POWERED BY WIND

energy
Department:
Energy
REPUBLIC OF SOUTH AFRICA

EMBASSY OF DENMARK

Name:

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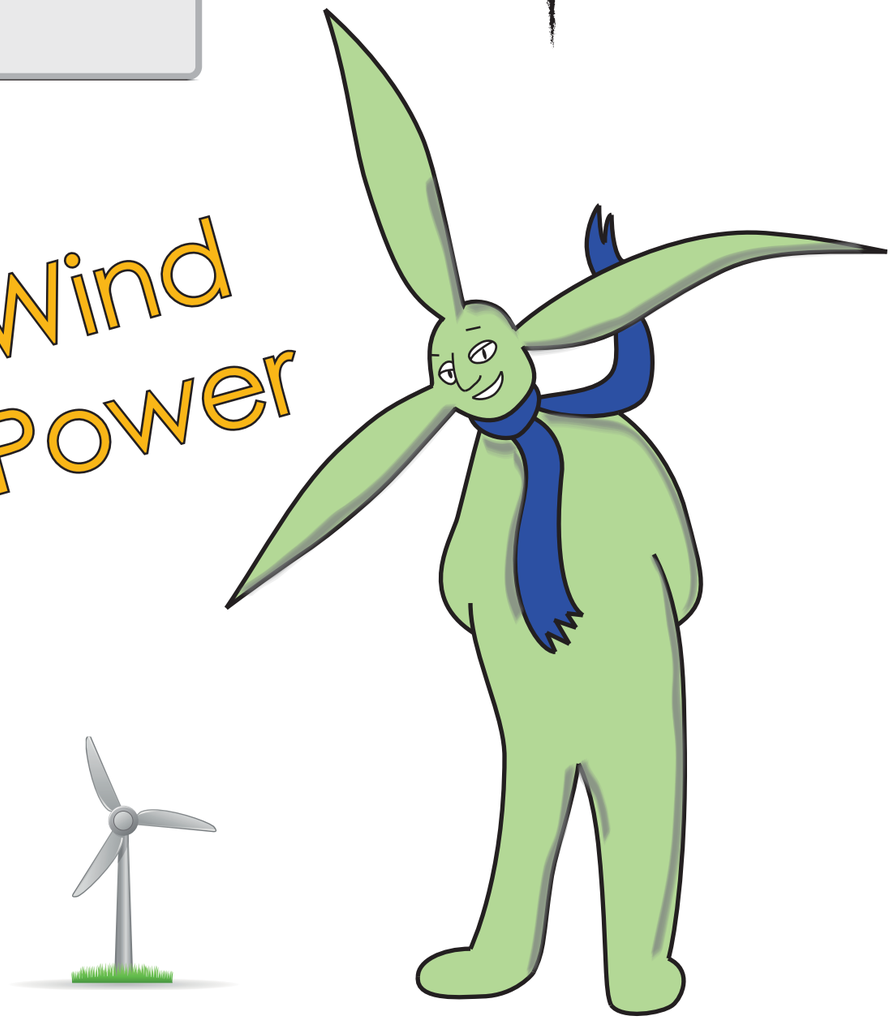
Wind Power



Clean energy that will keep you and our planet happy and healthy

WORKBOOK

What is electricity?

Electricity is the flow of electric charge. Electricity is known as a secondary energy source. This means that we get electricity by converting other sources of energy such as the thermal energy of burning coal, oil, or natural gas, or the kinetic energy of moving air molecules in the wind.

Wind, sunlight and fossil fuels are called primary energy sources. Normally, we convert these primary energy sources into electricity by using an electric generator. We cannot create electricity - we convert it from other sources.

What do we use electricity for?

We use electricity for many different things every day – often without thinking about it. Many of the things that you make use of daily would not work without electricity. We use electricity to light our houses and streets at night, to heat our houses in the winter and to cook food. Electrical appliances such as computers and televisions also require electricity to work. Most likely, most of the food as well as clothes, furniture and toys that you buy in the stores also required electricity in the production. When you visit a supermarket, a lot of food and beverages are kept cold and fresh in the refrigerators through the use of electricity.

