
How to Catch
the Wind

Introduction

As a company, Lautec is committed to providing excellent consulting and IT systems to help companies, states, and countries realize their wind energy goals.

We hope that this book and its accompanying exercises will engage you in learning about an up-and-coming industry and spark some great questions about renewable energies. Learn about electricity and offshore wind through reading, exercises and activities!

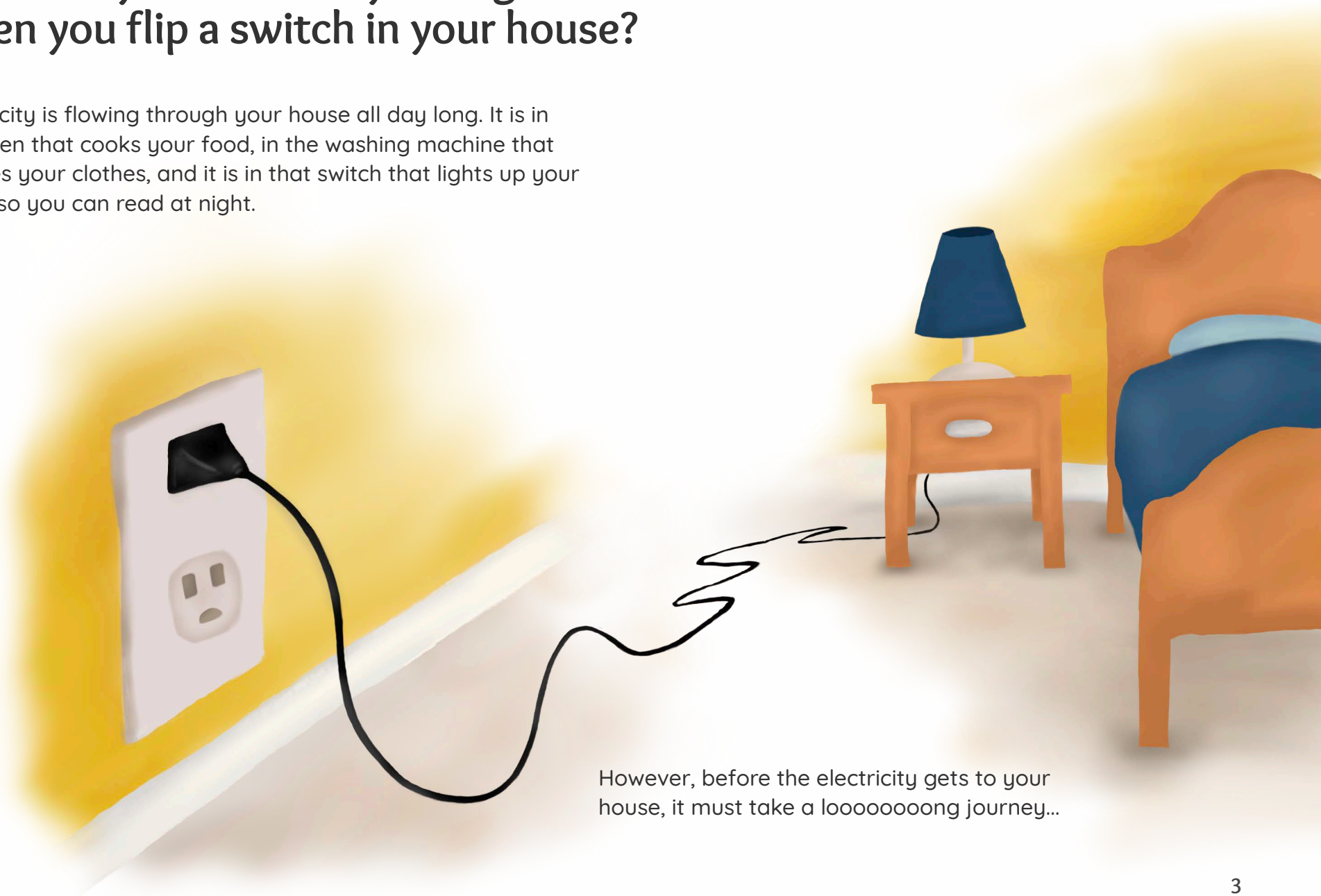
Download and print this pdf, then staple it on the top left corner to have your own physical book. You can write and draw on all the pages. Some of the last pages are also meant to be cut out.

Now, let's get started and have fun while learning about offshore wind!

LAUTEC

Hello! Do you know why the lights turn on when you flip a switch in your house?

Electricity is flowing through your house all day long. It is in the oven that cooks your food, in the washing machine that washes your clothes, and it is in that switch that lights up your room so you can read at night.



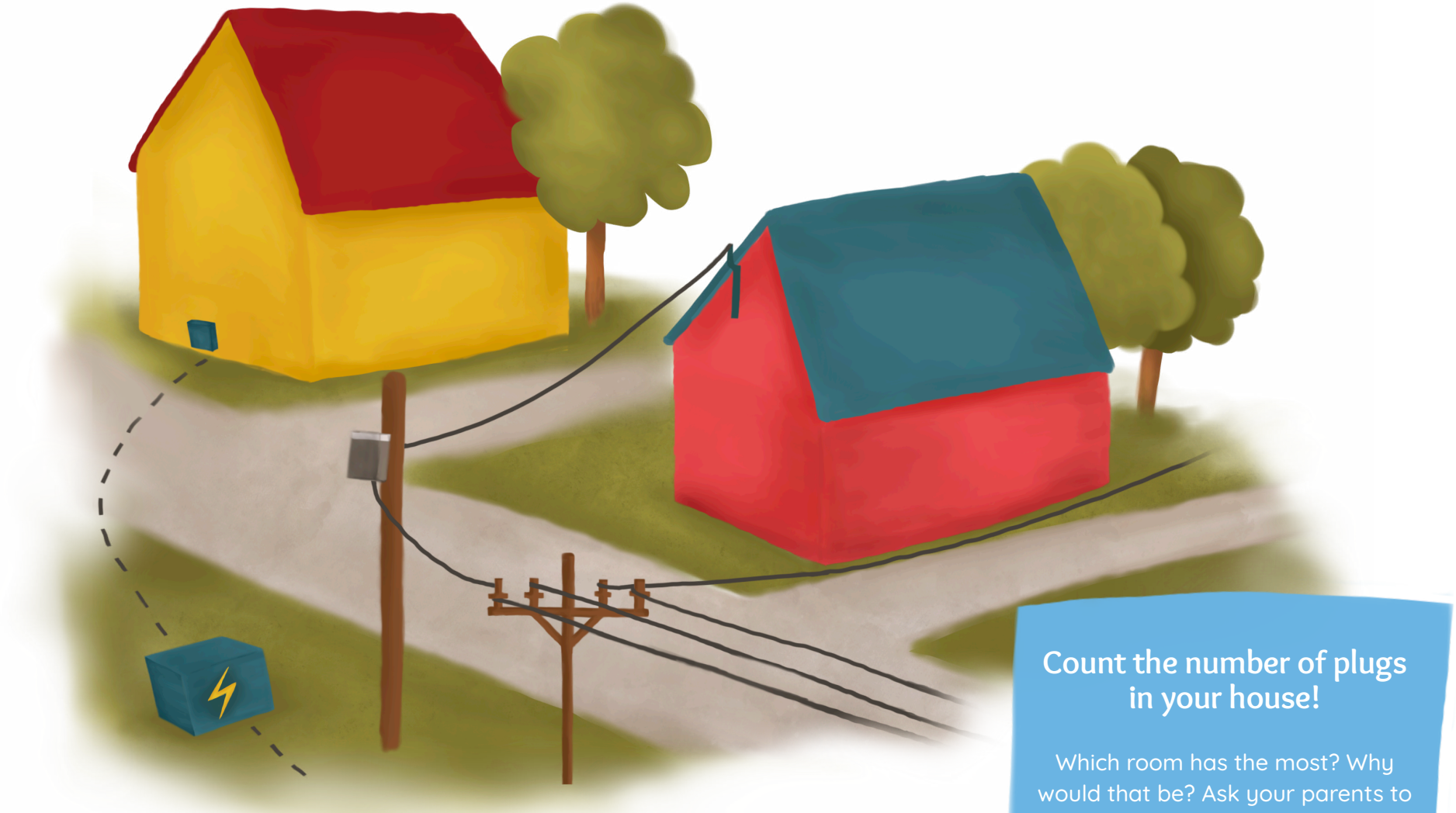
However, before the electricity gets to your house, it must take a looooooooong journey...

Join us on this journey!

We will see where the electricity comes from, how it gets to your house, and focus on one of the most exciting ways that electricity is made. Along the way, we will ask you to answer some questions and challenge you to some activities to explore the electricity in your own house.

Please note that electricity can be dangerous, and we advise you to be careful around electrical equipment

Are you ready? Then let's go!



Count the number of plugs in your house!

Which room has the most? Why would that be? Ask your parents to help you find where the electricity from your street connects to your house!

How does electricity get to your house?

