

Suitable for
3-7 years

- Solo
- Pairs
- Groups

Allison's activity

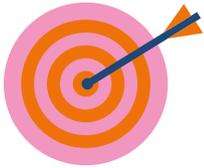
Build a wind turbine

How to guide



Allison's activity

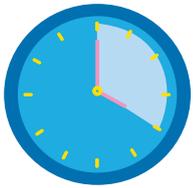
Build a wind turbine



Aim

To build/use a wind turbine to lift an elephant

(Older children could make the wind turbines, they could be pre-made for younger ones)



Time required

30 mins



Story to guide activity

Elmer and the wind by David McKee



Materials and equipment

Calculated for a class of 30

- 30 Paper plates – £5.00
- 30 Foam cones , 2.5cm tall – £3.00 (I got 100 for £9.30)
- Self-adhesive Foam Strip (12-20mm thick) – £6.00
- 30 Bamboo skewers – £0.50
- 30 Straws – £1.00 (for paper or plastic – can also get more robust bamboo straws at £6.99 for 24 – see below)
- Sticky tape – £0.50
- 15m string/embroidery thread – £1.00
- 30 Elmer pictures – £1.50

Equipment can be purchased through these websites

Polystyrene Cones available [here](#).

Foam tape available [here](#).

Bamboo straws (£6.99 for a 24 pack) are available [here](#).



Health and safety

Steps 4-7 involve using a sharp bamboo skewer. Judge whether this is safe for your class and consider that younger children might need help to complete these steps.



Instructions

Read the Book

Read **Elmer and the Wind** by David McKee (5-10 mins – it took me 4 mins to read aloud with no interruptions!)

(Synopsis – It's a very windy day and Elmer and Cousin Wilbur are up to one of their tricks: making friends believe that Elmer has been blown away!

But they didn't realise how strong the wind really is, Elmer is in for a surprise...)

Ask the Question

Do you think we could use the wind to lift an elephant?

Activity

Build/use a wind turbine to lift an elephant

(Older children could make the wind turbines, they could be pre-made for younger ones)

At first, just have the plate without the blades cut – no matter how hard you blow, the turbine won't turn. Learning – the wind has to go through the turbine to make it turn.

Then cut and fold the blades. You can either get the children to blow on the turbine to turn it, use a fan, or go outside and use the wind. Watch how, as the turbine turns, it lifts the elephant.

You can also experiment with turning the turbine in different directions: does it still rotate if it is sideways on, or has its back to the wind?

So we can see there is energy in the wind, and we can use that energy to lift things.

Show the picture of the wind turbines (see resource pack). Ask if anyone knows what they do.

They don't lift elephants - they use the energy in the wind to make electricity.

Ask if anyone can name something we use electricity for. Examples include TVs, computers, cooking, hairdryers, showers etc. You can also have electric heating, although in the UK 90% of our heating is from fossil fuels (gas and oil). We are also moving to the use of electricity for transport – some trains are electric and you can now buy electric cars (they may have heard of Tesla, or the Nissan Leaf). Because of the climate emergency we have to stop using fossil fuels like gas and petrol – for cars and heating this means going fully electric.

One good thing about using the wind is that it is renewable – it will never run out – and it is much better for the environment. Before we had wind turbines we used coal to generate electricity, and that produces greenhouse gases which contribute to global heating and climate change.

Also Scotland is one of the windiest countries in Europe – that is why wind is such a good choice for generating our electricity here!

