

ENGINEERS WEEK

STEPS SECONDARY SCHOOL ACTIVITY WIND ENERGY: WINDTURBINE CHALLENGE



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Wind Energy – Wind turbine Challenge

Summary

- Students explore what engineering and wind energy is through our discussion guide
- Students explore wind turbine design through our worksheets.
- Students make a paper wind turbine to learn about wind energy.

Teacher Preparation

1. Read through the discussion guide tips
2. Decide if your students will work in pairs, groups or as individuals.
3. Gather activity materials

OPTIONAL: Prepare and test your own wind turbine to show the students, if needed.

Wind Turbine Materials

Each student/pair/group will need:

- Scissors
- Straight/push pin, thumbtack or paper clip (to join to blades to the tower)
- 2 pieces of paper/light card,
 - One piece to cut into blades
 - One piece to roll into a tube to form the tower
- A thicker/heavier piece of card (to act as the base)
- A ruler
- Blue tack, Cellotape, glue etc.

Carrying out the Activity

There are three steps to this activity:

- STEP 1: Pre-discussion and contextualisation
- STEP 2: Worksheet
- STEP 3: Building the Wind Turbine

Did you know?

Engineers Ireland declare a climate and biodiversity emergency in February 2020?

STEP 1: Pre-discussion and contextualisation

STEPS has prepared a pre-discussion guide to get the students thinking about engineering and wind energy before building the wind turbine.

- You can either:
 - Display the prepared slide as a discussion prompt OR
- Write the questions on your board
- Students can discuss answers and share with the group, or makes notes in their copy book

STEP 2: Worksheet

- Your students are now ready to fill out the Wind Turbine Worksheet (Pages 4 & 5 of this document).
- This worksheet allows students to design their wind turbine, before they start building.
- We recommend that students complete the worksheets in full before moving on to building the turbine.
- You can have one worksheet per group/pair/individuals.
- This work is student led – allow the students to come up with their own

STEP 3: Building the Wind Turbine

- Allow the students to start building their wind turbines, based on their designs from the worksheet.
- It is ok to make changes to the design during the build phase.
- NOTE: If you are short on time, you can complete the three steps at different times/dates.

PRE-DISCUSSION AND CONTEXTUALISATION

DISCUSSION 1: WHAT IS ENGINEERING?

- Ask the students if they know what engineering is.
- You can use the Discussion Tips below to help prompt the students and get the conversation going.

DISCUSSION TIPS:

- Engineers are people who want to help solve problems in the world.
- Engineers take ideas and turn them into reality, using science, math and imagination.
- Engineers are masters of problem-solving and creative design.

Discussion 2: Wind Power

- Introduce Wind turbines to the class. Ask the students what they know about renewable energy.
- You can use the Discussion Tips below to help prompt the students and get the conversation going.

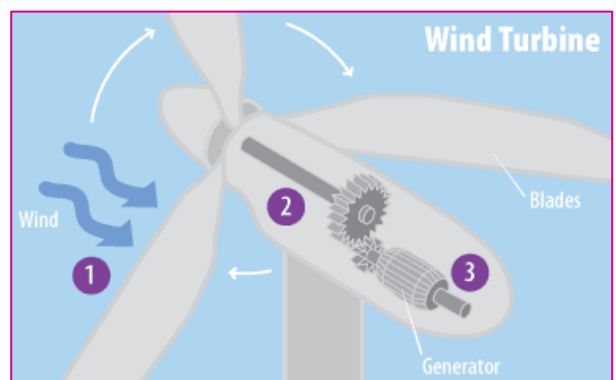
DISCUSSION TIPS:

- Wind energy has been used for centuries – it's not new – can you think of examples? E.G. Sailing boats, windmills etc.
- Wind turbines help us to rely less on fossil fuels which damage our environment. Engineers have come up with a way to use the energy from the wind to generate electricity that we can carry by cables to our fingertips.
- Wind energy is currently the largest contributing resource of renewable energy in Ireland. In 2018 Wind provided 85% of Ireland's renewable electricity and 30% of our total electricity demand (via www.seai.ie).

Now wrap up the discussion with the below explanation of how wind turbines work.