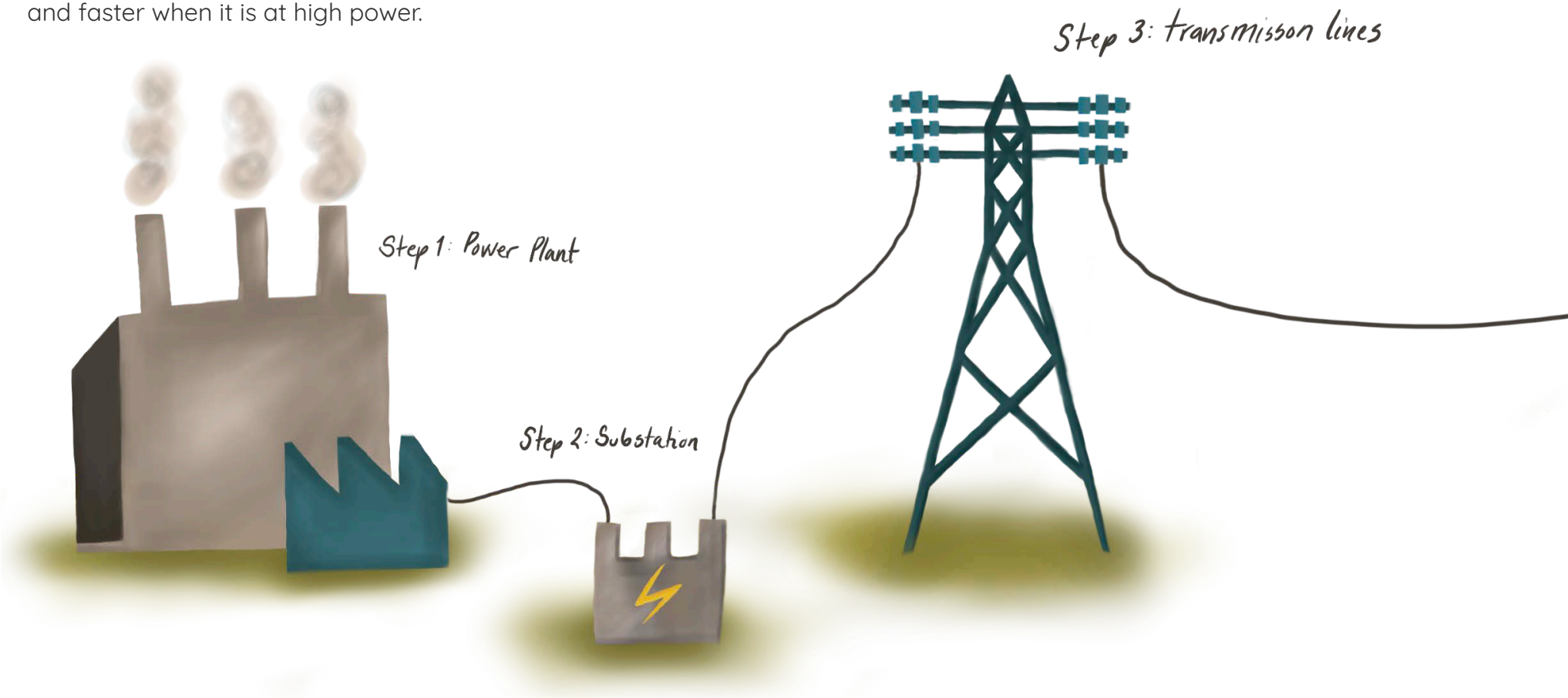
If you walk down your street, you will probably see power poles with dozens of wires attached to them. These wires are bringing the electricity to your house. If you look super close, you will see a small box on every pole where a wire comes off to connect to a house. These boxes hold one of the secrets of how to send electricity to houses.

When electricity is made at a power plant (we will get to this soon!), it is so powerful that it could **melt the appliances in your home.**

That is why at several steps on its journey, electricity is changed into a lower power so that it is safe for the plugs and switches in your house.

Electricity is powerful!

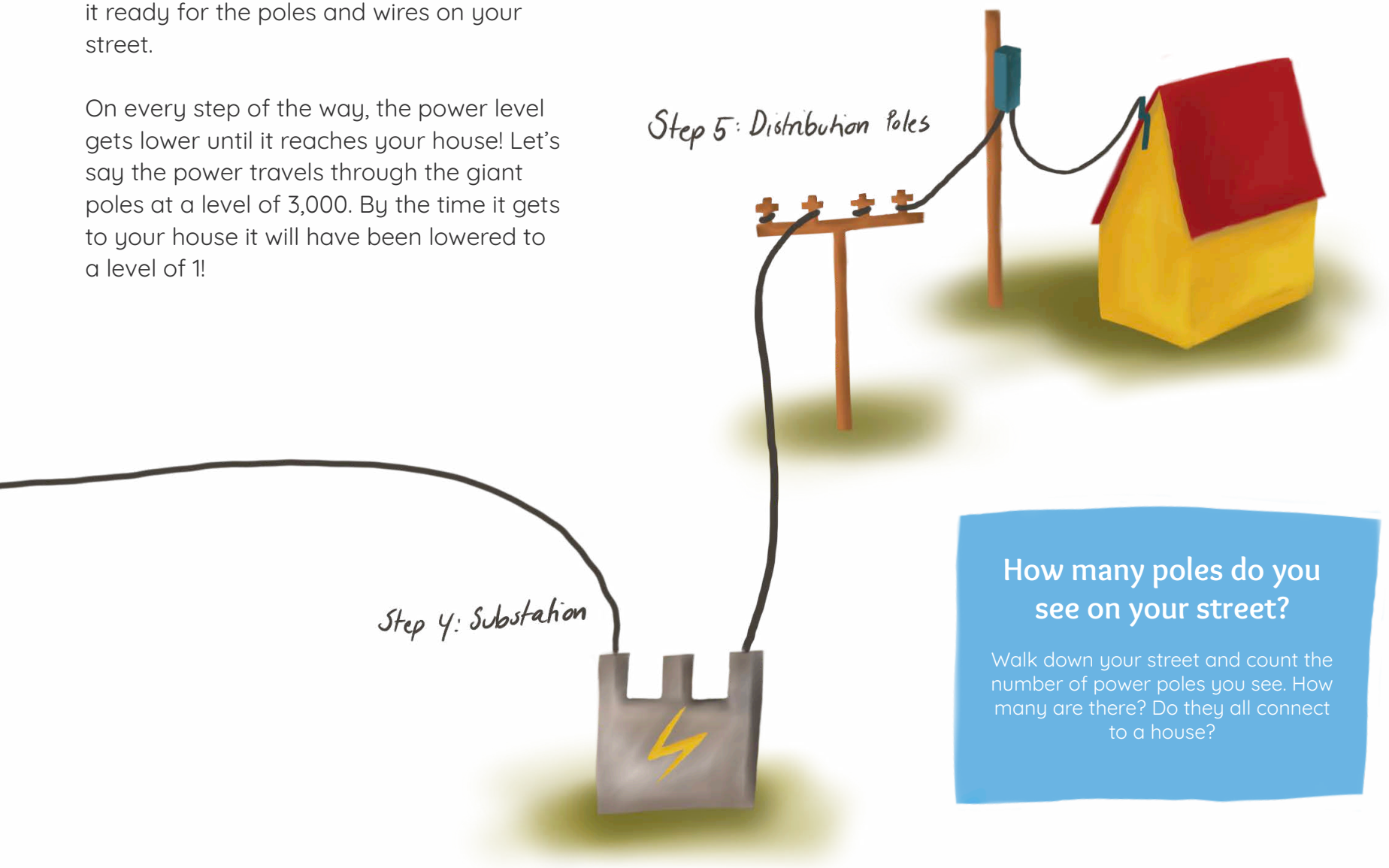
We have a question for you: If electricity is safer at this low power, why would you ever make it high power? Well, electricity can travel farther and faster when it is at high power.



To make this high-powered electricity as safe as possible, the poles and wires that carry it are much taller and stronger than the poles on your street. You might see these giant poles, also called **transmission lines**, driving down the highway. This is another step on the electricity's journey, where it will be changed to a lower power.

This work is done by a **substation**, which contains lots of special equipment to control the flow of the electricity and gets it ready for the poles and wires on your street.

On every step of the way, the power level gets lower until it reaches your house! Let's say the power travels through the giant poles at a level of 3,000. By the time it gets to your house it will have been lowered to a level of 1!



