# Solar House

Build your own Solar House and use the power of the sun to turn on LEDs and an electric fan.

Written By: Pete Prodoehl

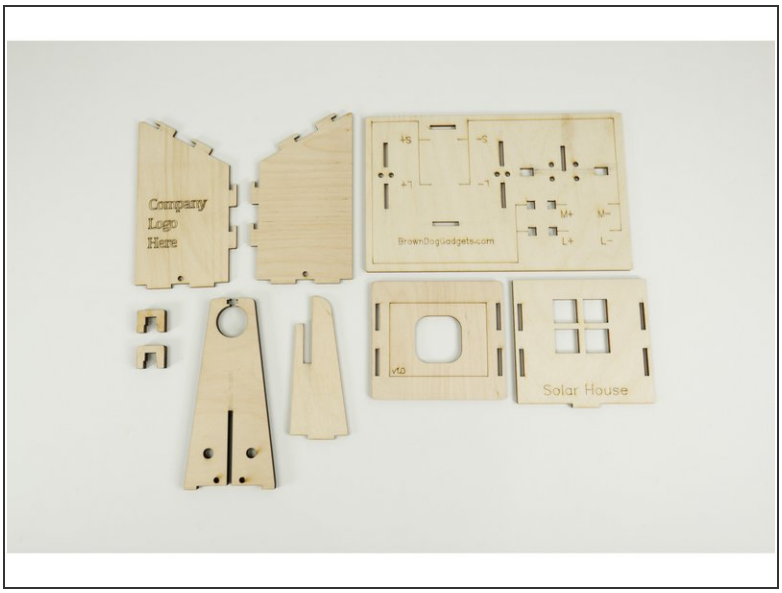


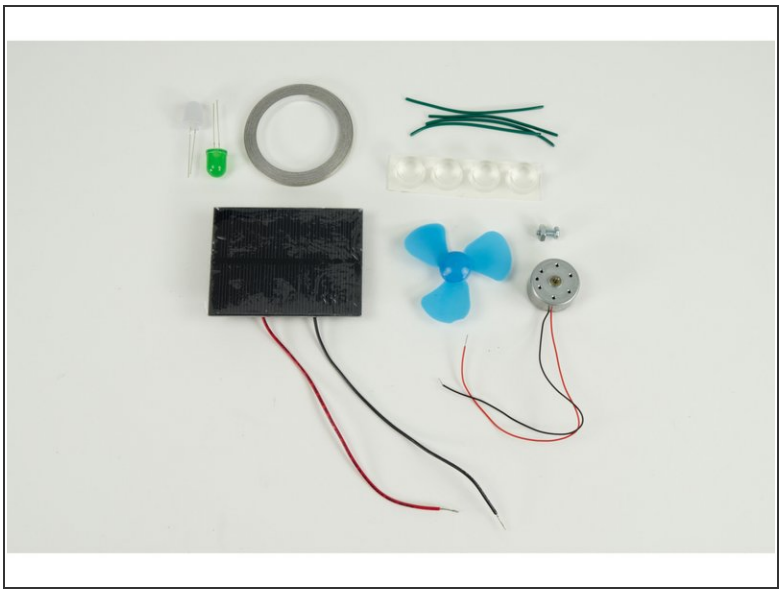
# INTRODUCTION

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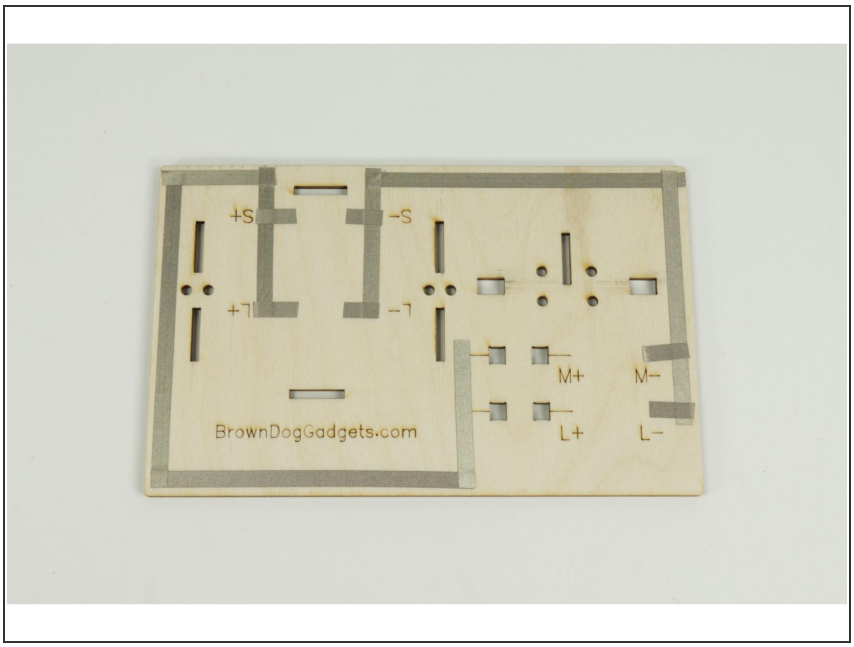
## Step 1 — Take Inventory



- Your Solar House Kit should have the following parts:
  - 9 laser cut wood pieces
  - 1 Solar Panel
  - 1 Green LED and 1 White LED
  - An electric motor, a fan blade, and a nut & bolt
  - 4 Rubber Feet
  - 4 short lengths of wire
