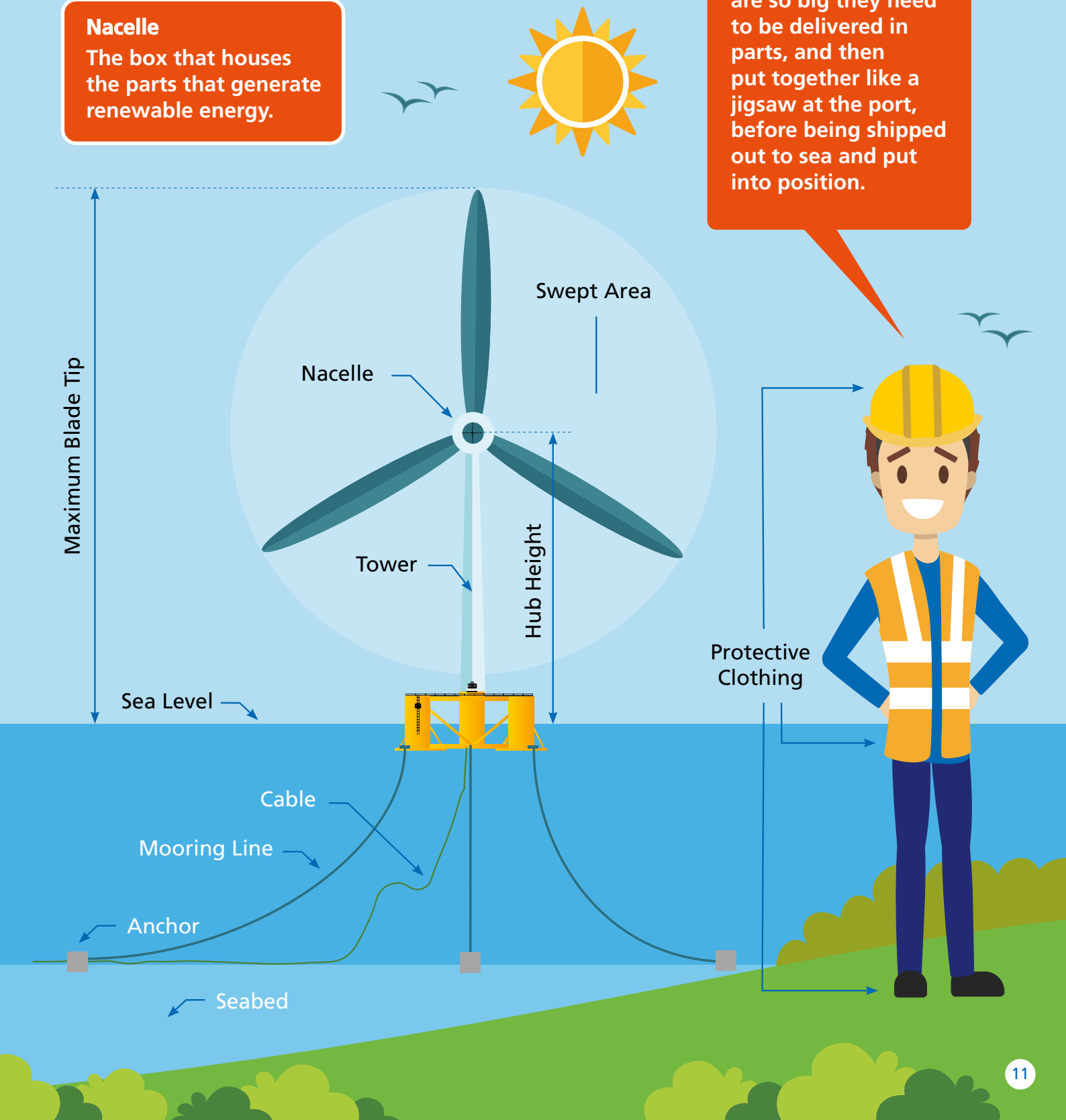
There are huge projects like this being developed all around the UK and the World!

It is more difficult to put a wind farm out at sea than it is on land because of the harsh environment – the wind, the waves and sea currents, and the saltwater.

We also need to be very careful not to harm others that use the sea, especially fish, marine mammals, and birds.

Nacelle
 The box that houses the parts that generate renewable energy.

Offshore turbines are so big they need to be delivered in parts, and then put together like a jigsaw at the port, before being shipped out to sea and put into position.



What does it mean?

What is a light bulb's favourite kind of news?
Current events!

1 = d

1 Climate change

9 Electricity generation

2 Electric Car / EV

10 Cable

3 Wind turbine

11 Metal

4 Fossil fuel

12 Lightning

5 Current electricity

13 Renewable electricity

6 Solar energy

14 Engineer

7 Static electricity

8 Carbon dioxide

15 Wind farm

d A big change in normal climate and weather patterns

j A cord that connects a device such as a lamp or mobile phone to the electricity source

a The heat and light of the sun

h A person who operates and maintains wind turbines

b A material that is good at conducting electricity

e Coal, gas and oil are types of what?