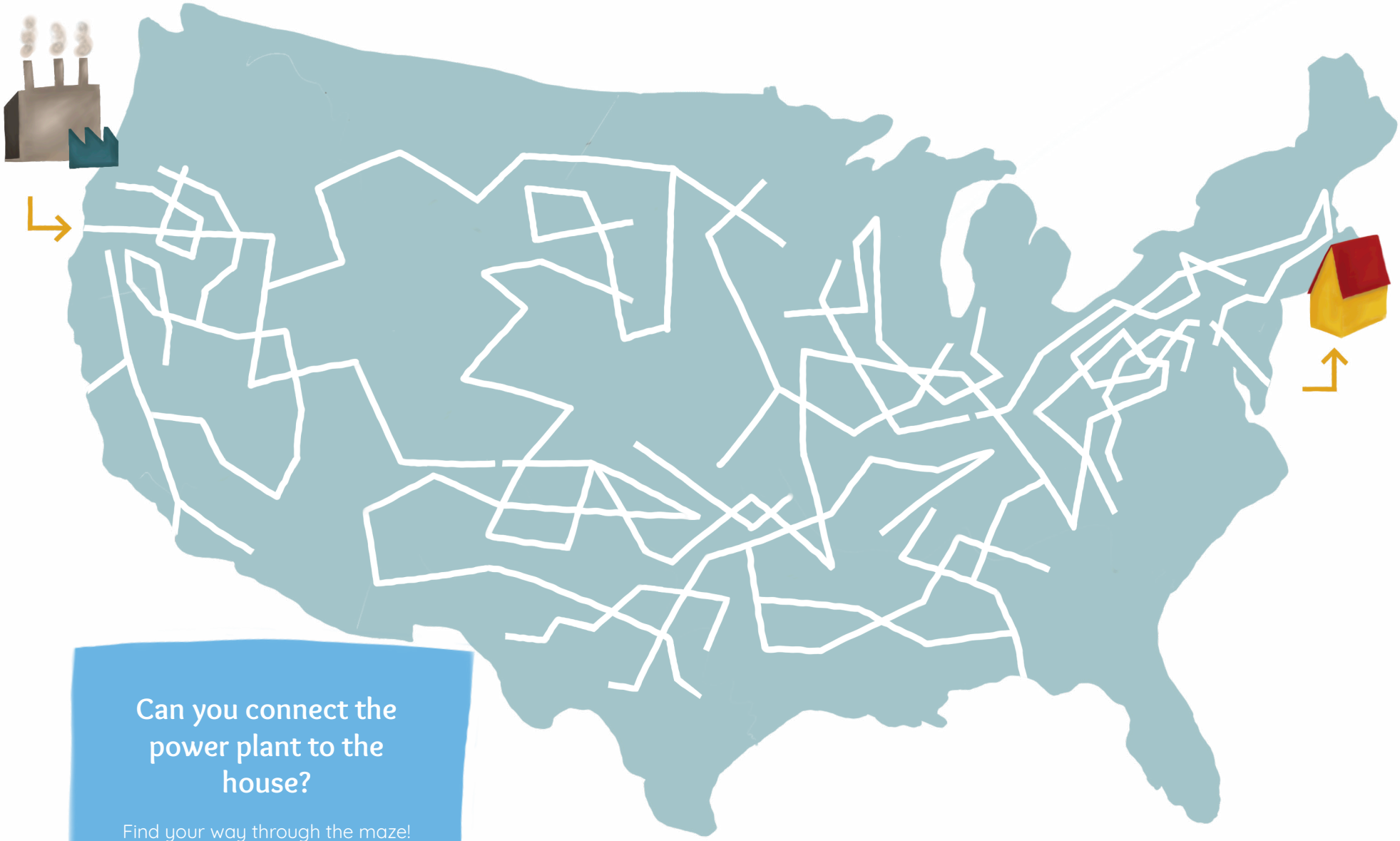
How many poles do you see on your street?

Walk down your street and count the number of power poles you see. How many are there? Do they all connect to a house?

What is the electric grid?

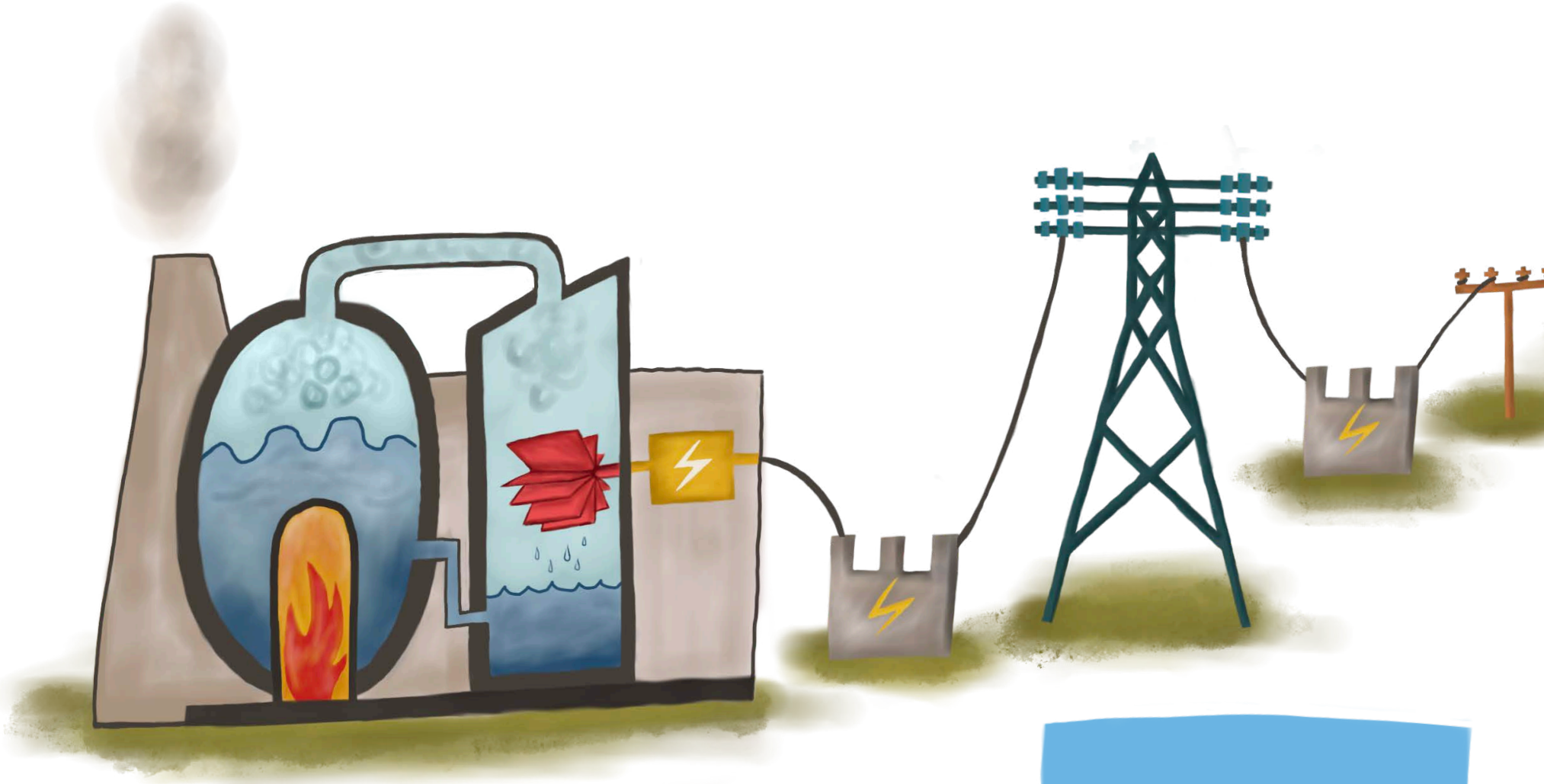
The power poles, wires, and substations make up the **electricity grid**, which is one of the biggest machines in the world. It connects nearly every house in the country.

Although it would take a lot of time and travel, you could follow a wire from your house, through the air all the way to the other side of the country. In fact, the wires involved with carrying electricity could wrap around the Earth dozens of times.



Can you connect the power plant to the house?

Find your way through the maze!



What makes the power plants run?

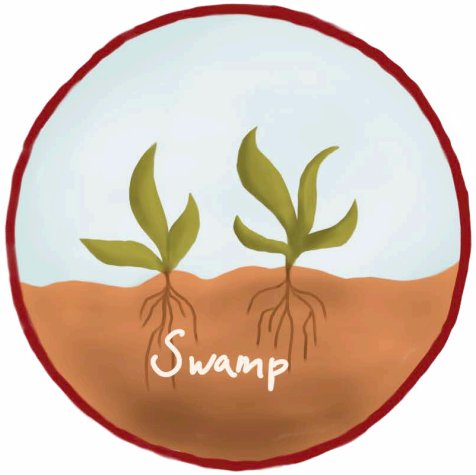
For a long time, most power plants burned coal to heat water. When the water gets really hot, it boils and makes steam. This steam can be used to run trains or to turn giant wheel-like machines called turbines, which create electricity when they really get spinning. This electricity is then sent out on the electric grid and eventually reaches your house.

Look in your own house!

What are some things in your house that use an engine? Do any of them require electricity? Write your answer down here..

Why do we not just use coal to run the power plants?

Coal and other fossil fuels can be burned all day long to provide a constant source of electricity. But, burning these fuels creates a thick smoke which makes the air we breathe less healthy and causes damage to our environment.



Approx. 300 million years ago: Many plants died in swamps

Approx. 100 million years ago: The plants were buried under water and dirt

Today: Heat and pressure turned the plants into coal

Also, it takes a long time for the Earth to create a block of coal. Think about how long ago dinosaurs were walking around, a lot of the coal that we burn today started its journey way back then. Because we burn coal faster than the Earth is making it, we could run out of coal.