  - A roll of 1/4" wide Maker Tape

## Step 2 — Apply Maker Tape

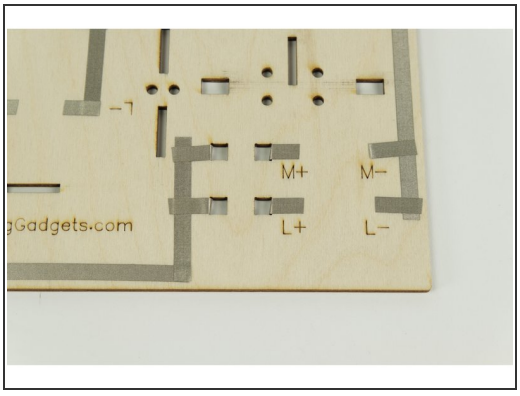


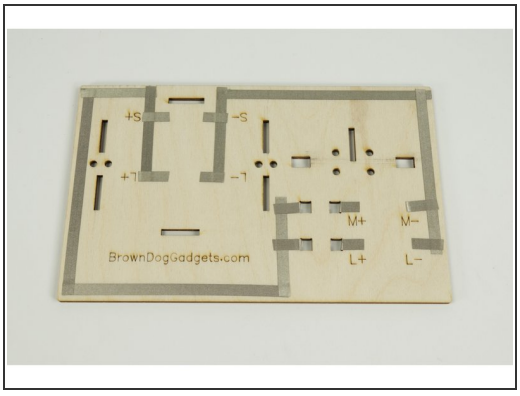

- Let's build a Solar House!
- We'll start with the base of the Solar House Kit.
- Apply Maker Tape to the base following the etched lines.

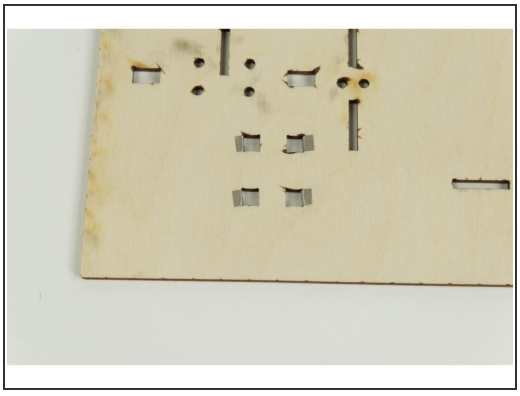
You'll need a pair of scissors to cut Maker Tape as it's a very strong nylon-based material.

The great thing about Maker Tape is that you can overlap it and it will still work fine because it's conductive on both sides and all the way through.

