SWEducational

ACTIVITY PACKET

SUSTAINABLE ENGINEERING EDITION

WHAT IS SUSTAINABLE ENGINEERING?

Sustainable Engineering works with designing systems that use energy and resources more efficiently. This leads to us being able to use less resources and energy to do more. Sustainable engineers could work on solar panels, wind turbines, recycling processes, and other systems that help the environment.

PHOTO RAFFLE

Do you like prizes? How about showing off your project work? The **FIRST 5** students to submit a photo of their **completed Sustainable Engineering activity** through the link below will win a gift card of their choice from the list!

Get your cameras ready and stay tuned... there will be a photo raffle in the next packet!

Gift Cards to...

- Starbucks
- XBOX
- PlayStation
- iTunes
- More!

Submit Here! Or type the link below:

https://forms.gle/AcEXCZkePKxmqJCJA

IMPORTANT TERMS

Sustainable Energy: energy that can be reused, can be called renewable energy

- Solar panels or taking energy from the sun and transferring it into electricity is a sustainable energy
- In this activity you will be demonstrating a form of sustainable energy with your windmill.
- What are some ways you could incorporate sustainable energy in your life?

Mechanical Energy: energy that an object has because of movement or its position

- A ball rolling down a hill would have mechanical energy because it is moving, and because it is at the top of a hill. Once it reaches the bottom of the hill and stops rolling, it does not have mechanical energy.
- In this activity, you will be seeing mechanical energy by the windmill blades spinning.
- What objects in your house have mechanical energy? (Hint: think about the machines in your house)

Fossil Fuel: fuels that come from old life forms that decomposed over a long time

- The gas that you put into your car is a fossil fuel.
- Fossil fuels are not sustainable, therefore in this activity you are going to make an alternate form of energy.
- What are some areas in your life that you could use less energy and use less fossil fuels as a result? (Example: Carpool to school)

ACTIVITY INSTRUCTIONS

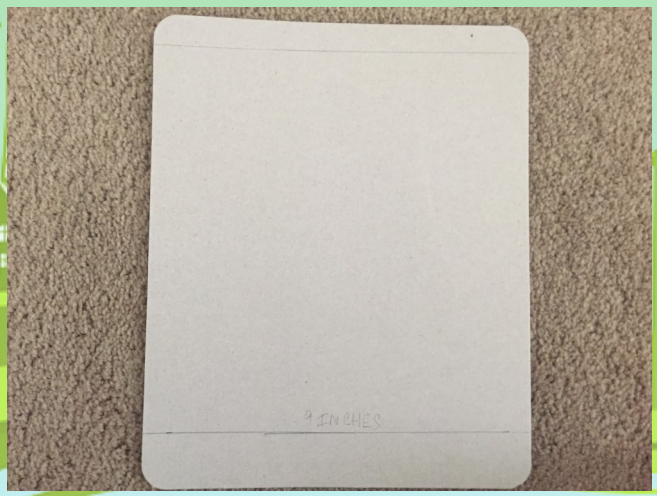
Humans use many resources from the environment to make the things we need and use everyday! One of the most important is energy, so today, we will be making a model windmill! Windmills help us convert the power of the blowing wind into energy that we can use as electricity. Wind energy is a form of sustainable energy, so it is a better way of getting energy from the environment than burning fossil fuels.