When an economy grows and a country like South Africa becomes richer, people demand more electricity to heat and light their houses, to use their refrigerators, stoves and ovens, and to power their televisions and computers. We also need more electricity to power factories, offices, hospitals, street lights and stores.

Working questions

1. Where do you use/need the electricity the most?

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2. What would the world be like without electricity?

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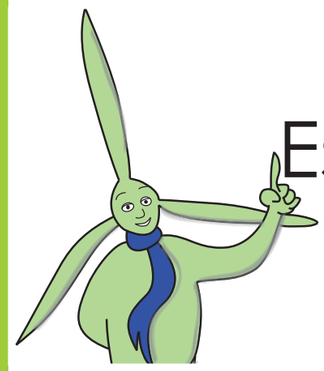
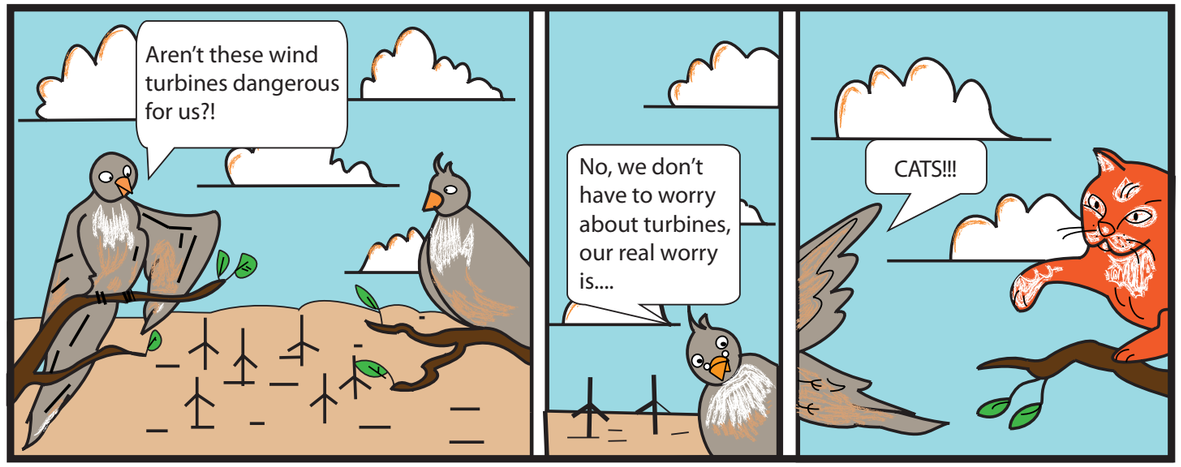