## Step 3 — Press Tape through Holes



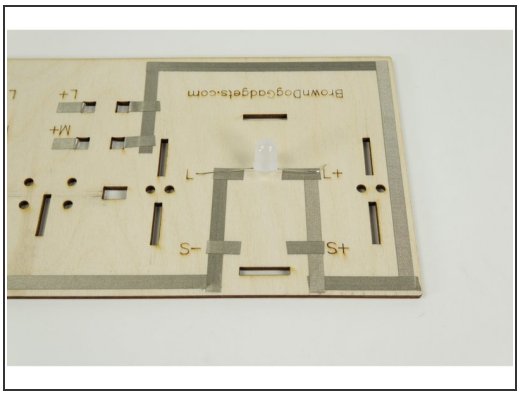



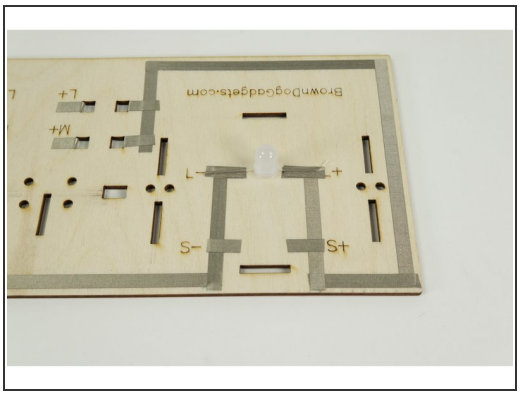



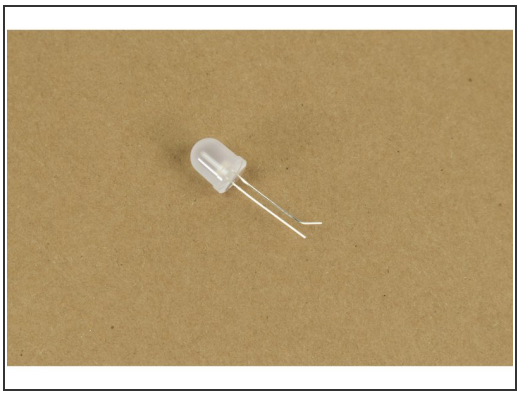
- There are four square holes in the base that you'll need to push the Maker Tape through.
- Wrap the tape around to the back side of the base as shown.

The holes create a gap in the circuit that we'll close using switches we'll make in Step 19.

