GRADE LEVEL: ELEMENTARY

# Everyday Engineering: STEM@Home

## Activity: Daylight in a Bottle Structure

**INTRODUCE THIS:**

More than a billion people around the world don't have electricity. Many live in houses without windows. This means that even during the day they must burn candles or use kerosene lanterns which cost money. Sunlight is free, renewable, and doesn't cause pollution. It is also known to improve how people feel. There is a growing movement to bring sunlight inside by using water-filled plastic bottles.

**WATCH THIS:**

See the difference daylighting can make in a Philippine settlement. "Philippines: Plastic Bottles Go Solar", https://youtu.be/hPXjzsXJ1Y0.

Engineers are always looking for ways to use renewable energy sources such as the sun and wind. Learn more at "Dream Big - Lean and Green: Engineering Alternative Energy", https://youtu.be/wB4B23MUMko.

**MATERIALS:**

- Cardboard box—the bigger the better
- 2 pieces of extra cardboard—something large enough to cover the hole made for the water bottle
- 3-4 clear water bottles (0.5 L or 17 oz)
- Food coloring
- Scissors or box cutter
- Duct tape or paper—used for covering small gaps or holes

**DO THIS**

*PART ONE: PREP THE BOX*

1. Look inside the box. If it has holes or gaps cover them with opaque tape or paper.
2. Place the box on its side, so that the flaps of the box are open either to the right or left. Place a water bottle on the top side of the box. Trace a circle around the water bottle and then cut a hole just big enough for the water bottle.
3. Take another piece of cardboard, trace a circle as above and draw lines across the circle as though you were dividing a pie into 6-8 pieces. Extend the lines about 1 inch beyond the circle. Use scissors or box cutter on the lines. This is called the collar.
4. Cut out a small rectangle near the bottom of one of the sides of the box (do not cut the side that was originally the bottom of the box). This will be a view hole.
5. Tape a colorful picture on the inside of the box opposite the view hole.
6. Close the box by either holding the flaps closed or taping them together.

Step 3

Step 5

*PART TWO: TESTING*

Insert an empty water bottle in the collar, then place the water bottle/collar into the hole on top of the box. Move to a place where the sunlight or flashlight hits the bottle, and look through the view hole. Can you see the picture? Is it dim?

Now try it with a completely filled water bottle.

Is it any better?

Does it matter if the water bottle is only half full?

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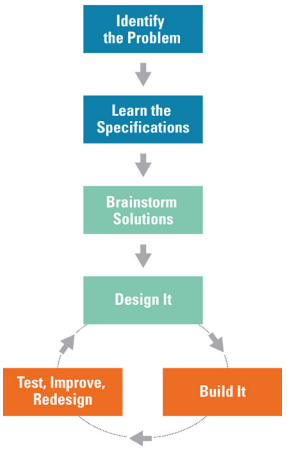
Would it work better if the water was colored?

Can you think of something that would work better than a water bottle?

Engineers use the Engineering Design Process to find ways to solve problems. First, they identify the problem. Then they research possible solutions, test them out, and try again




## TALK ABOUT THIS

Light (such as sunlight) travels in a straight line. As light travels through the water it spreads out so it can reach into all the corners of the box.

How do you think people used to light their houses before electricity was invented? If you didn't have electricity to light up your home what would you do?

Structural engineers and architects who design buildings often look for ways to bring natural light into a building. This saves electricity, reduces costs, and often improves the mood of the building's users.

## WANT MORE CHALLENGE?

Try the same activity with a different clear liquid such as soap, vegetable oil, or rubbing alcohol.

## WANT TO GO FURTHER?

This activity and over 65 others were developed in support of the award-winning documentary *Dream Big: Engineering Our World*. This version has been adapted to showcase how to do it at home.

For more in-depth coverage download the "Daylight in a Bottle" activity from the *Dream Big: Engineering Our World* website: http://discovere.org/dreambig/activities. There you will find discussion questions for younger as well as older children, relevant vocabulary, and more.

*Dream Big: Engineering Our World* is available on Netflix and Vimeo.

The free library of over 65 activities and webisodes can be found at discovere.org/dreambig.
You can find **Everyday Engineering: STEM@Home** activities, videos, and other links at asce.org/pre-college_outreach. The YouTube playlist of supporting videos can be found at https://www.youtube.com/playlist?list=PLA61bxD8Jg-0V3ExN9sHkUYIrdKqSgfXJ.