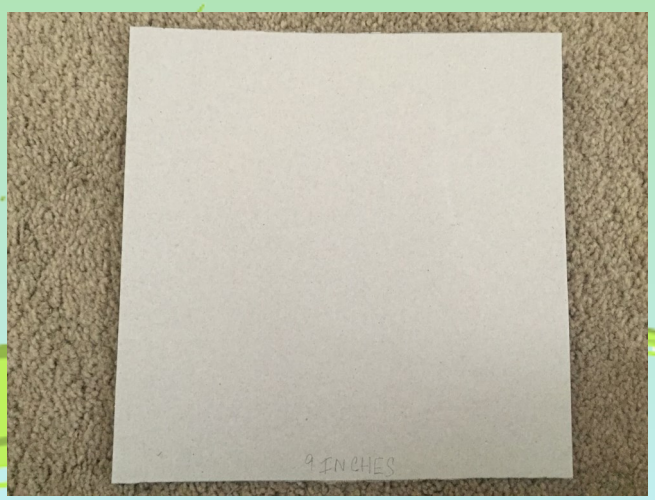
SUPPLIES

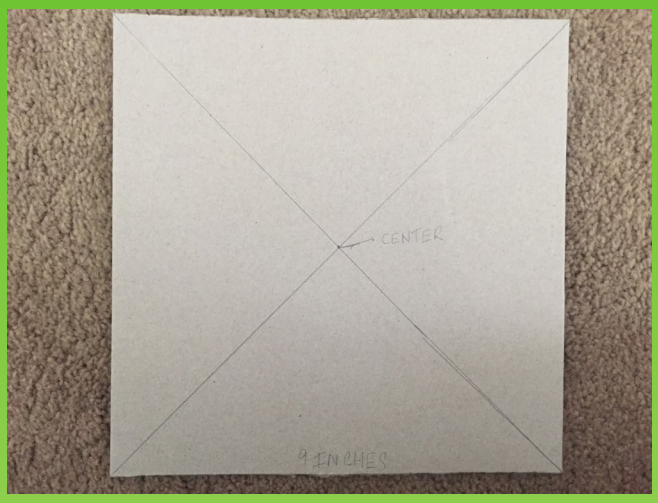
- A square piece of cardboard with sides that are around 8-12 inches for the blades of the windmill
- Another piece of cardboard for the base
- 5-6 Foam cups. You can also use paper or plastic disposable cups, but they should not be too small
- A wooden skewer
- A bit of air dry clay as a stopper (optional)
- Tape or hot glue
- Scissors (ask an adult for help if you are unsure about using scissors)
- Ruler
- Pencil or pen
- Thread or yarn (optional)

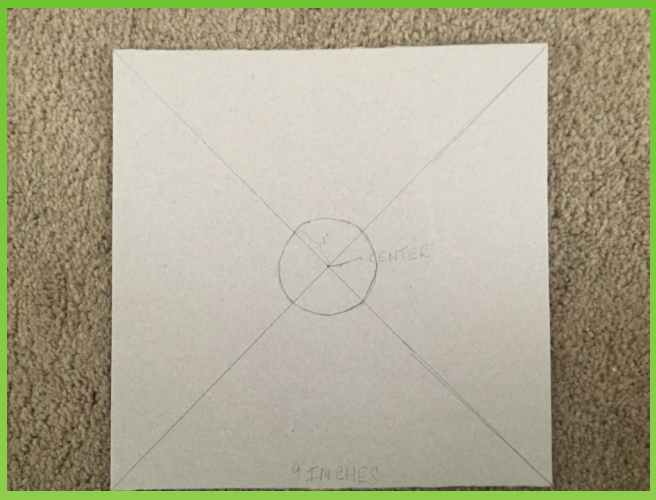
STEPS

1. Start by taking your square piece of cardboard from which we will make the blades of the windmill. Draw two lines that join opposite corners, making its diagonals. Next, draw a circle that has a radius of 1 inch and is centered at the point where the diagonals meet, as shown in the picture below.