f An example of static electricity

o Lots of wind turbines in one place that produces enough electricity to power a whole community

m Electricity that is produced from natural resources, such as the wind, water or sunlight

g Electricity that stays in one place

i A car powered by electricity

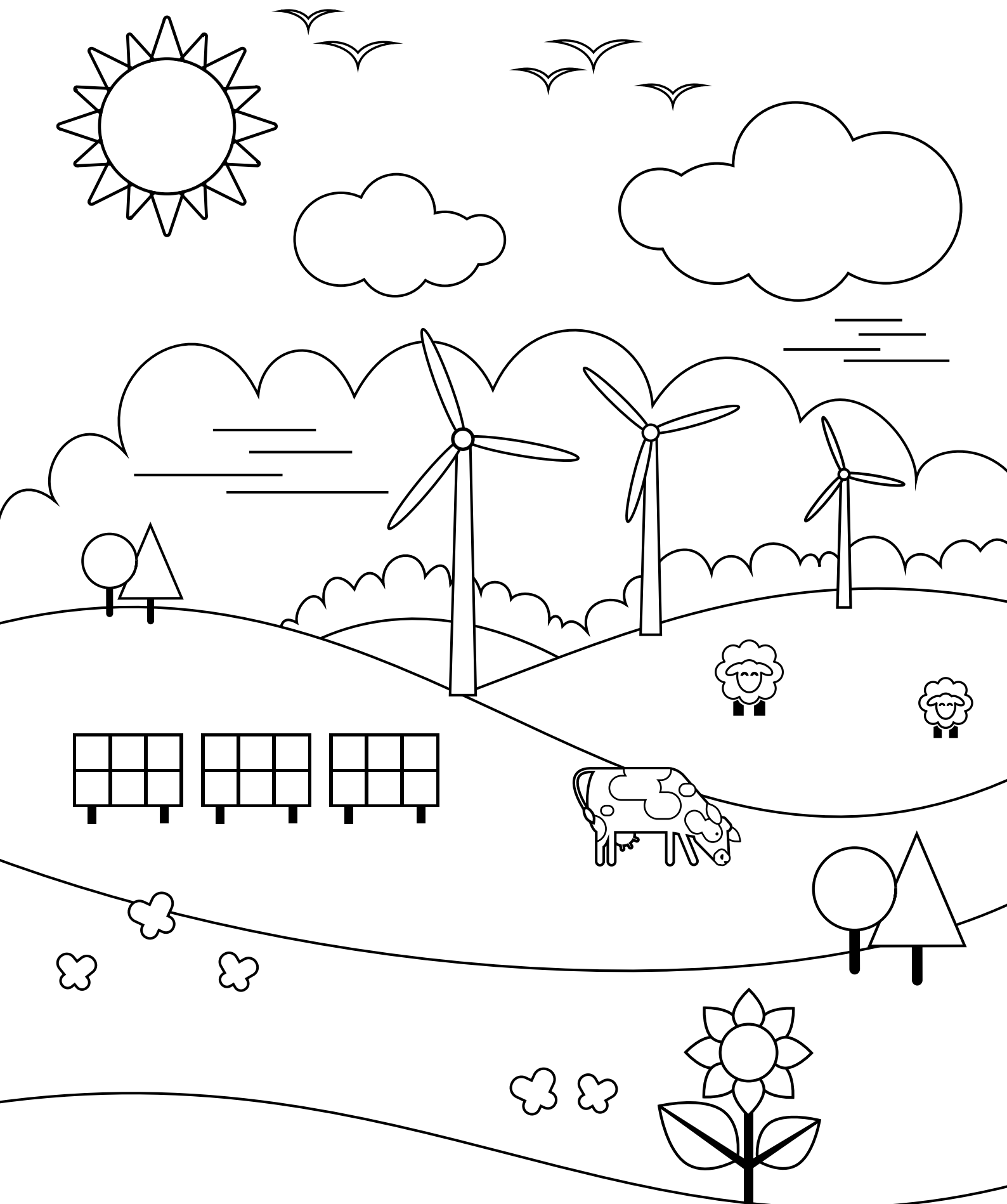
k A tower and blades that capture wind and turn it into electricity