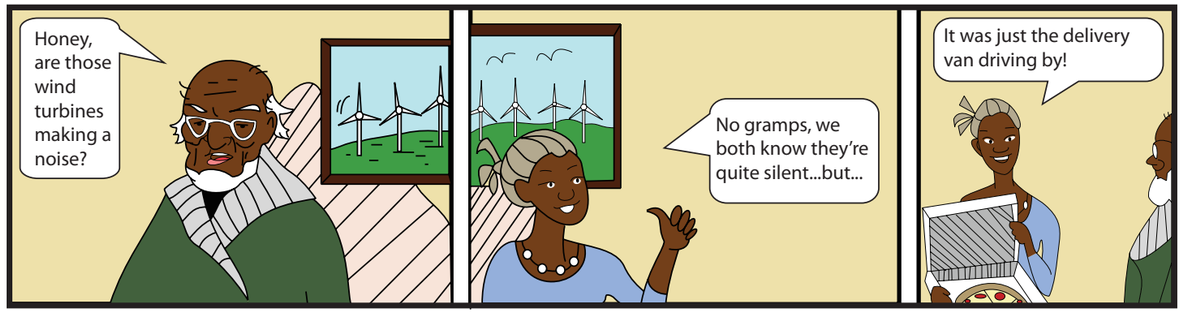
Essay writing competition

Cartoon Corner

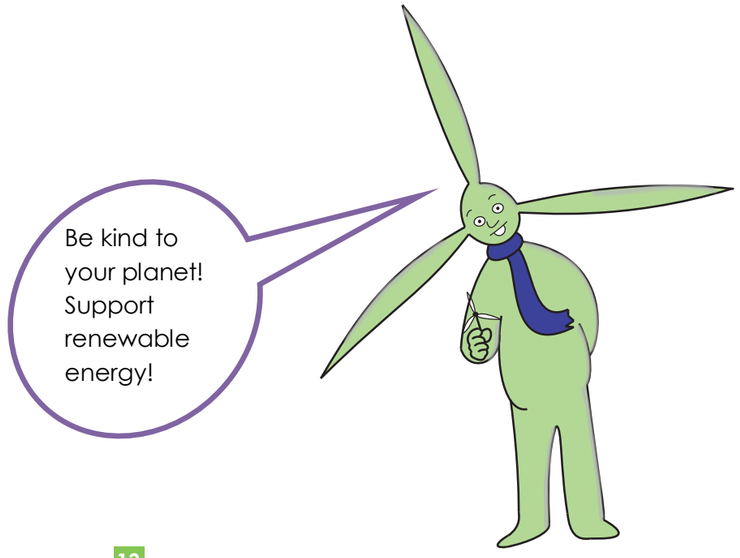
Wind turbines' effect on birds is minimal



Wind turbines have low noise levels



Fast Fact:
In 2009 wind power provided 2% of worldwide electricity usage!



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What sources of energy do we have?

RENEWABLE
Renewable energy resources are sustainable. This means that they can be replaced and will not run out. They are clean and friendly to the environment.

NON-RENEWABLE
Non-renewable resources cannot be replaced once they have all been used up. These resources can either be fossil fuel or nuclear. These forms of energy cause pollution.


Wind


Solar


Biomass


Hydro


Oil

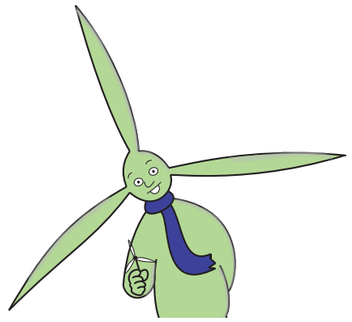
Gas


Coal


Nuclear

What is wind power?

Wind power is the conversion of the energy in wind into electricity. Wind energy has been used for thousands of years. The first windmills were built over 1500 years ago, for both grinding stones that crushed grain into flour, as well as to pump water. Windmills have also been used to pump water out of wells on farms in South Africa since the old days. By the end of 2009, wind power supplied 1.3% of global electricity consumption. Wind power is widely used in European countries, and in the United States and Asia, but it is still a relatively new technology in South Africa. Studies have shown that South Africa has a lot of wind and will be able to produce a lot of electricity from wind.



Working questions

1. What are the ways in which we can tell that the wind is blowing?

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2. What are important activities that require electricity?

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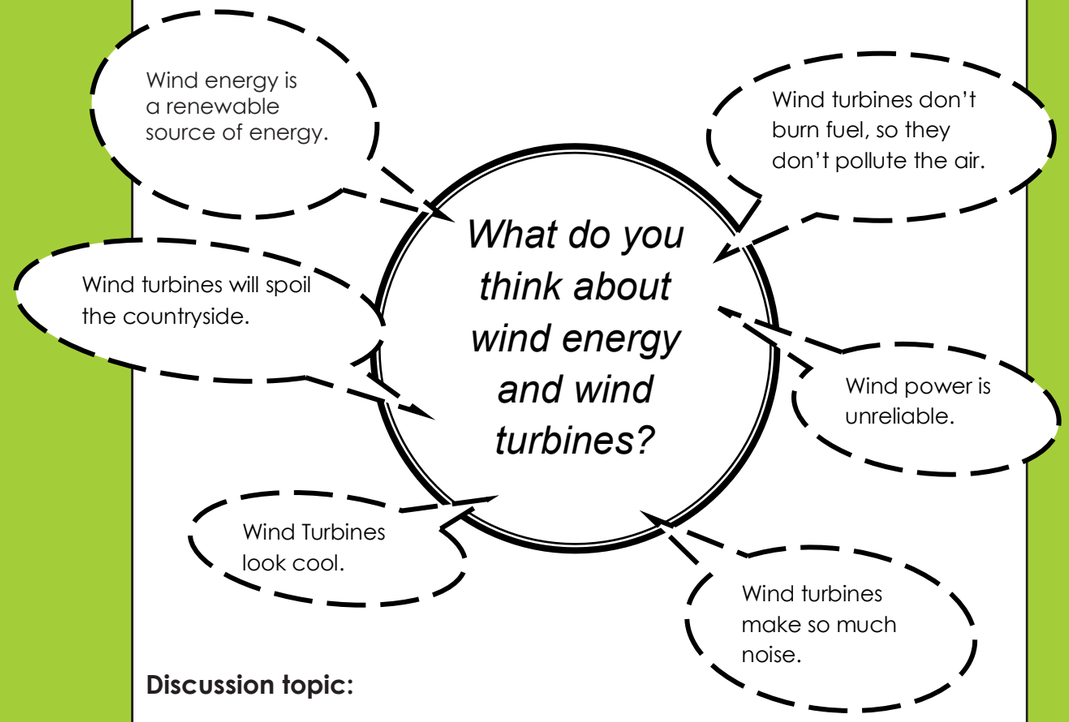
Despite the benefits of wind power, not everyone thinks it's such a good idea. Take a look at the statements below and note which statements you think are in favour of wind energy, and those that are against it.