Fortunately, fossil fuels are not the only way to create electricity. It is possible to make electricity from natural forces that never run out and do not pollute the air we breathe or the water we drink.

What is renewable energy?

Renewable energy is driven by natural forces, like sun, water and wind and therefore, never runs out. It is a clean source of electricity.

When we get energy from the sun, we call it **solar power.**
When we get energy from water, we call it **hydroelectric power.**
When we get energy from the wind, we call it **wind power!**

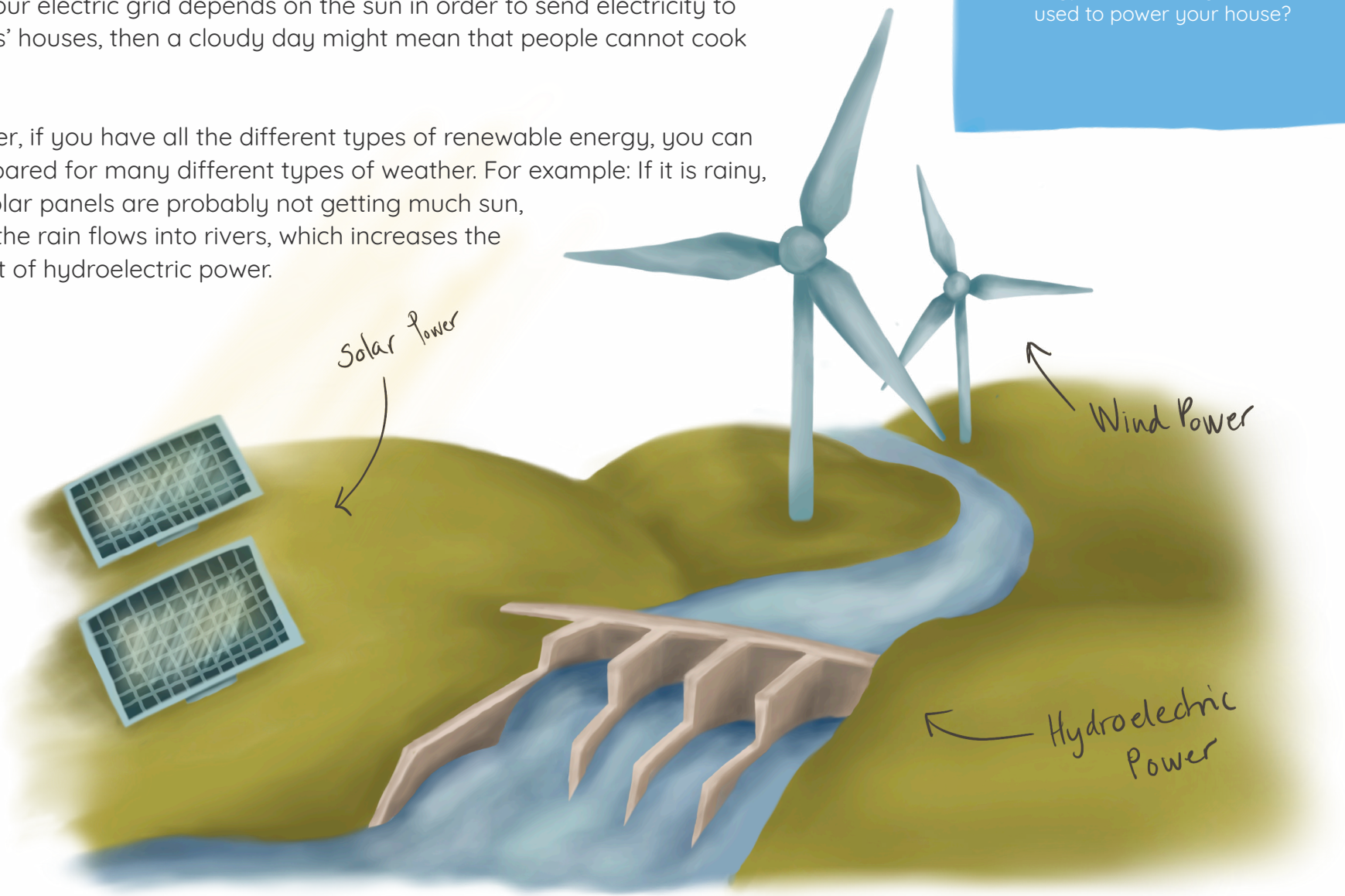
What if the weather changes?

The negatives to renewable energy is that weather changes everyday. So, if your electric grid depends on the sun in order to send electricity to peoples' houses, then a cloudy day might mean that people cannot cook dinner.

However, if you have all the different types of renewable energy, you can be prepared for many different types of weather. For example: If it is rainy, your solar panels are probably not getting much sun, but all the rain flows into rivers, which increases the amount of hydroelectric power.

Ask your parents

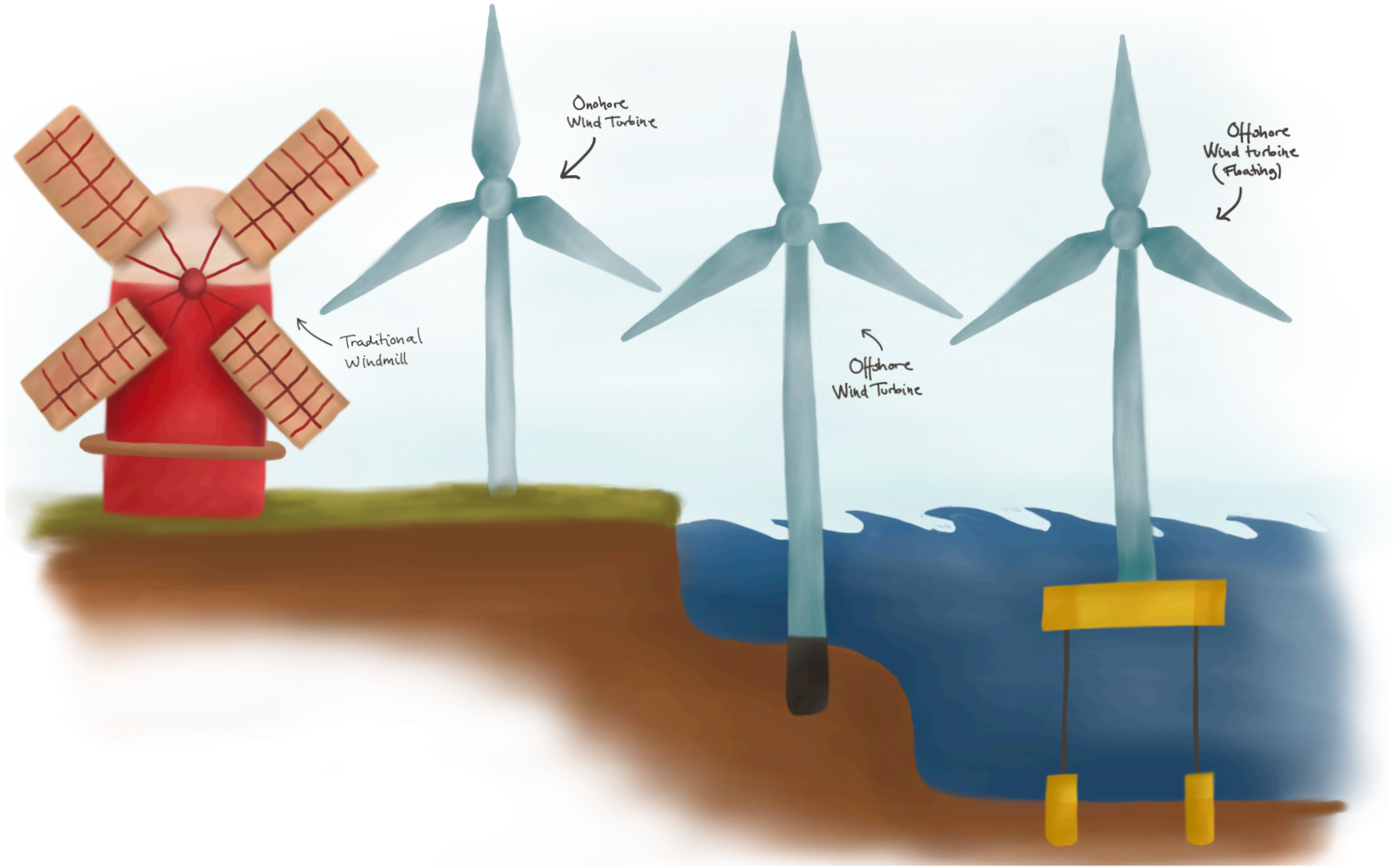
What type of electricity sources are used to power your house?