n Making or producing electricity

c Electricity that moves from one place to another

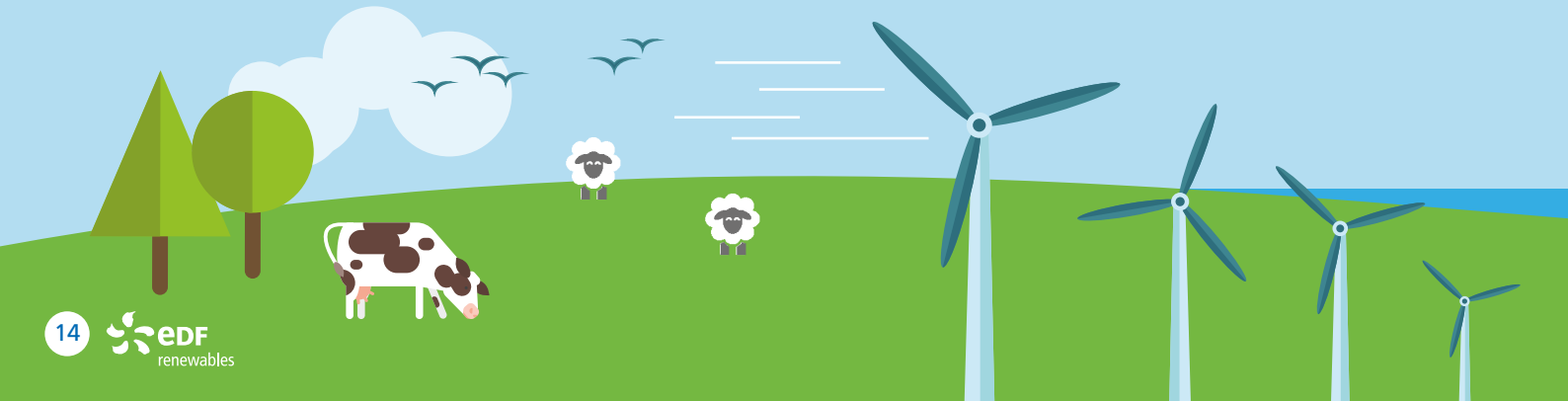
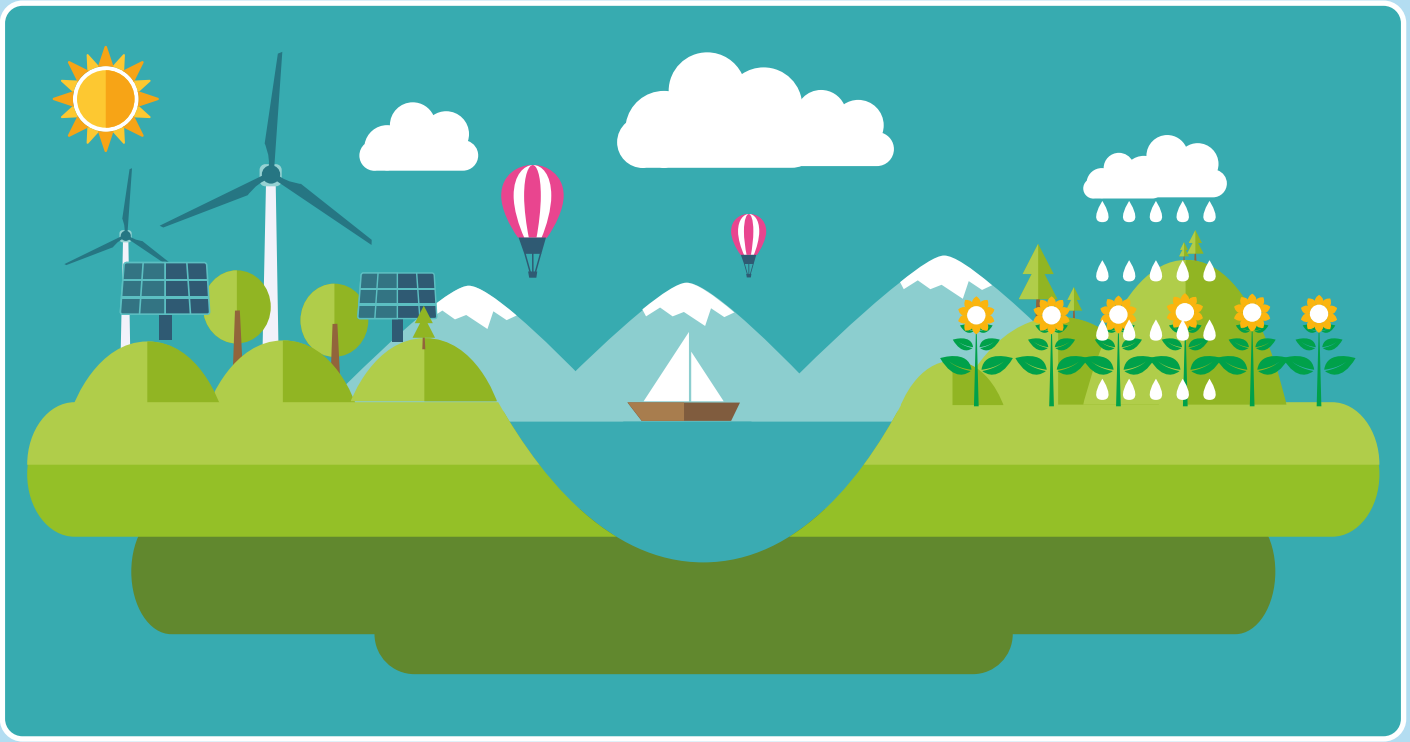
l A gas that is produced when fossil fuels are burned, that is harmful in great quantities

Colour me in



Spot the difference

Look carefully, there are 22 to find.



Fun Facts – did you know?

Electricity first came into widespread use in the Victorian era, when people started to use it to light streets, shops and homes.



Why doesn't the sun go to university?
Because it has about a million degrees already!

Electricity travels at the speed of light, which is more than 186,000 miles per second!



A bolt of lightning is electricity travelling from the clouds to the ground, or from cloud to cloud.



Thomas Edison was the first to design a lightbulb that could be used in a practical way, although inventors before him had discovered the science behind the light bulb.



In 1887, electricity was generated using a wind turbine for the very first time.



In 1974 the computer was born. It was called the 'Altair' but it wasn't until a few years later that the 'PC' went mainstream led by Apple, Tandy and Commodore.

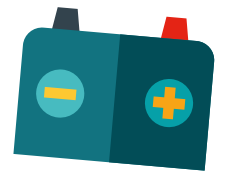


One flash of lightning could power 1,000 homes for a whole year. Lightning lasts one second, but can create up to 3 million volts of electricity!

