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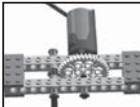

Renewable Energy Engineering with LEGO Bricks
Brain Builders Educational Programs

Windmills: Windmills harness wind power to produce electricity. Inside a windmill, you will also find a generator. Wind energy is used to spin the blades on the windmill, and in turn, it spins the generator.







By now you should already know how to engineer a hand cranking generator. The design of the windmill is similar, but instead of using a crank to turn the generator, we use the blades. The blades of the windmill are designed a special way so that when the wind hits them, they will turn.


Engineering a Windmill
To engineer a windmill, we must use gears to make it easier to turn the generator, so we use a big gear on the generator paired with a small gear.

This is how the blades are connected.

Tips on Engineering a Windmill

-  Make sure your windmill is high enough off the ground so the blades don't hit the ground.
-  Make sure the moving parts are not on too tight. This will make it difficult for the blade to spin.
-  Make your project sturdy! If your windmill will fall over just by touching it, then it probably will not work.
-  Make sure the blades are faced in the right direction. The blades have a slight curve to them. The side that feels like its curving inward should be facing the wind.



Windmills can be engineered many different ways and it is up to you to come up with your own designs. Here is one example.

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After you have your windmill completed, see if it works! Experiment with different designs to see if you can produce more electricity.

Try using 2 blades to power the windmill. Does it turn faster or slower?

Put your windmill far away from the fan. Put it closer. Where does the windmill work the best?

Use different gear combinations and find out which works the best. Record your findings below.

Answered all the questions above? Design a LEGO house with lights and see if you can use your windmill to power it!



Good job! Keep building and experimenting with different designs. You are a renewable energy engineer. We also call renewable energy, "green energy!" Having trouble getting your windmill to work? Look below for some tips.

Is your windmill not working?

- Feel where the wind is blowing the hardest and place your windmill there.
- Build your windmill higher or lower to be in the wind stream.
- Try turning your windmill and see what works the best.
- Make sure the parts to the generator are not connected to tight.

Review last weeks lesson and challenge

-Sample Questions-

- What are gears?
- What happens when the gear on the generator is larger? (easier to turn)
- What happens when the gear on the generator is smaller? (harder to turn, but produces more energy because the generator spins faster)

Pass out this weeks worksheet

-Go over and have students read through the worksheet in class. Students will try to answer the questions on the 2nd worksheet whilst testing and engineering their project.

Challenge 1 - Team build - teams of 2

- Engineer a windmill that works.
 - Have one student in the team build the generator and gears.
 - Have the other student construct a base for the generator to mount to.
 - Pass out one propeller to each group. They may use a 2nd after the first test.

Setting up the test area

- Setup fan at least 2 feet away from where the students will test their projects.
- Use tape to mark out the test zone.
- The fan has variable speeds, so adjust accordingly.

IMPORTANT

- Do not let students put LEGO's in the fan or put their finger in it.
- When stopping their windmill, have them turn their windmill away from the fan.
- Do not have students put fingers in the windmill blades to stop it.
- Limit test area to 2 projects.