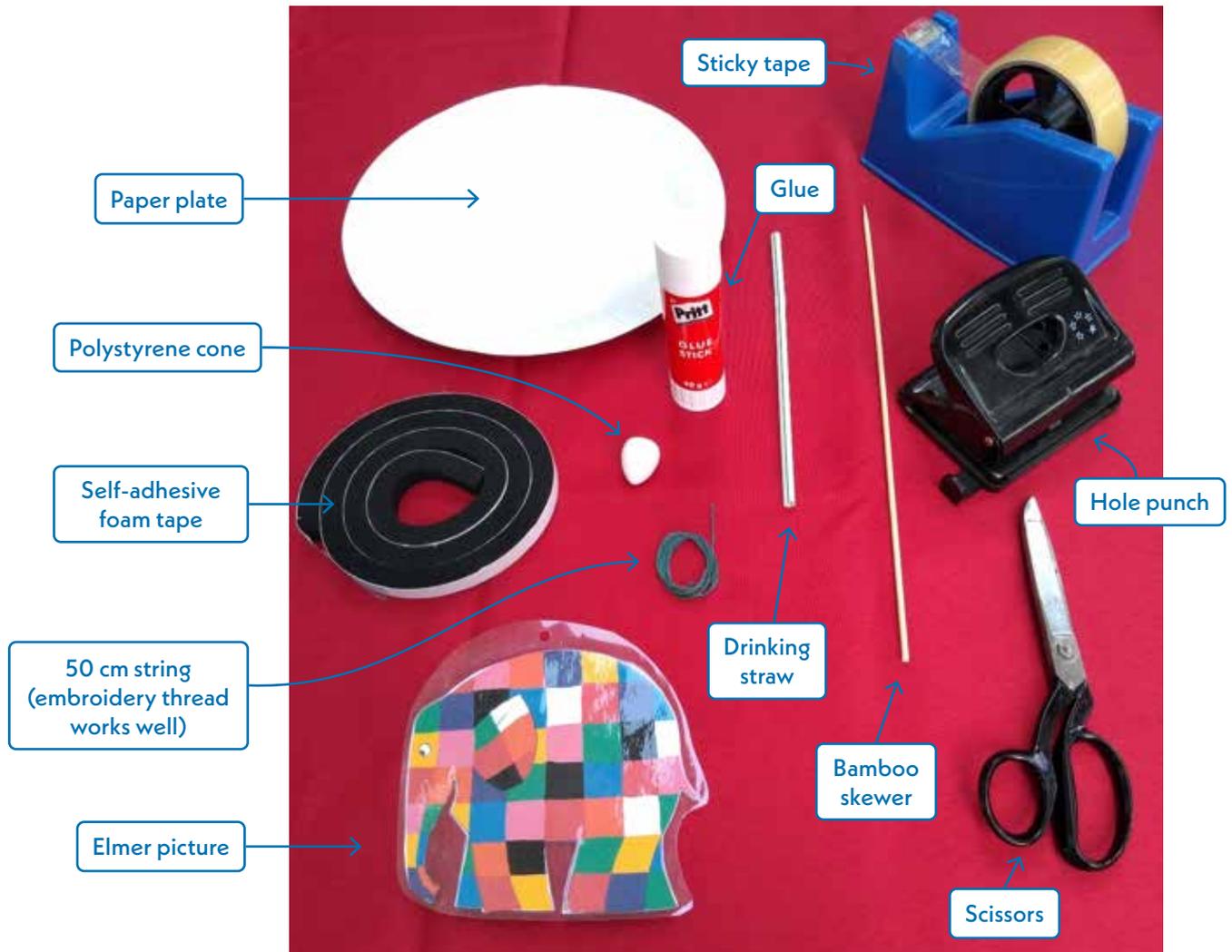
Learning outcomes:

- There is energy in the wind
- We can extract that energy using wind turbines
- We can use the energy in the wind to make electricity
- We use electricity for a lot of things in our homes

→ Because of the climate emergency, we need to stop using fossil fuels. This means changing our cars and heating to use electricity and using renewable sources (like the wind) to generate that electricity.

Making the Turbine

You will need:

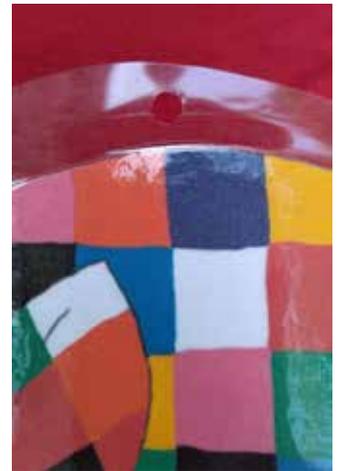


Comments on potential areas of difficulty: The turbine turns pretty easily but depending on how well the younger children can blow they might need some help to blow to trial the turbine – it might be good to have a desk fan or a small handheld fan available just in case. Step 9 involves accurate sellotaping and again younger children might need help to complete this.

Alternative approach: you might want to be in charge of the turbine assembly step and challenge the children to design the blades component (see idea 2 in the extension). You could use card to make a demonstration turbine and communicate the idea about the requirement for blades. Then set up a range of materials (e.g. paper, foam, plastic, card, paper plates etc of different sizes) to allow the children to explore material section, shape and size of the turbine, shape, size and number of blades etc

1. (Prior to the lesson) Make the laminated Elmer pictures
 - Print out the two Elmer pictures (front & back views) at the end of this document
 - Cut them out and stick them together, so you have a 'complete Elmer'





- Laminate Elmer (two pictures will fit in one A4 pouch)
- Cut round the picture, leaving a thicker strip of plastic over his back
- Punch a hole in this extra plastic – it will be used to attach him to the turbine during the lesson

2. Put the paper plate on the table face up and fold it in half
3. Unfold the plate and fold in half again at 90 degrees to the first fold – you will now have fold lines that divide the plate into quarters



4. Cut a square of foam from the foam strip, and attach it to the back of the plate in the centre (the folds you have just made cross at the centre of the plate)



5. Take the skewer and push it through the centre of the front of the plate (again marked by where the folds cross), making a hole through the plate and all the way through the foam square.
6. Remove the skewer, turn the plate over and insert it, point first, into the hole you have just made in the foam square. Push the skewer through until about 1–1.5 cm of the point comes through the front of the plate.



7. Stick the polystyrene cone over the exposed point of the skewer (you can glue the base of the cone for a stronger join).

Your turbine will now look like this:



8. Slide the drinking straw onto the skewer, then slide it up to meet the foam square.



9. Tape the string to the end of the skewer, behind the straw



10. Tie the Elmer picture to the other end of the string



11. You are now ready to do the first test! Hold the straw and spin the plate with your hand to test that your turbine turns freely. If it doesn't just check the straw is not getting caught on the foam square or on the tape you used to attach the string.