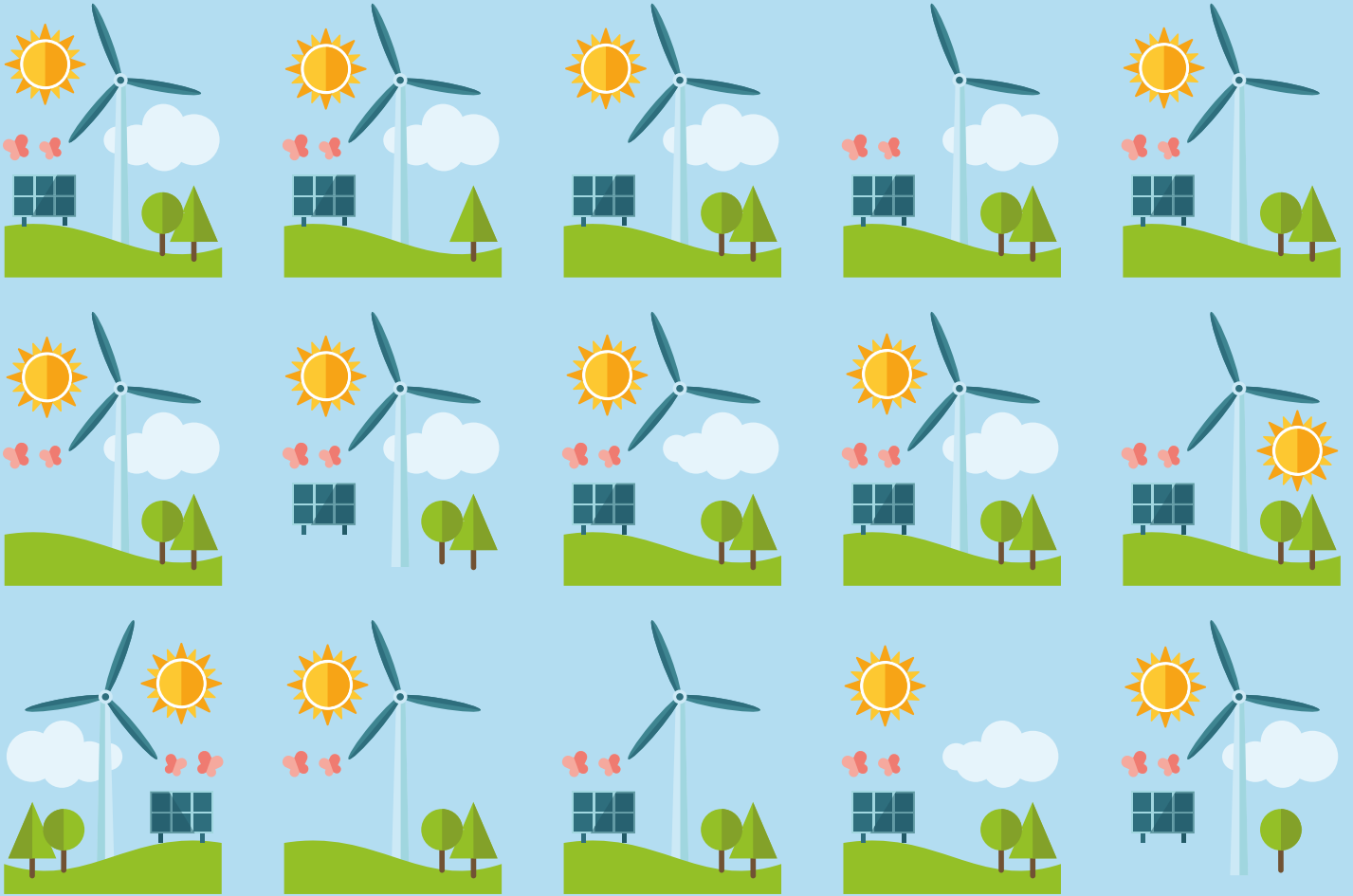


An electric eel can produce strong electric shocks of around 500 volts. They use this to hunt and to protect themselves too. Electric eels can grow to 8 feet long and live for 15 years!