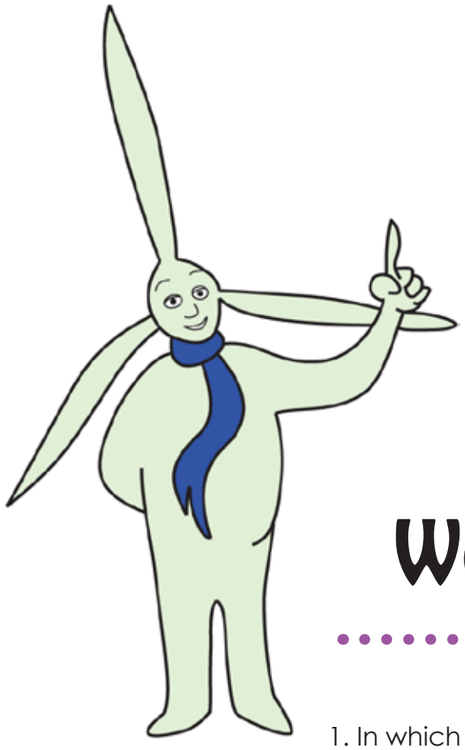


Discussion topic:

What do you think about wind energy? Do you think the benefits outweigh the criticism of wind turbines and wind energy?

Why don't we use more renewable energy?

The use of renewable energy is increasing at a very fast pace, but we cannot yet rely on renewable energy to meet all of our electricity needs. Firstly, renewable energy is not easy to store. Secondly, renewable energy is usually more expensive than conventional energy sources. As technology for renewable energy improves and the cost of fossil fuels increases, renewables will become more competitively-priced, or cheaper than fossil fuels.



Fast Fact:
One wind turbine can generate up to 6,5 million units of electricity each year. That is enough to run a computer for 2,250 years!

Working questions

1. In which ways can we save energy?

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2. Why is it so important to use and develop renewable energy sources?

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What is a wind turbine?

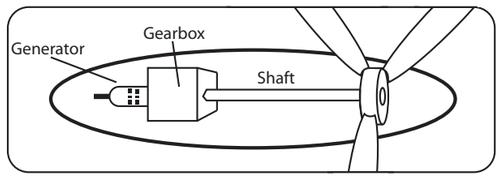
A wind turbine is the modern advancement of the windmill. Instead of using wind to lift water or move heavy rocks to grind seeds, wind is used to turn an electrical generator to make electricity. Sometimes students mistake the model wind turbine below for a fan. Just as a fan uses electricity to produce wind, so a wind turbine uses the wind to produce electricity!