How wind turbines work:

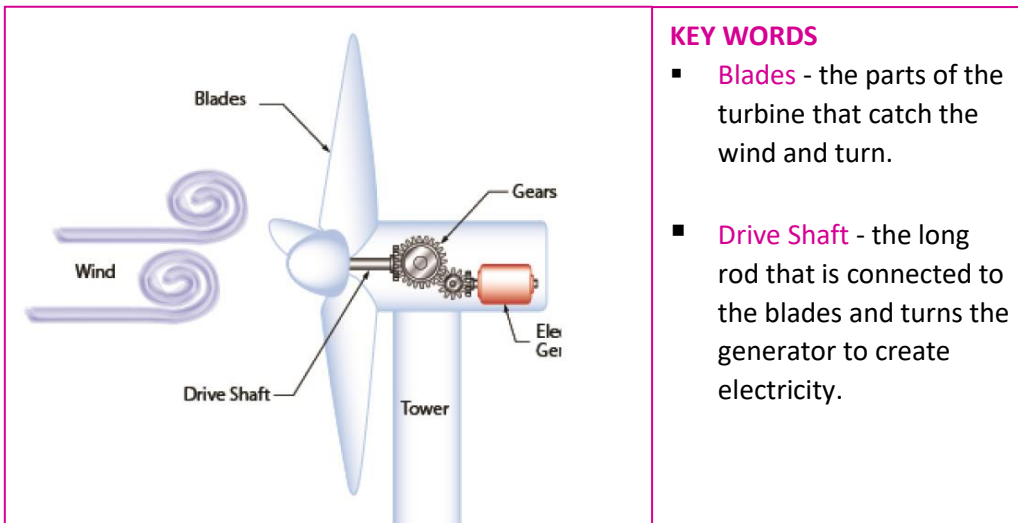
1. The wind catches the blades and turns them .
2. The blades (1) are connected to a rod called a drive shaft.
3. The drive shaft (2) is connected to a generator (3) where electricity is created.
4. This electricity is carried by cables down the tower and into the electrical grid and is delivered to our towns and homes.



Now it is time to fill out the worksheets

- Following the discussion guide above, you are now ready to make the wind turbine.
 - Allow the students to fill out the worksheets, giving support when needed.
- Following the worksheets, the students are now ready to make the wind turbine.
 - The students should use the design they came up with in the worksheets.

WIND TURBINE WORKSHEET



KEY WORDS

- **Blades** - the parts of the turbine that catch the wind and turn.
- **Drive Shaft** - the long rod that is connected to the blades and turns the generator to create electricity.

1. Decide the location of your wind turbine

A) Where will you build your wind turbine in your locality?

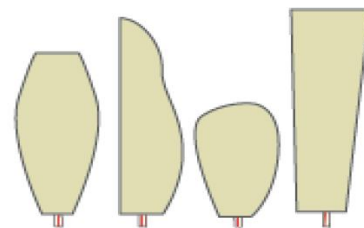
B) Why did you choose this location?

2. Decide the shape of your blade

You will think about shape, size and number of blades.

(a) What shape blades will you use for your turbine?
Draw your shape below:

HINT: here are some shape ideas – but be creative!





(c) What size will the turbines of your wind turbine model be (approximately).

Length (cm):

Width (cm):

HINT:

- Use rough work paper to draw the approximately the blade size you would like to use for your wind turbine.
- Use a ruler to measure the width and the length.

(b) How many blades will you use?

Why did you choose this number of blades?

HINT:

- The more blades the more force the wind can give to create electricity.
- But more blades make the wind turbine heavier and need better, more costly materials.

3. Decide what materials to use

Look at the available materials for building your wind turbine in your classroom. But don't be tempted to start to build yet - you are an engineer and you must design before you build! Have fun making it!

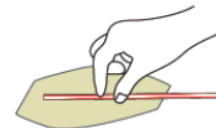
(a) Blades - What material(s) will you use for your blades?

HINT:

- Choose something light but stiff that you can cut easily with a scissors into shape.

(b) Blades - Can you think of a way to make them even stronger?

HINT:



(b) Drive Shaft - What materials will you use for your Drive Shaft?

HINT:





Building the Wind Turbine

Tip

If timetabling is an issue, you can complete steps 1-3 on different days to suit you and your students schedule.

Now that the students have completed the discussion guides and completed the Wind Turbine Worksheets, it is time for them to build a model wind turbine.

We won't give specific instructions for students to construct their wind turbines. This is intentional on our part! The students should use the engineering decisions they made when filling out their worksheets to make their turbines, using the materials available to them in the classroom.

Building a wind turbine:

- Ensure that each student/group has materials listed on page 1.
- Allow the students to start building their wind turbines, based on their designs from the worksheet.
- Note: It is ok to make changes to the design during the build phase.
- Optional: Test your pinwheel by:
 - Going outside on a windy day
 - Blowing on it with a hair dryer

Tip

It is ok to make changes to the design during the build phase. Engineers do this in real life, based on real time information. Can you explain why you need to make changes to your wind turbine?