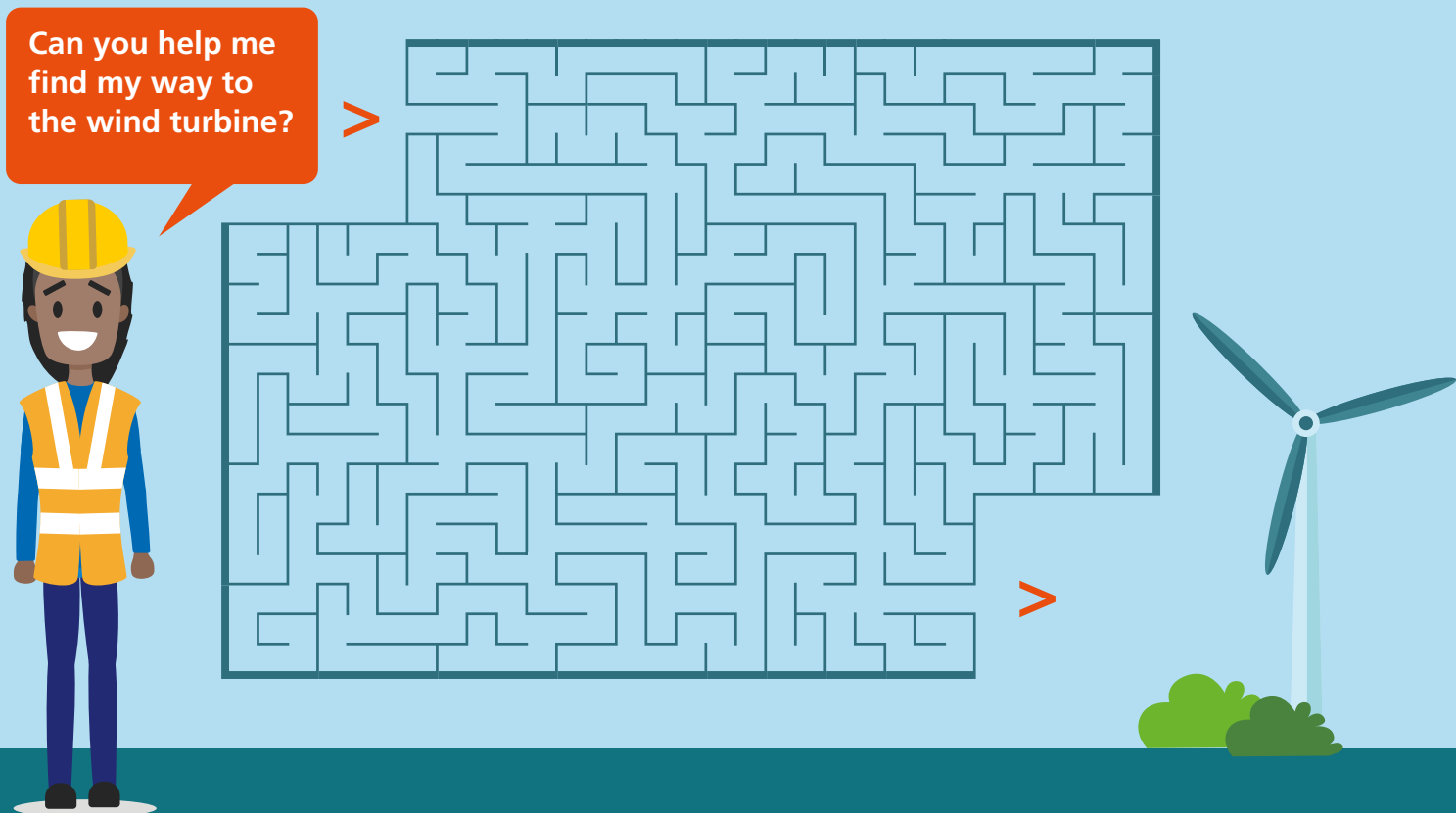
When electricity travels through you, it is called an electric shock. It can be very painful and can even kill people.



Which two energy pictures are identical?



Energy maze puzzle



Energy challenge

What's an electrician's favourite ice cream?
Shock-a-lot!

A kilowatt hour (kWh) is used to measure how much electricity you use in your home. Learn more about how much electricity is used in your home by completing the task below.

The typical medium sized household uses around 3,600 kWh of electricity per year.

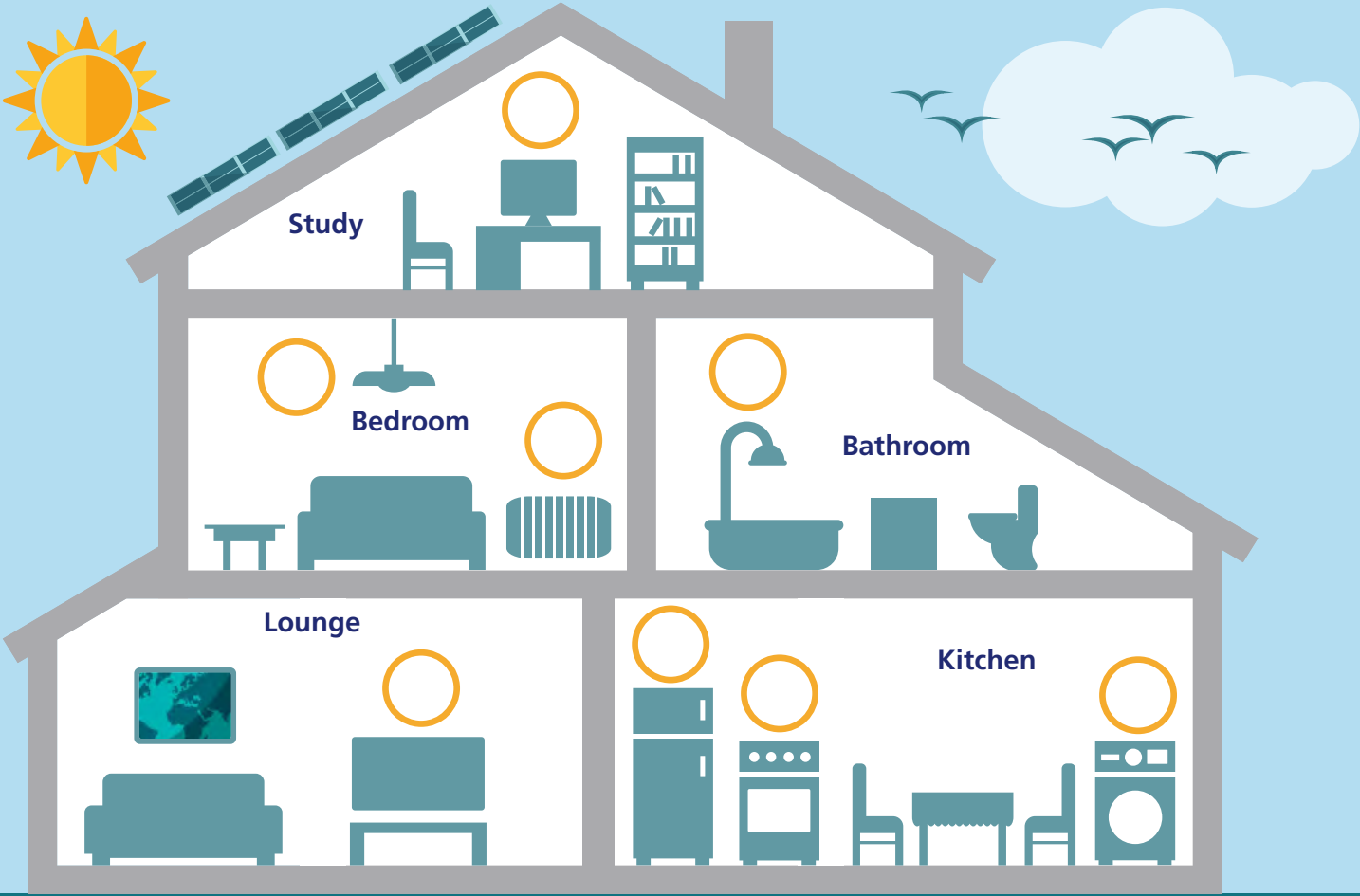
The amount of electricity that is consumed will depend on the type of appliance and how often it is used, and how energy efficient it is.