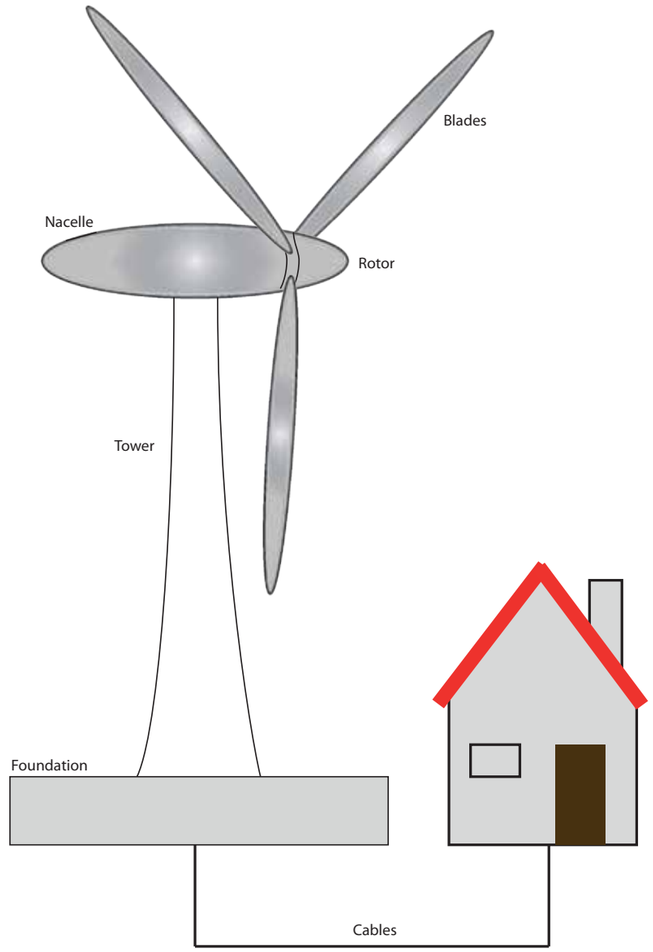
How does a wind turbine work?

Wind turbines are designed in such a way that the wind makes the rotor blades turn. The wind makes the blades spin around. This action then turns the rotor, which the blades are joined to.

The rotor is connected to the nacelle which contains the gearbox. This makes electricity when it turns. The wind turbines are connected to the electricity supply grid though thick cables.

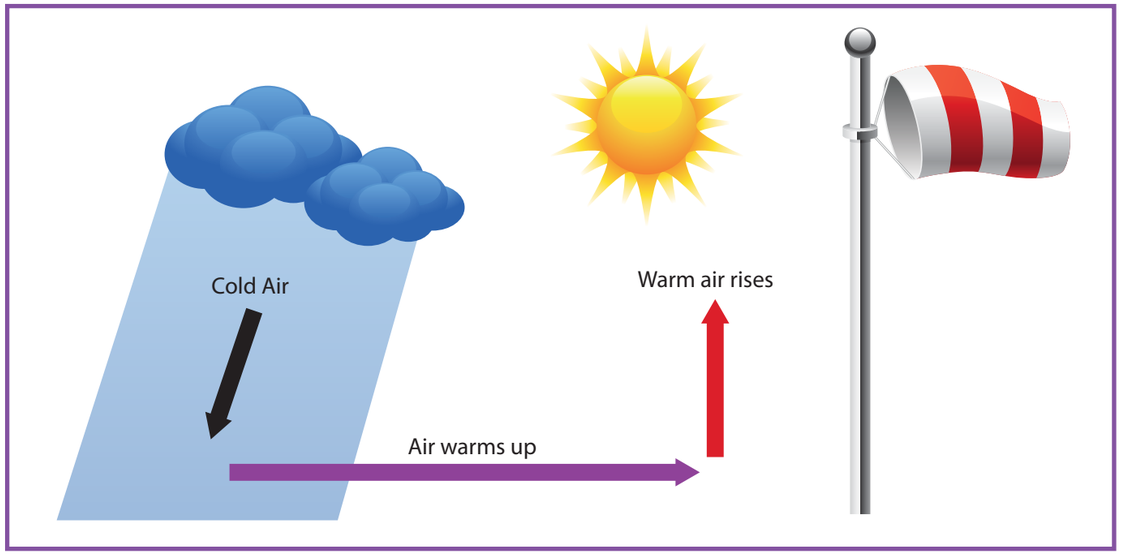
Inside the nacelle





How is wind created?