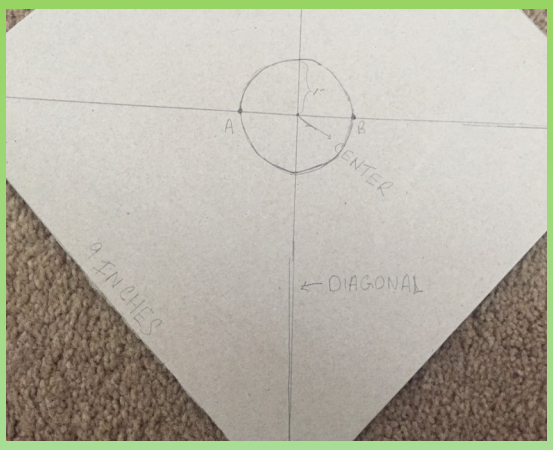


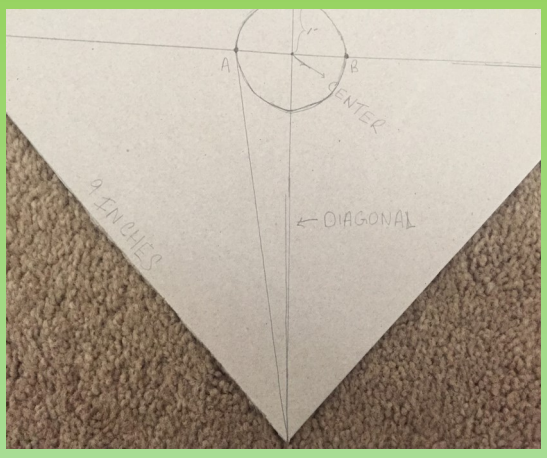


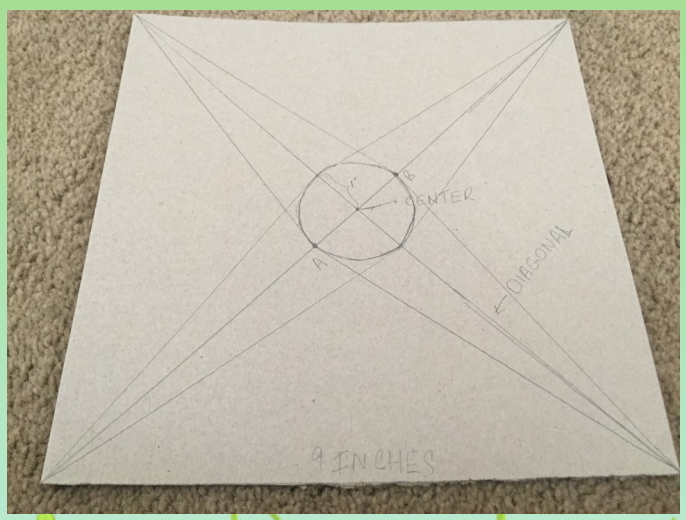




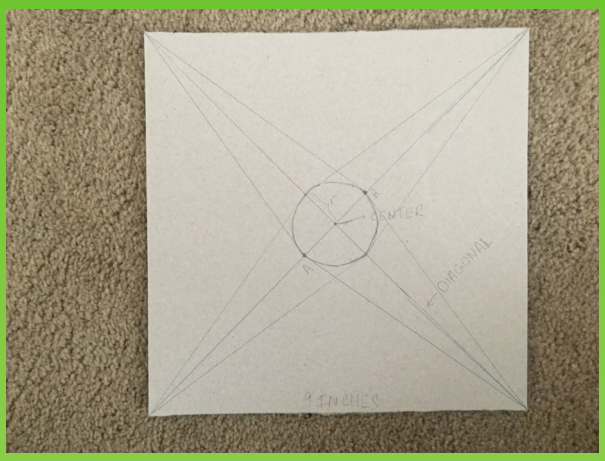
2. You can see that the circle intersects the diagonal at four points, from these points we will draw lines to make the blades. First, pick a diagonal and notice the points where the other diagonal meets the circle, let's call these other points A and B. What you have to do is, draw a line from A to the corner where the diagonal you picked ends. Next, draw a line from B to the corner where the diagonal you picked ends. The pictures might help make the step more clear!