Here are 8 household appliances with the typical average use per year.

Fridge freezer	400 kWh
Cooker	500 kWh
Lighting	60 kWh
Plasma television	650 kWh
Electric heater	300 kWh
Washing machine	200 kWh
Electric shower	500 kWh
Computer	150 kWh

Look at the picture below. Put the kWh for each item in the correct orange circle. Now, count the total kWh for each room and put that number in the orange box.

Study	<input type="text"/>	Lounge	<input type="text"/>
Bedroom	<input type="text"/>	Kitchen	<input type="text"/>
Bathroom	<input type="text"/>		
Add them up. What is the total?		TOTAL	<input type="text"/>



Maze + one!

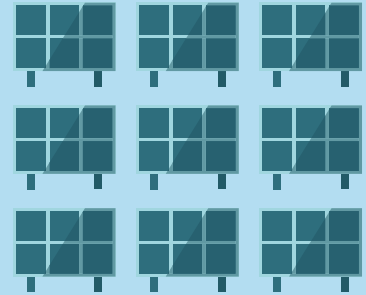
Find your way to the solar panels, in numerical order 1, 2, 3, 4 etc.



21 22 27 29 22 21

28 29 26 30 25 23

21 23 24 25 22 29 30 >



20 21 25 27 24 28 27 29 22 26 25 23

21 26 28 20 22 23 26 28 25 27 26 29

22 20 21 22 23 24 25 22 21 24 27 30

17 19 15 20 21 11 20 23 19 20 22 25

20 18 17 16 15 14 13 15 12 13 17 19

15 12 11 10 17 16 12 11 10 9 19 13

8 5 7 8 10 13 10 15 13 8 11 12

3 5 7 4 5 6 7 9 10

> 1 2 3 8 2 4 6 8



Can you help me find my way to the solar panels?



Energetic sudoku

Put letters in the empty squares so that every row, every column and thick-lined square contains each of the letters that spells out the word:

What is a wind turbine's favourite saying?
One good turn deserves another!

WIND

	N		D
	W		I
	D	W	

WAVE

	A		
W		A	
A		V	
		E	

HEAT

	A		T
T			
	H		E
	T	H	

FUEL

	U		
F		U	
		E	
U		F	

Energy crossword

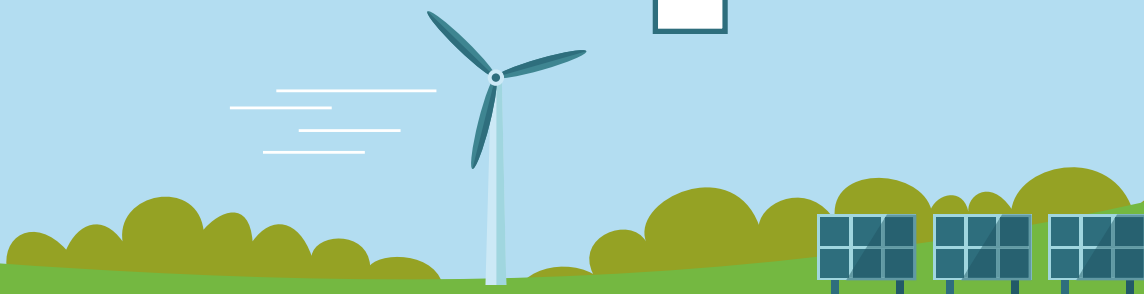
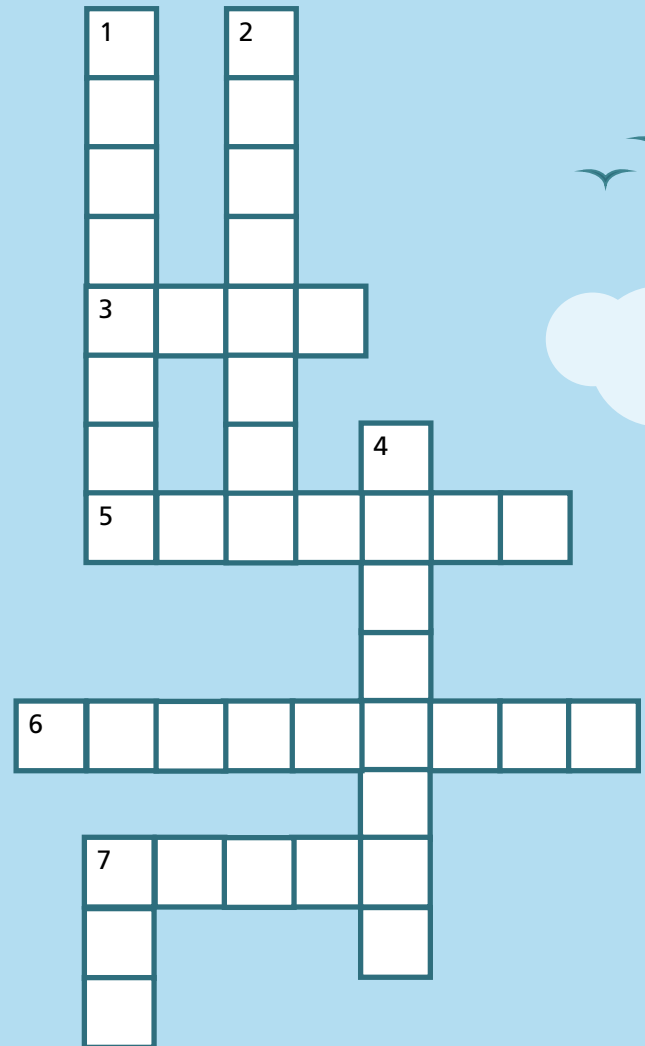
Hint: you'll find the answers on the pages numbered in red next to each clue!