Wind is created through differences in air temperature. Hot air does not weigh as much as cold air, so when the sun makes some of the air hotter than other air, the cool air moves closer to the earth and the hot air rises into the sky. The wind is the air moving because the cold air always wants to be closer to the ground and the hot air wants to rise up into the sky. Once the cold air has moved closer to the ground it might be hit by the sun's rays and heated up which makes it move up in the sky again. The same thing might happen to the hot air because of the lower temperatures in the sky, so once it gets up there it cools down and thus becomes a bit heavier, which brings it back down to the ground.



Science helps us to predict that the sun will continue to shine for at least another million years so it will also continue to heat up cold air, which will rise up to create a continuous flow of wind. So we will never run out of wind because it is created by the air and the sun.

This is why we call wind a sustainable or renewable source of energy.

Once we have put up wind turbines, we just have to keep an eye on them and maintain them to enable us to have energy for free. Most wind turbines have a life expectancy of 20 years. This means that the wind turbines will be changed after 20 years. However, we can expect technology to make wind turbines much more efficient and thus able to produce more electricity in the future.

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Sharing the planet

For many years scientists have been able to prove that the temperature of the planet is rising. This is caused in part by large-scale use of fossil fuels. Increases in the temperature are predicted to lead to, among others things, drought, floods, as well as rising sea levels. This will especially affect people living on the African continent where many people will not have enough resources to adapt to climate change.

The international community made an agreement to reduce greenhouse emissions in 1997. However, much more needs to be done and world leaders are still talking about how all countries can do their part to fight climate change.

An increase in the use of renewable energy will be an important part of reducing greenhouse gases. Governments all across the world are now laying the foundations for increased use of renewable energy sources. The South African government is also in the process of getting energy from renewable sources. In the future much more energy will come from wind and solar power, hydro sources and others.

Fast Fact:
Europe has 70% of the world's wind energy.

This is partly due to laws that encourage its growth in Germany, Denmark, and Spain.

Discussion topic:
When have you used electricity today?

What uses wind to work?

Circle the five items in the picture that use wind. If you can think of any other objects or devices that use wind to work, draw them in. Then colour the picture in!

Working questions

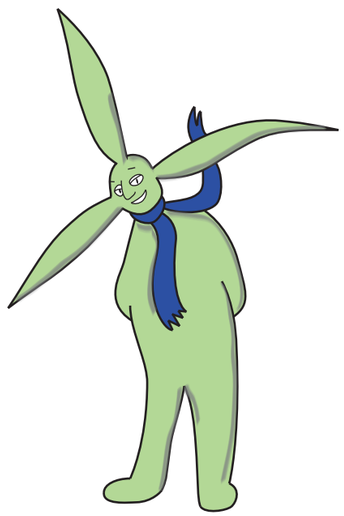
Explain in your own words how wind energy is created.

Explain why wind energy is sustainable.

What happens if the wind stops blowing?

It is very seldom that the wind will not blow in areas where wind turbines have been put up. Moreover, periods with little or no wind can be predicted in advance and other sources of energy can be increased. Also, variations in wind energy are smoother because there are many smaller units compared to, for instance, a big coal power plant which can trip off the grid unexpectedly. In other words,
if managed properly, if the wind stops blowing for a while it will not have an impact on the electricity supply.