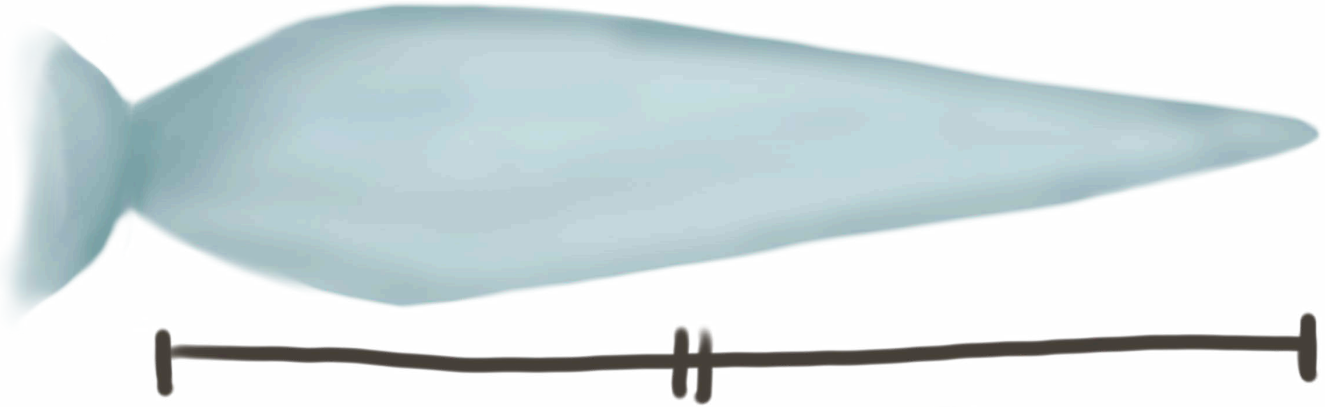
Let’s talk about wind power!

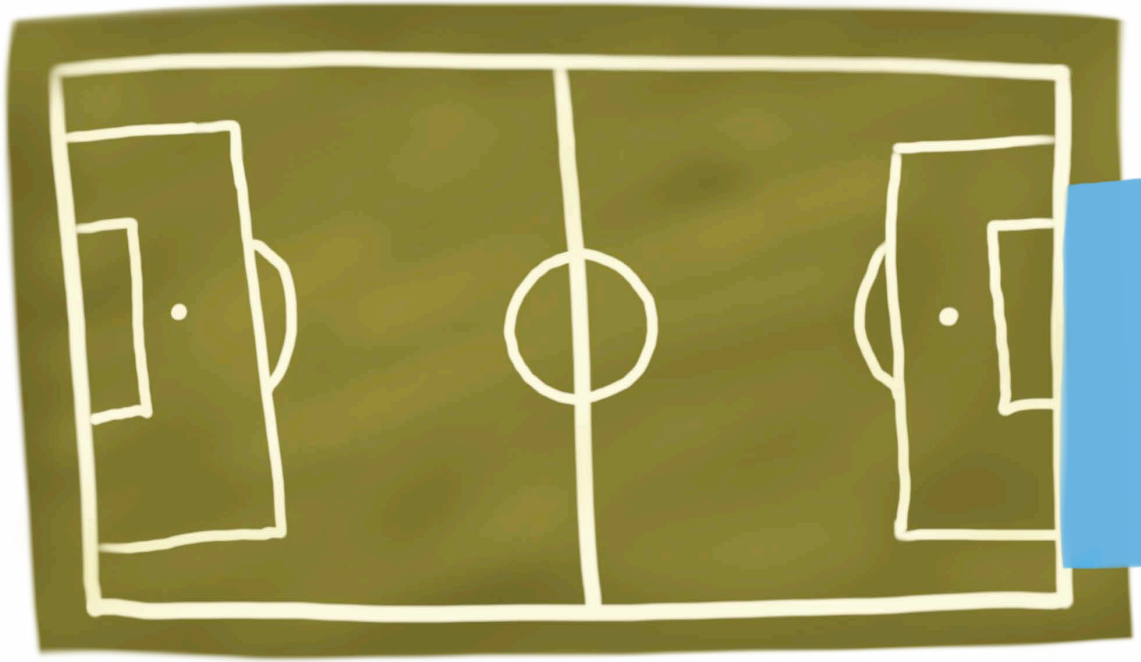
Have you ever seen a windmill towering over a hillside or a field? Windmills are one form of renewable energy that have used the power of the wind to pump water or grind grain for hundreds of years.

More recently, wind turbines have been used to make electricity. As more states and companies use wind turbines, they test new ways of catching the wind. This has led to bigger and better turbines.



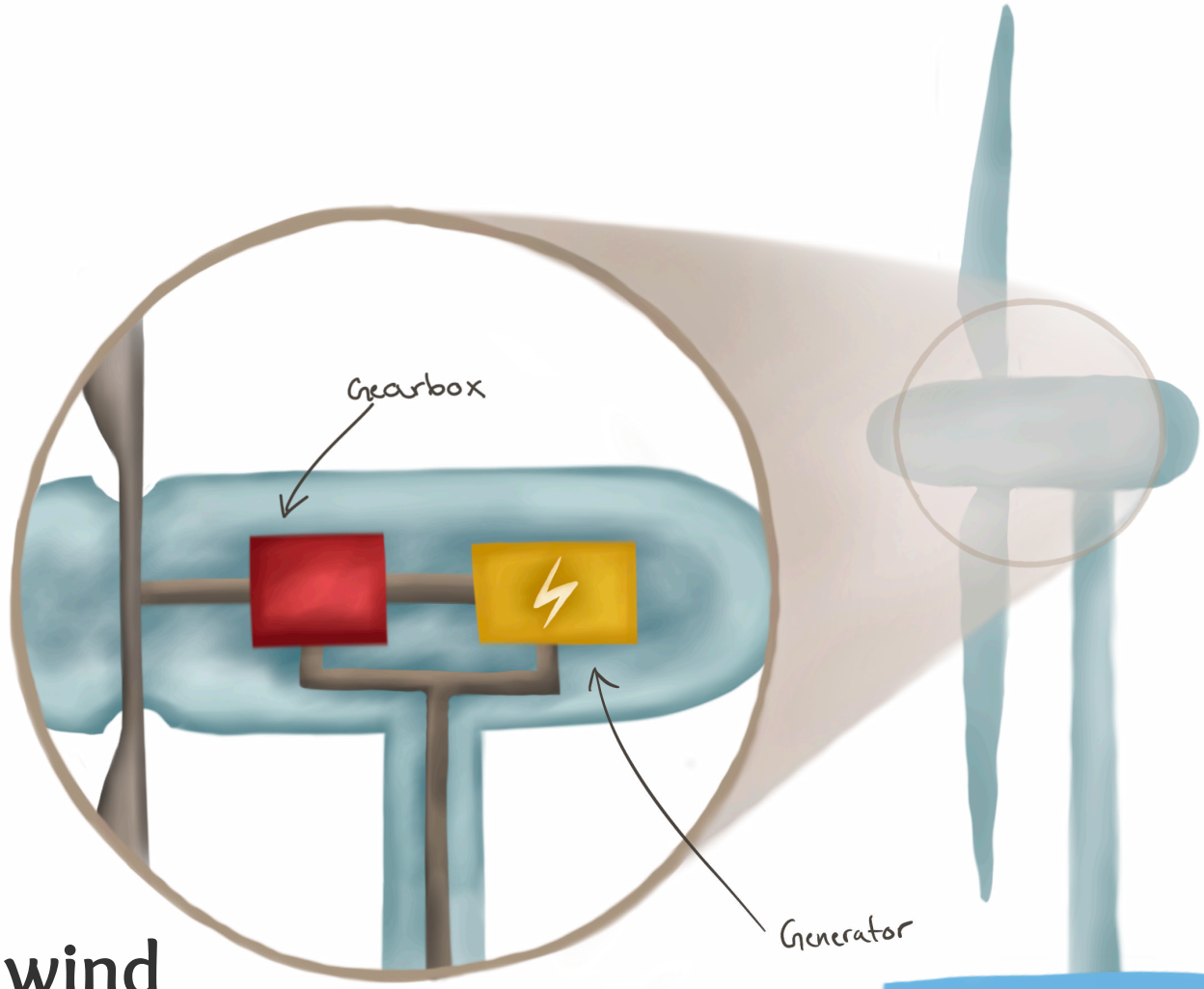
Did you know that some turbines have blades **as long as a football field?** By making the blades bigger, they can catch more wind and create more electricity.





What else needs wind to work?

What other things, toys or machines can you think of that need wind to work?



How does a wind turbine create electricity?

Since the wind is stronger high in the sky, wind turbines are built tall to catch as much wind as possible. When the blades spin, they turn gears (much like how steam turns the turbines in the coal power plant) to create electricity. This electricity is then sent through underground wires to the nearest substation.

Think about this!

Do the wind turbines make electricity even when they are not spinning? If not, how does the power go on in your house when the wind is not blowing?