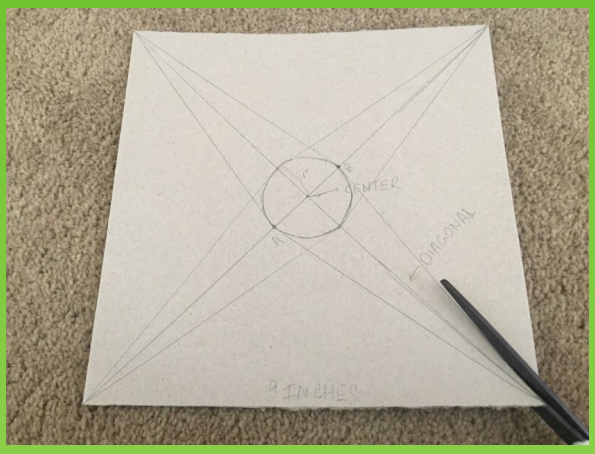


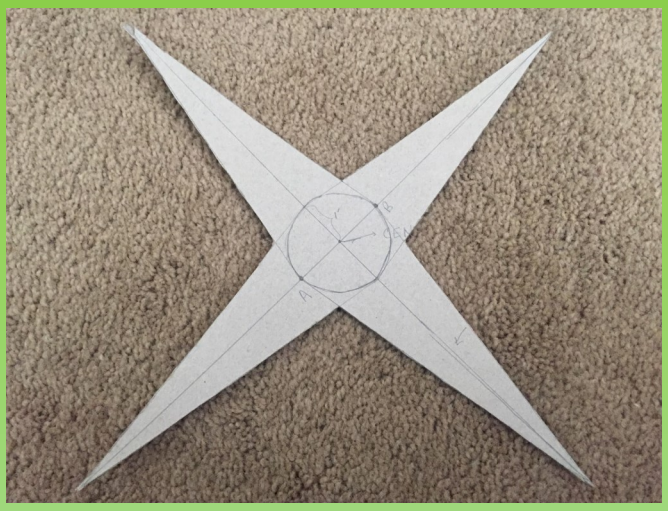




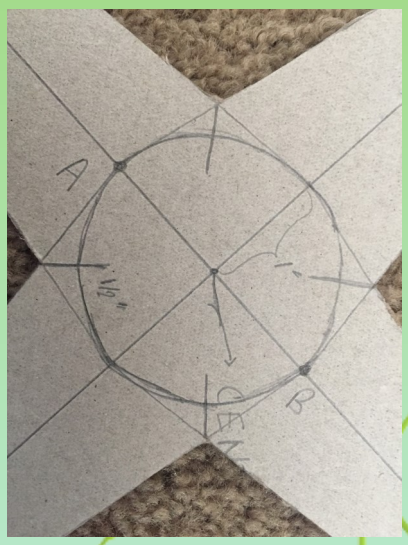
3. Repeat step 2 for all the diagonals, until your cardboard looks like the picture. Once you are sure, cut out the blades along the line you just drew. Be careful not to cut more the points where these lines meet.



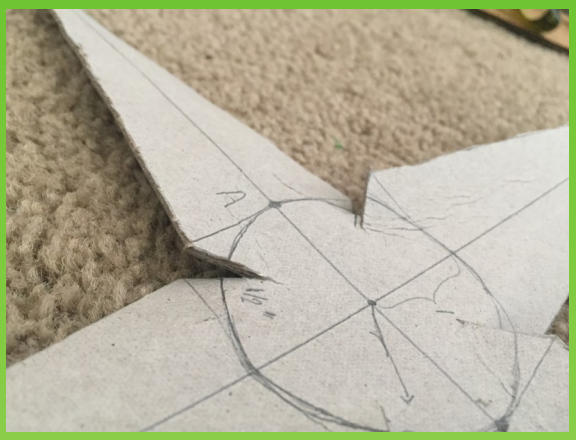




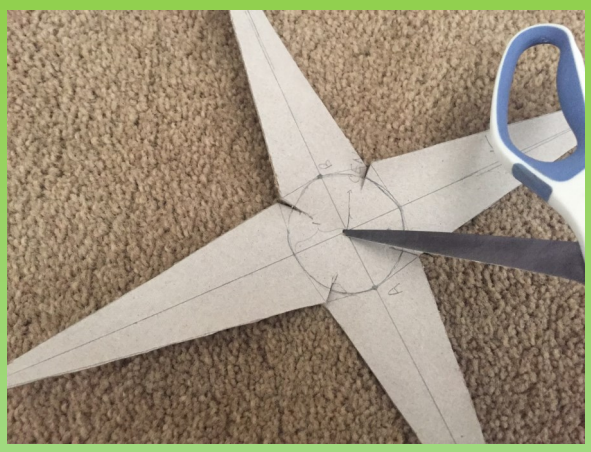
4. Draw a half inch line from a point where the blades meet, towards the center of the circle. Draw three more lines where the other blades meet. You should have four lines in all. Carefully, make slits at these lines. Try not to cut too much.

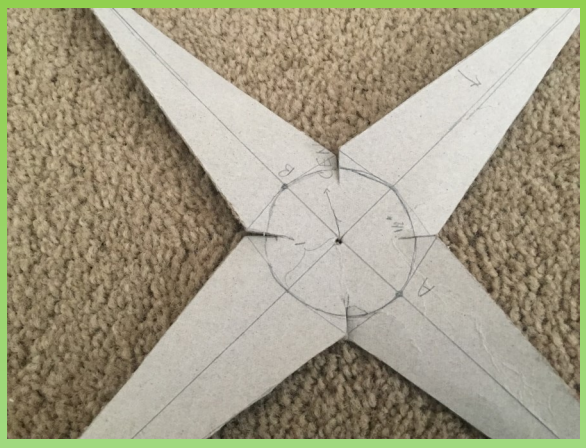


5. Use these slits to tilt the blades slightly so that they have a better shape that can move with the wind. Be gentle with this process. Your blades are ready!