12. Now get a friend to blow on the front of the plate. Does it turn? (It won't, or not very well!)
13. This is because the turbine is just acting like a wall, and stopping the wind. To make it turn, we need to make spaces so the wind can flow through the turbine – our turbine needs blades.
14. To make the blades, cut along the four fold lines on the plate, stopping about 2cm from the centre.





16. Then fold the left-hand corner of each section over to form a blade:
17. Now, when you blow on the front of the plate, the turbine should turn. See if you can blow hard enough to lift Elmer!

Extending the learning

1. Instead of lifting the elephant, you could test how much weight the turbine could lift. Replace the Elmer picture on the end of the string with a small paper cup (e.g. an espresso or mouthwash cup) – punch a couple of holes at the top of the cup on either side, and tie the string through the holes. Use small weights (e.g. metal washers, pennies) and gradually add the weights to the cup one at a time to see how much weight the turbine can lift. (With lots of weights, you may need to give the turbine a wee push to start it turning – this is because it needs a lot of turning power (which engineers call ‘torque’) to start, but once it is moving its momentum will keep it going with
2. You could try different designs of turbine and see how well they work:
 - a. Make the turbine out of a different material - a paper one will be too floppy to turn properly, a foam or plastic one will make it harder to fold the blades. (Learning – the material is important –

Further information about wind turbines

The diagram on the right shows the parts of a wind turbine.

The generator is the bit that makes the electricity.

The gearbox changes the slow rotation of the blades into the fast rotation that we need to work the generator.

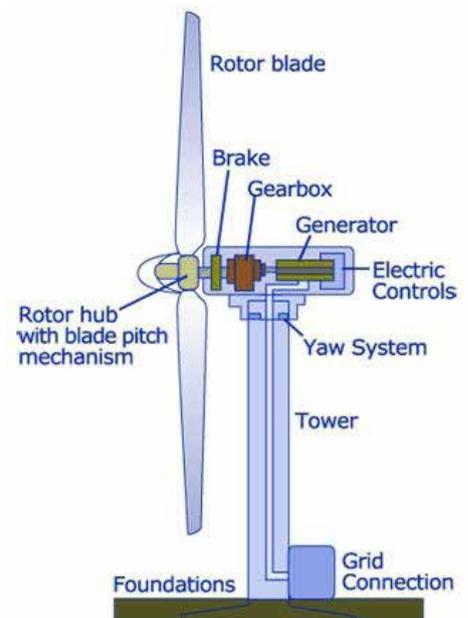
The yaw system is what turns the turbine to face the wind – you will have found in your experiments earlier that it is harder to get the turbine to turn if it's not facing in the right direction!

The grid connection is where the electricity enters the wires so it can get to the places it is needed.

The foundations hold the turbine to the ground and make sure it doesn't blow away or fall over!

The blade pitch mechanism tilts the blades so that we can control speed of the rotor and control the amount of electricity that is produced.

The brake is used to keep the rotor stationary if the wind speed is too low or high, or if we need to do maintenance on the turbine. (It is a bit like the handbrake in a car).



Useful online resources

- The turbine model is adapted from ReCharge labs and can be found [here](#). This link also has some good information on wind turbines and ideas to extend the lesson.
- A description of how wind turbines work, and some nice interactive animations can be found [here](#).
- For pupils in the west of Scotland, a visit to Whitelee Windfarm may be a possibility – it also has a visitors' centre with various energy related activities. The website can be found [here](#) for further information.

- [MyGridGB](#) shows the renewable energy sites in the UK, so pupils can find sites near them.
- A video of the inside of a wind turbine can be found [here](#).
- The UK hosted the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow between 31 October and 12 November 2021. This is where the world comes together to discuss how to tackle climate change – click [here](#) for the official website.
- National Grid has produced an [interactive report](#) for COP26, with some good visualisations on how the way we produce electricity has changed over the years
- The 6th Carbon Budget was published in Dec 2020. It sets out the changes the UK has to make to become carbon-neutral by 2050. (To become carbon neutral by 2050 is what world leaders will be working towards at COP26.) It has separate summaries for different sectors of the economy. Click [here](#) to view the report.

Further reading suggestions

For nursery age

Where is the Wind by Celia Warren & Lisa Williams (Collins Big Cat) – Mole goes out to look for the wind – but where is it?

Wind by Carol Thompson (Child's Play international) – A picture book of wind sounds and effects.

Baby loves Green Energy by Ruth Spiro & Irene Chan (Charlesbridge) – A simple explanation of global heating.

For primary school age

The boy who harnessed the wind by William Kamkwamba, Bryan Mealer & Elizabeth Zunon (Dial) – the author's own story of building a wind turbine from junkyard scraps in Malawi.

See Inside Energy by Alice James & Peter Allen (Usborne) – a lift the flap book about different types of energy.

The Magic School Bus and the Electric Field Trip by Joanna Cole & Bruce Degen – kids take a trip through the electricity system from power station to plug.