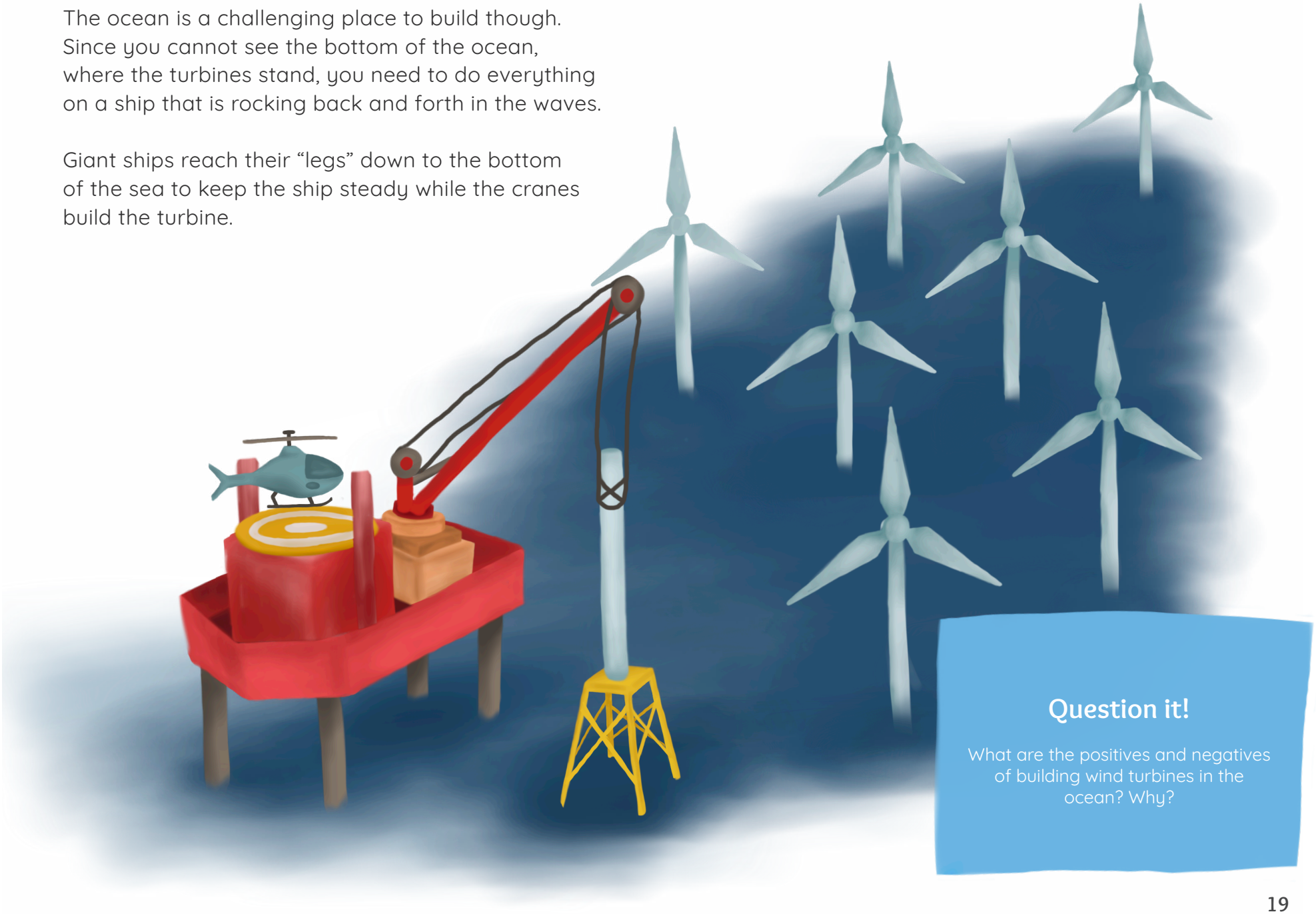
Can you put turbines in the ocean?

Have you ever been to the beach? If yes, have you ever noticed that the wind is almost always blowing there? As a matter of fact, **the ocean is one of the windiest places on Earth, which makes it an excellent place for wind turbines!**

Also, there is much more space in the ocean than there is on land, so you can build many more turbines which create much more electricity.

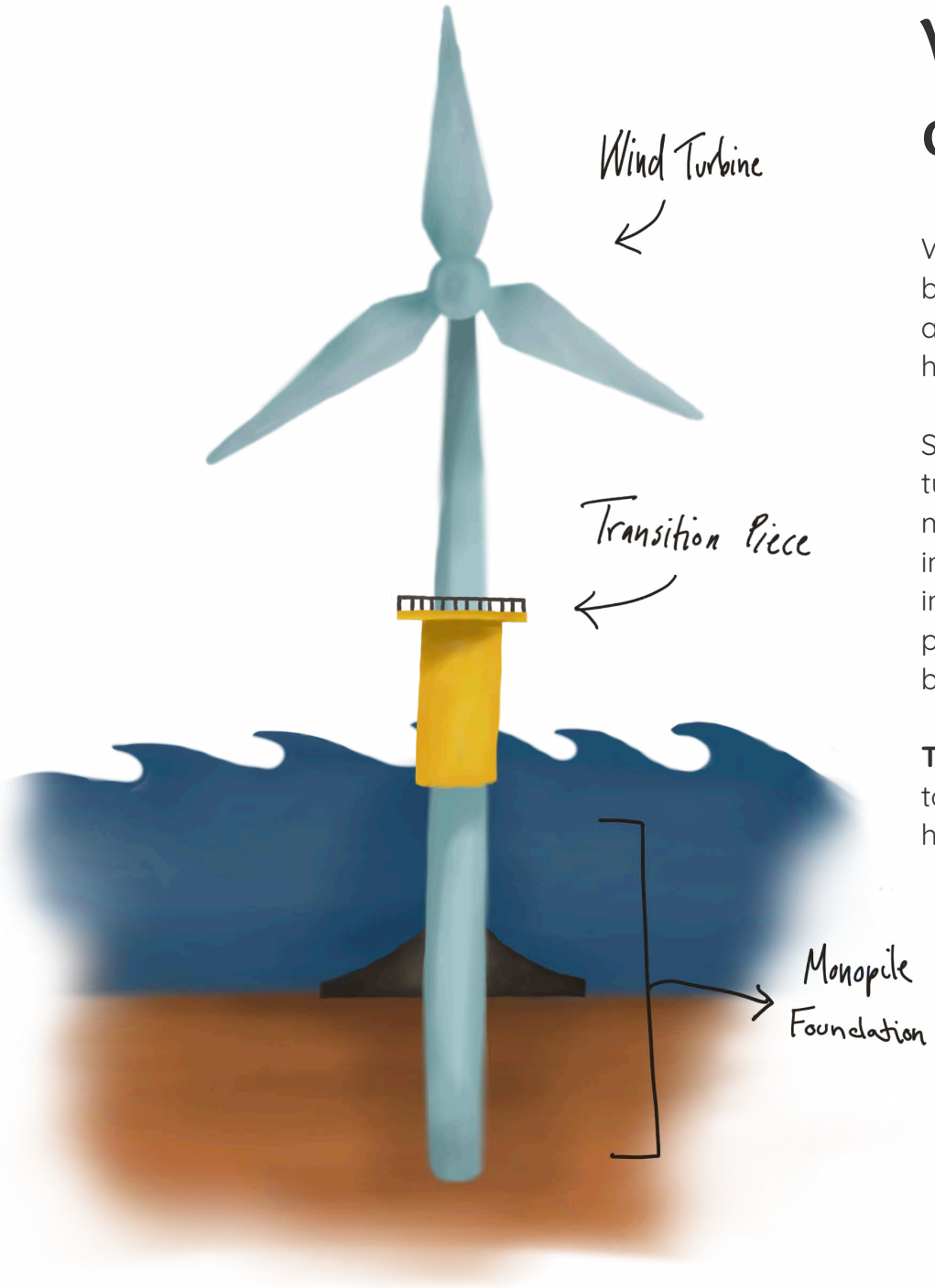
The ocean is a challenging place to build though. Since you cannot see the bottom of the ocean, where the turbines stand, you need to do everything on a ship that is rocking back and forth in the waves.

Giant ships reach their “legs” down to the bottom of the sea to keep the ship steady while the cranes build the turbine.



Question it!

What are the positives and negatives of building wind turbines in the ocean? Why?



What is unique about offshore wind turbines?