ACROSS

- 3 Electricity can be made from this when it blows (4) **3**
- 5 Machine that makes electricity from wind (7) **8**
- 6 Lots of panels making electricity from the sun (5,4) **6**
- 7 Energy from sunlight (5) **6**

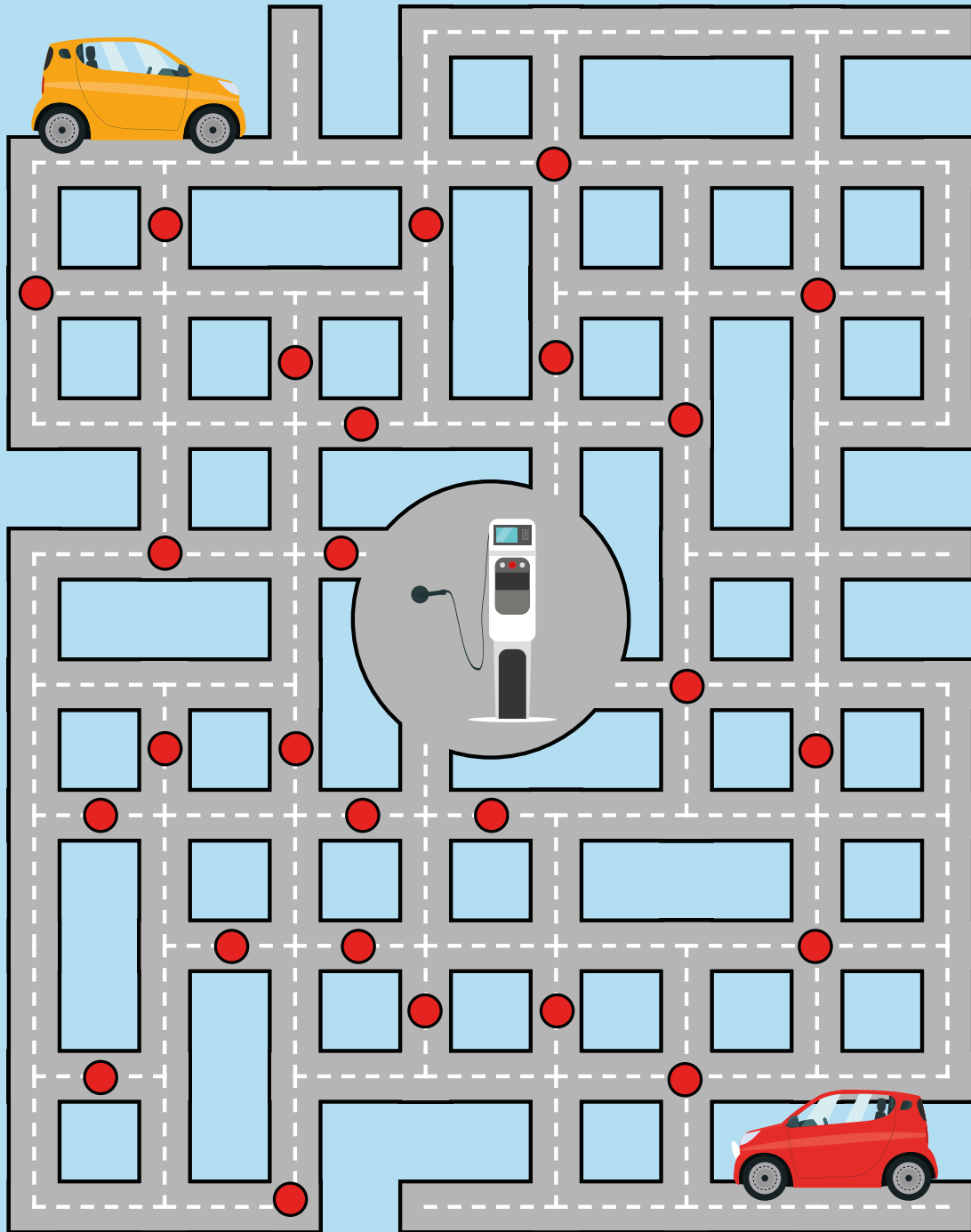
DOWN

- 1 Unit of electricity used in fridges and TVs (8) **15**
- 2 A worker who runs a wind turbine (8) **2**
- 4 Lots of turbines in one place (4,4) **2**
- 7 Source of solar energy (3) **6**



Energetic journey!