6. Poke a hole big enough for the skewer, into the blades, at the point where the diagonals meet. This step might be dangerous, so ask an adult for help.





7. Place the tip of the skewer into the hole you just created. Secure it in place using tape or hot glue.

8. Next, we will make the base of the windmill. Take two foam cups and hold them so that their bases touch. Hot glue or tape these together.

9. Take another cup, and place its rim to the rim of one of the cups that we joined in the previous step. Hot glue or tape these together. You should have three cups glued together.

10. Tape or glue this structure to the piece of cardboard that will be the base, keeping the cup with the rim touching the base cardboard.

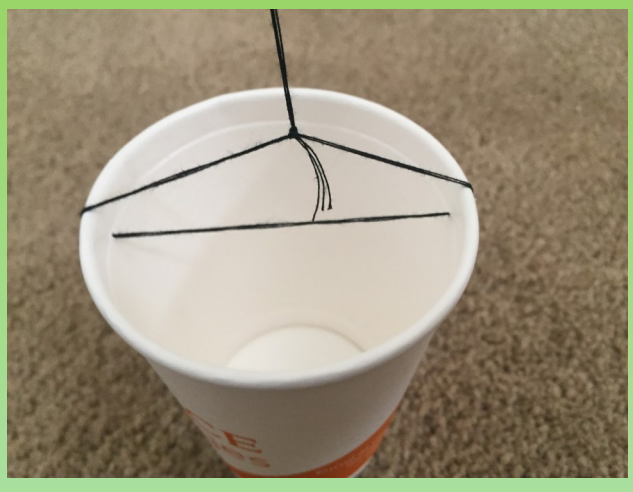
11. Take two more cups, and make a hole big enough for the skewer to fit in the center of each of their bases. Now, hold them so that their rims touch and hot glue or tape these together as well.

12. Place these joined cups horizontally on the base structure. Attach these together. One of the holes in the cups should be facing you.

13. If you have air dry clay, you can use it to make the stopper by molding it around the skewer, 1-2 inches behind the blades. Make sure it is thick enough to not pass through holes in the foam cups. If you don't have clay, you can make a cardboard circle, poke a skewer sized hole, and attach it 1-2 inches behind the blade.

14. Pass the skewer through the holes in the cups until you hit the stopper. Your windmill is ready!

15. This is an optional step, if you have an extra up and thread. We can use these to make a simple lift that will go up and down when the windmill turns! Make two holes in the opposite end of the sup and pass the string through them. Tie one end of the string to the string a little above the cup. Tie the other end of the string to the skewer coming out through the back hole of the windmill. You might want to use glue or tape here to ensure that the string doesn't slip off.



16. To make the windmill rotate, you can try blowing on it or using a hairdryer. If you did the optional step, you can also see the cup moving up as the blades rotate!\

RESOURCE LINKS / VIDEOS

Engineering Sustainability- Going Green with Robots and Automation:

- https://www.youtube.com/watch?v=LatqW98SMXU

How do Wind turbines work?: https://www.youtube.com/watch?v=xy9nj94xvKA

How do solar panels work?: https://www.youtube.com/watch?v=xKxrkht7CpY

The Engineering Challenges of Renewable Energy: Crash Course Engineering #30:

- https://www.youtube.com/watch?v=4k5gyYAAEEU

The Future of Clean Energy: Crash Course Engineering #31:

- https://www.youtube.com/watch?v=v6uRuNboy4A

Principles of Sustainable Engineering Lesson from Penn State University:

- https://www.e-education.psu.edu/eme807/node/688

Sustainability: https://kids.britannica.com/kids/article/sustainability/631786

Sustainability- Full Documentary: https://www.youtube.com/watch?v=bjrPilem30g

Sustainability in California: https://water.ca.gov/What-We-Do/Sustainability

Renewable energy in California:

- https://www.energy.ca.gov/programs-and-topics/topics/renewable-energy/renewable-energy-resources

University of California Student Projects and other Resources on Sustainability:

- https://www.uctv.tv/search/?page=1&catSubID=211

Can 100% renewable energy power the world?:

- https://www.youtube.com/watch?v=RnvCbquYeIM

What is the Most Sustainable City in the World: https://www.youtube.com/watch?v=fsWr0LfM_uQ

City of the Future: Singapore-National Geographic:

- https://www.youtube.com/watch?v=xi6r3hZe5Tg