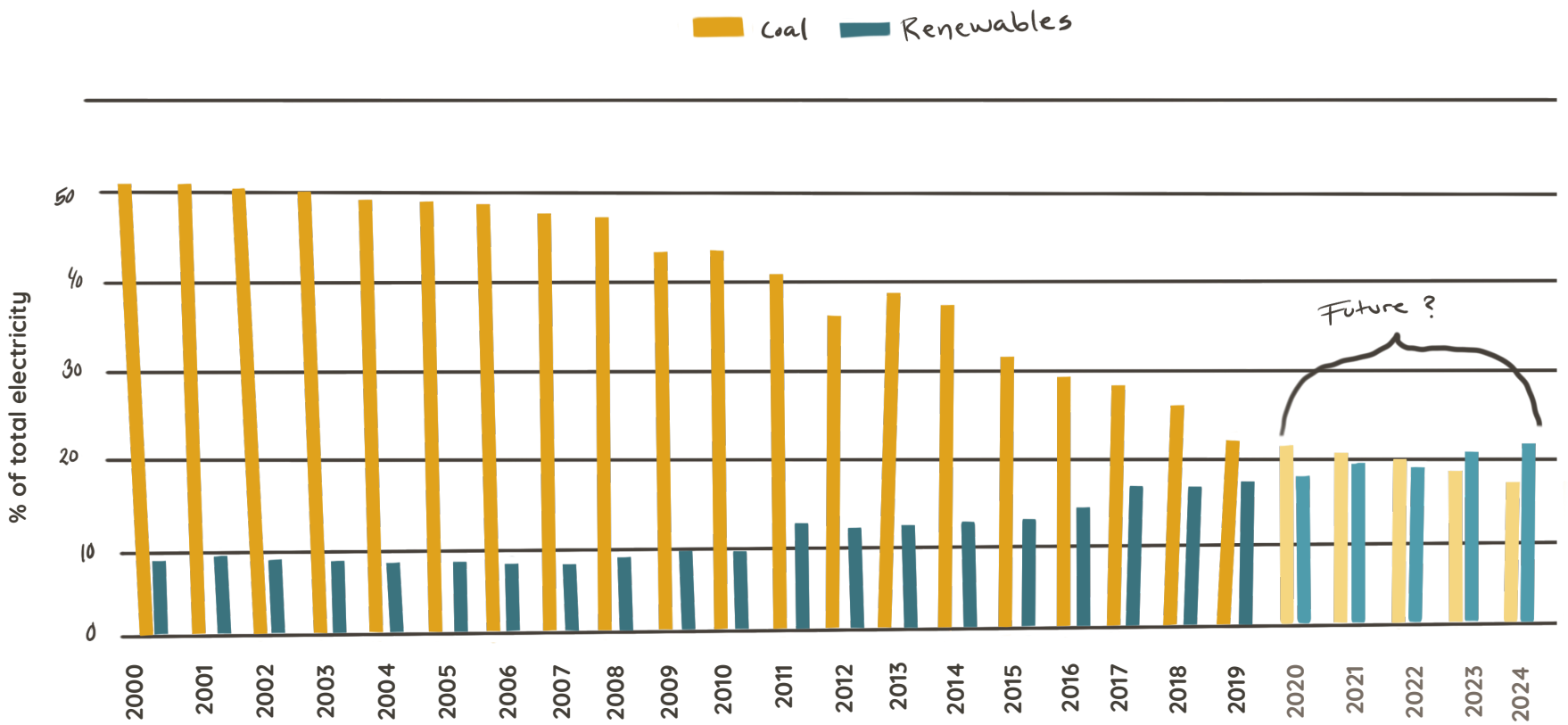
Windier conditions are able to spin larger blades, which is good because that means they can produce more electricity. This also means that the tower has to be taller, so the blades do not hit the water.

Since the blades and towers are both bigger, the base of the turbine, which you can hardly see because it is below the water, must be much bigger and heavier to support the tower. For instance, it could be a monopile foundation which is put deep into the ground. Offshore wind turbines also have a transition piece where the tower connects to the foundation. This is where boats connect to the turbine so that people can work on it.

Think of offshore wind turbines as super turbines that have to hold up to the windiest, waviest conditions on Earth, like hurricanes.

Question

What is the difference between a wind turbine in the ocean and a wind turbine on land?



Renewables are getting popular

Since there are so many environmental benefits of renewable energy, countries around the world are changing from using fossil fuels to renewable energy. Many states and countries have goals to use **100% renewable energy in the next 20 to 30 years.**

This means that some day, your house might get all of its electricity from either a wind turbine, a solar panel or a river. Maybe even from some other sources, like waves.

Look at the graph!

What is the total % of electricity coming from renewables in 2000, compared to 2020? In which year will renewables be more popular than coal?

You just learned how to catch the wind!

We hope you have enjoyed learning about electricity's long journey: from the power plant to the high-power wires, then to the substation through the low-power wires on your street, until it finally reaches your house.
You learned about how we create electricity using the natural forces like sun, water and wind – especially, **how to catch the wind using super turbines in the ocean.**

Next time you flip on a light switch or see the power lines outside your house, you may wonder: Is there a turbine in the ocean right now that is creating this energy?

It's quiz time!

How much of the electricity's journey do you remember? Answer the questions below.
Circle the letter next to the correct answer and fill them in the blanks. Which word do you spell?

1. Where is electricity typically generated?

T. Power plant
U. Substation
V. Transmission station
W. Volt factory

2. What are the fan-like parts of a wind turbine that are used to catch the wind?

R. Engine
S. Substation
T. Grid
U. Blades

3. What is one of the negative impacts of burning coal to make electricity?

Q. Coal is expensive and rare – burning it is wasteful.
R. Burning too much coal can hurt our environment.
S. Burning coal is cheap.
T. Coal only exists in the rainforest, so it is hard to find.

4. What is one reason why we put wind turbines in the ocean?

A. It costs less money.
B. It is often windier on the ocean.
C. Offshore wind turbines never break.
D. Offshore wind turbines look nicer.

5. What is the fastest growing renewable energy source in the U.S.?

H. Solar
I. Wind
J. Hydro
K. Biofuels

6. What is one of the main differences between offshore and onshore wind turbines?

M. Onshore turbines are generally larger.
N. Offshore turbines are generally larger.
O. Onshore turbines are more expensive.
P. Offshore wind turbines are typically painted black.

7. Why do people make wind turbines really tall?

C. The wind turbines look better when they are taller.
D. So airplanes can see them and easily avoid them.
E. It is windier higher up in the sky.
F. They are easier to transport when they are built taller.

Spell the word!