Help the yellow and red electric cars get to the electric charging point. Avoid the RED warning circles that indicate road obstacles.

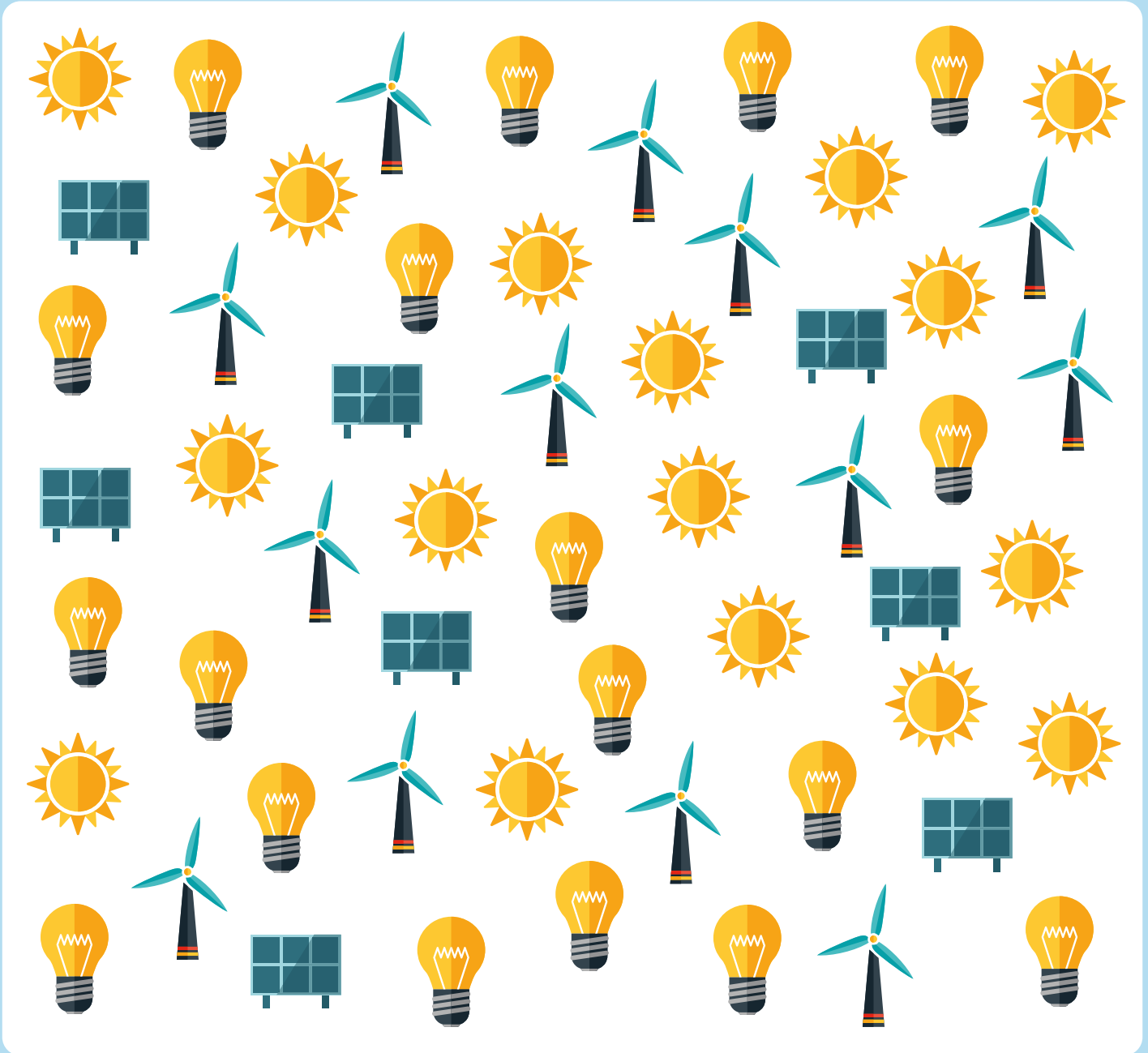
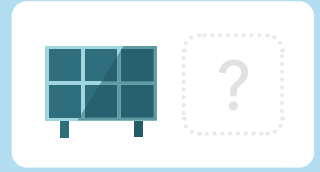
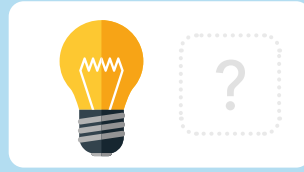
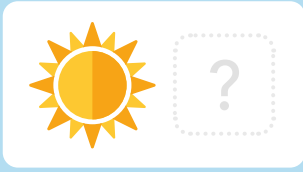


Help me drive the small yellow and red electric cars to the electric charging point.



How many of each kind?

How many of these energetic objects can you find?



Draw a picture of a wind farm



Cut and glue



Can you help cut out and glue me back together again?