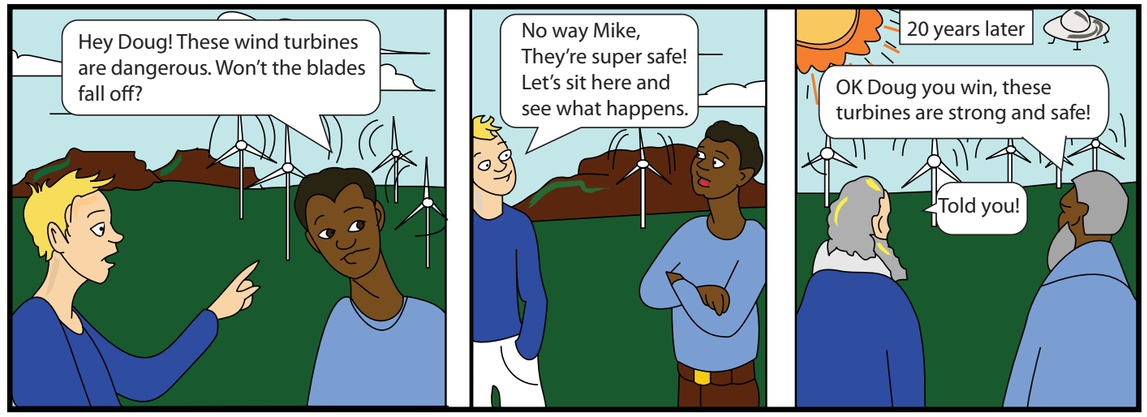
Fast Fact:
Wind energy is one of the fastest growing energy sources in the world!



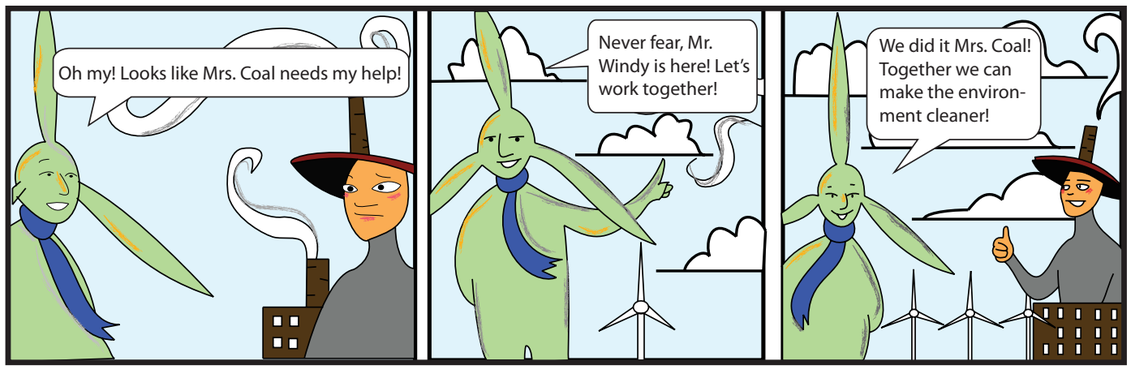
Take a break!

Wind power is reliable

Wind turbines are very safe



Wind turbines impact the environment positively



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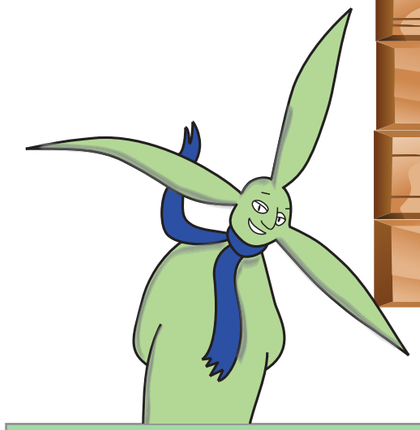

Instructions

Build your own wind turbine

Tower

1. Cut out the shape along the solid black lines.
2. Fold along all the dotted lines, fold A inwards and B outwards.
3. Apply glue to A and stick to opposite side to create triangular tower.

Wings

1. Cut out shapes along the solid black lines.
2. Fold along all the dotted lines inwards.
3. Apply glue to A and stick to opposite side to create a pyramid shape.
4. Repeat until there are 3 wings.

Turbine

1. Cut out the shape along the solid black lines.
2. Fold along all the dotted lines inwards.
3. Apply glue to A and stick to opposite side to create a long triangle.
4. Apply glue to B and stick C on top, both ends will then be closed.

Assembly

1. Cut out platform along the solid black line.
2. On the tower, apply glue to B and place the tower on the grey triangle on the platform.
3. On the wings, apply glue to B and place the wings on the grey triangles on the turbine.
4. On the turbine, apply glue to the green area and insert the turbine into the tower.

A

B

B

B

Wing

A

B

Wing

B

B

B

A

Turbine

B

C

A

B

C

Platform

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B

B

B

Tower

You built your own wind mill!!