___ ___ ___ ___ ___ ___ ___

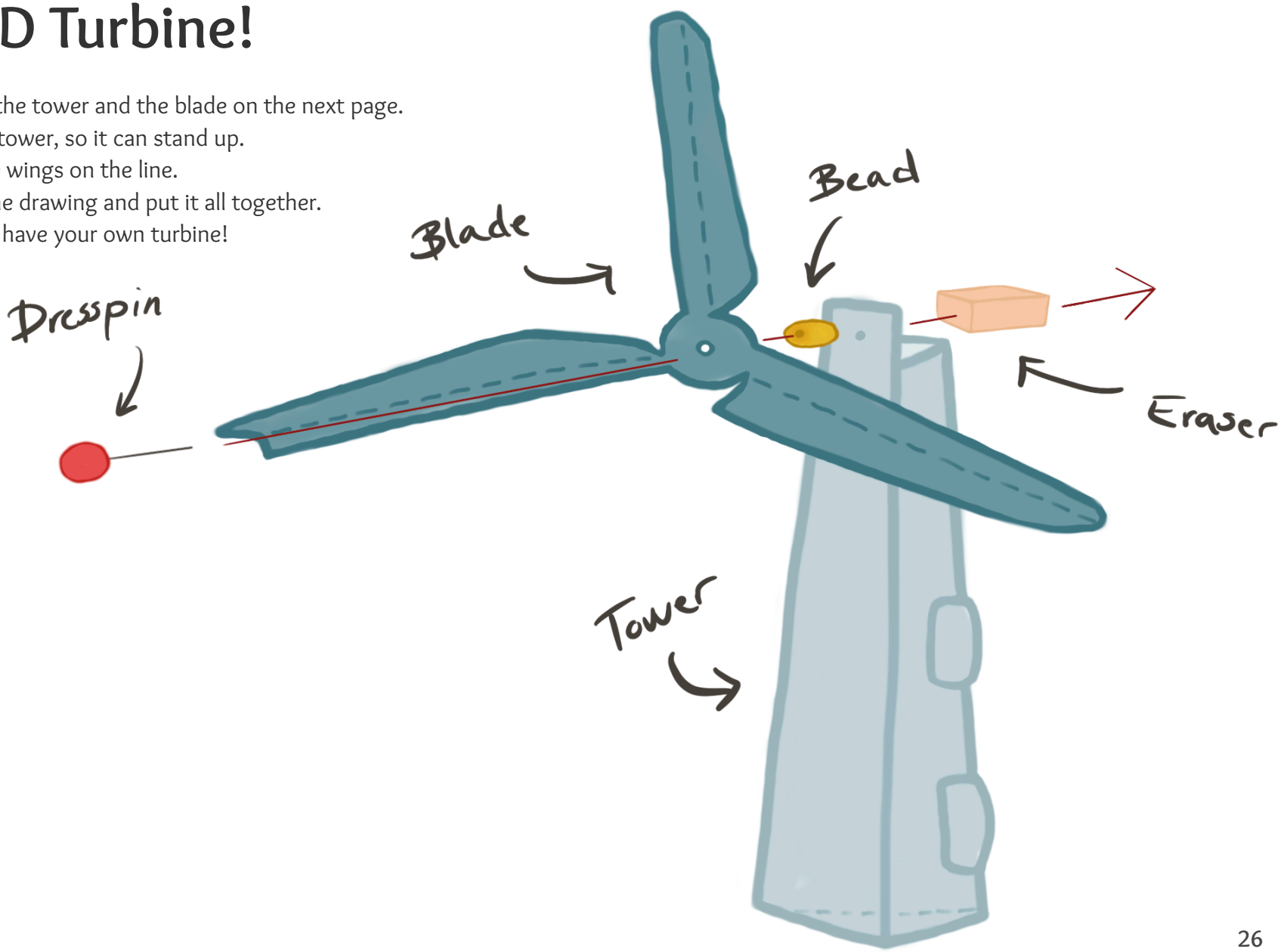
1 2 3 4 5 6 7

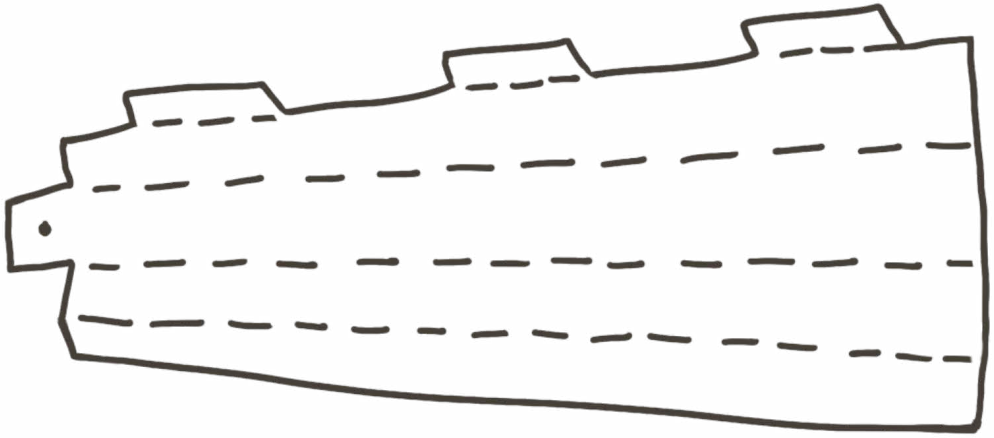
Connect the dots. What do you see?

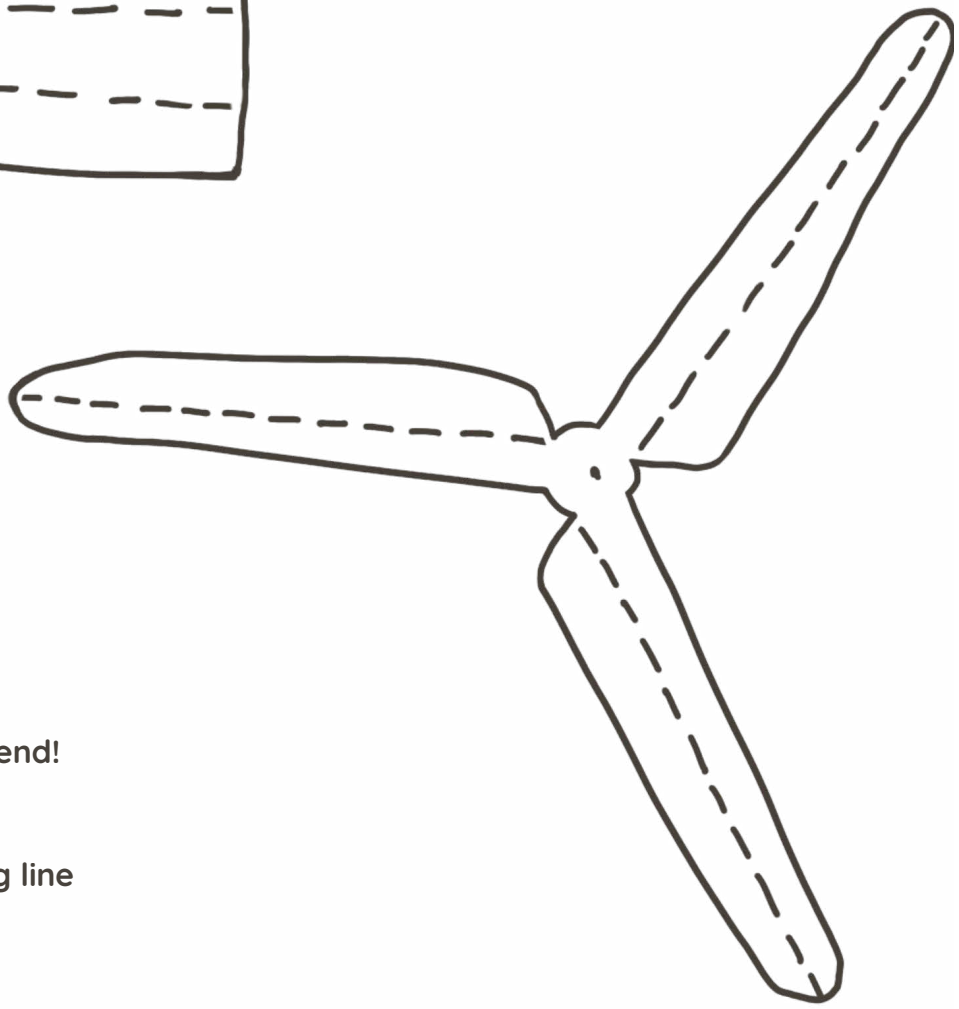
Find your way through the maze!
Connect the ship with the wind farm.

Cut out and create your 3D Turbine!

Step 1: Cut out the tower and the blade on the next page.
Step 2: Fold the tower, so it can stand up.
Step 3: Bend the wings on the line.
Step 4: Follow the drawing and put it all together.
Step 5: You now have your own turbine!







Only bend!

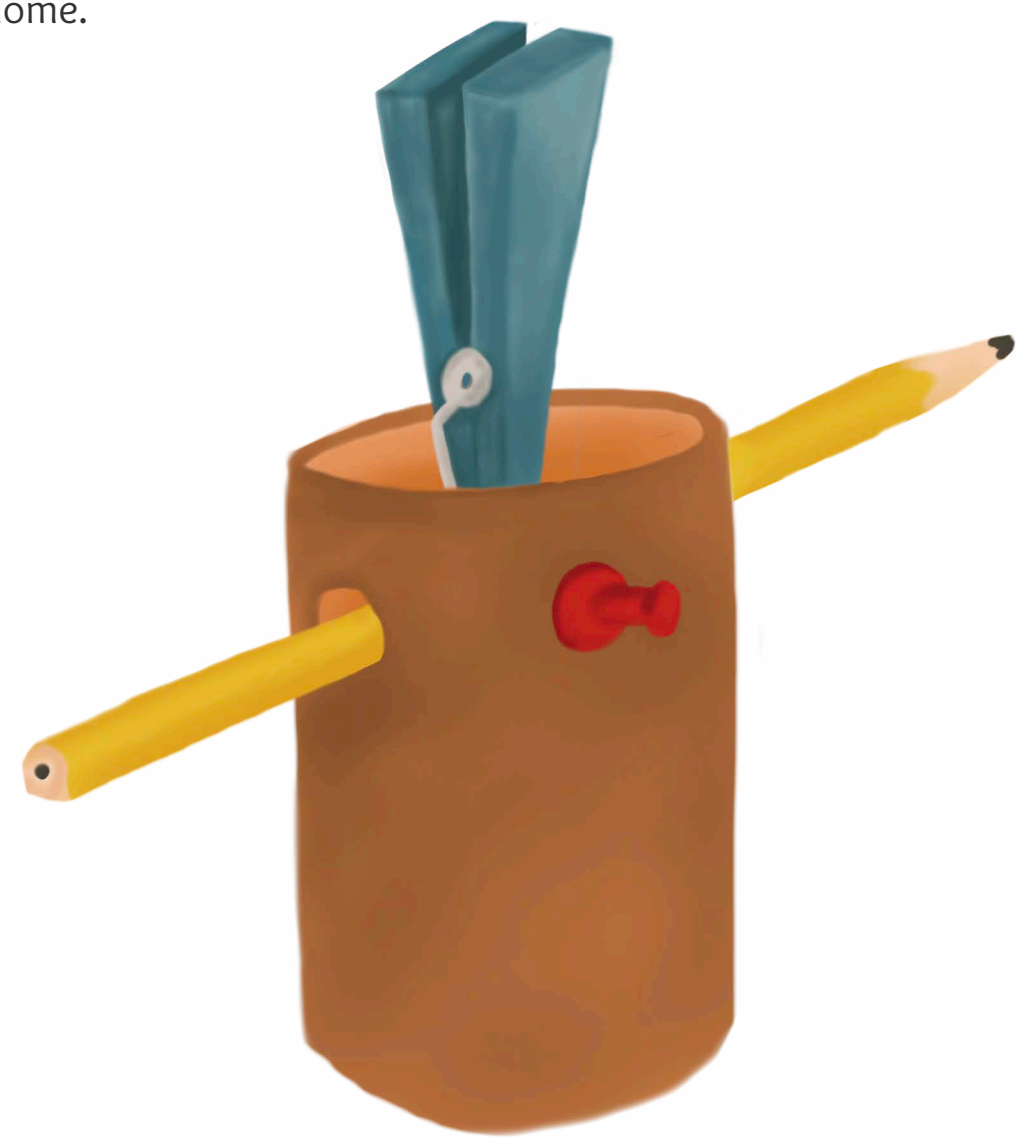
Cutting line

Competition: Build your own wind turbine!

Build a turbine from whatever you can find at home. There are no limitations. Can you make it spin? Can you make it float? The challenge is on!

Take a picture of your masterpiece, send it to catchthewind@lautec.com and receive your 'How to Catch the Wind' certificate.

We want to see your great work!



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