## Step 4 — Add White LED



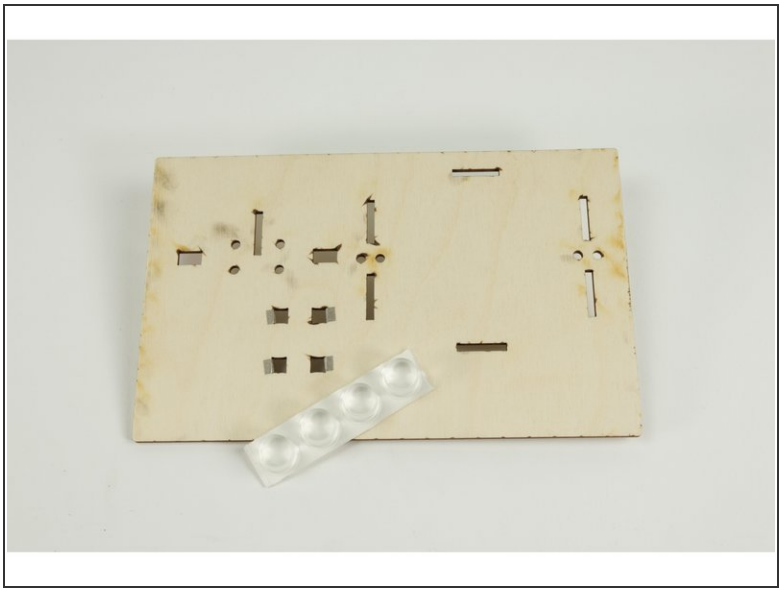



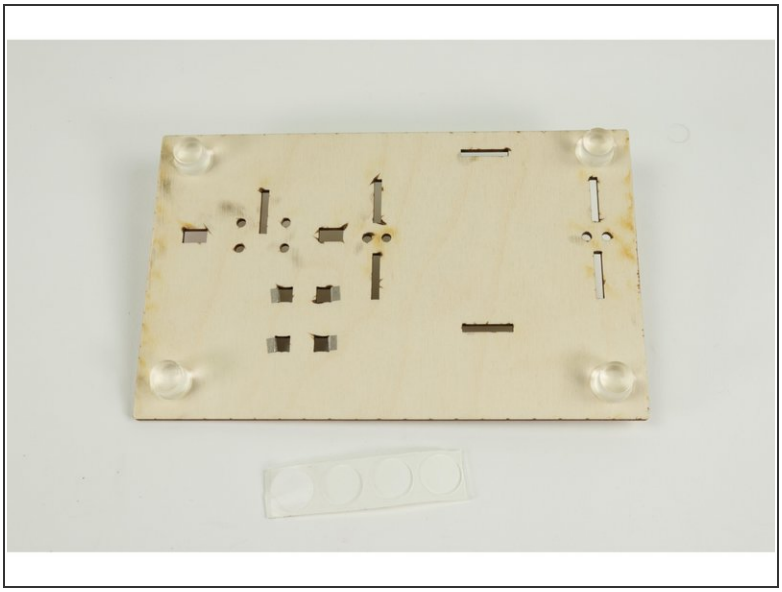



- Next we'll add the White LED to the base.
- Turn the base around so the back of it is facing you. You'll see an **L-** and **L+** in the center of the section where the house will sit.
- Remember! An LED has a **positive** and **negative** leg. The positive leg is **longer** than the negative leg.
- Attach the **positive** LED leg to the **L+** side and the **negative** LED leg to the **L-** side.

**Tip**: Since we need to bend the LED legs straight out it's easy to forget which one is the positive (longer) leg! Our trick is to give a slight bend to the end of the **positive** leg as shown in the photo.

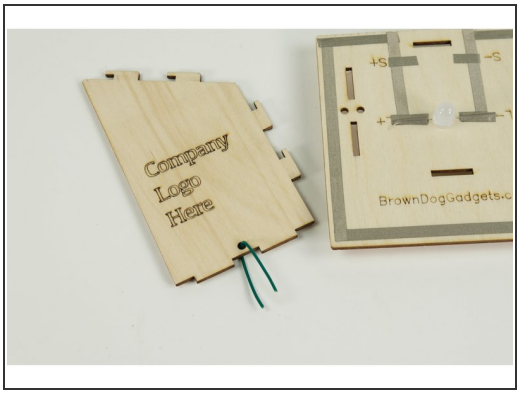
## Step 5 — Add Feet to Base

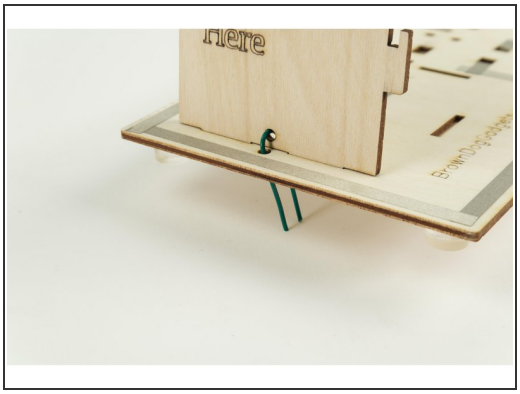


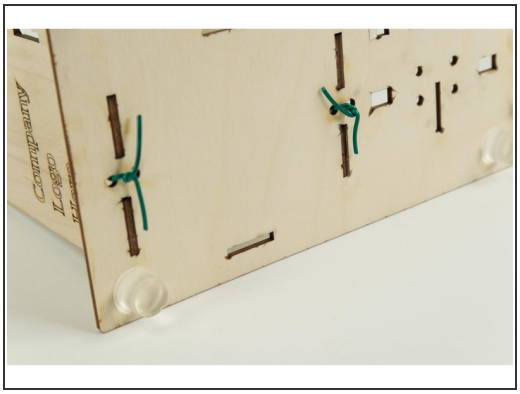


- Flip the base upside down so we can add the four large rubber feet to the bottom.
- Peel the feet off the strip they are attached to so you can stick them to the base.
- Put one foot in each corner of the base.

## Step 6 — Add Side Walls of House





Note that the house can face forward or backwards, and you can easily change it later, but for this guide we'll face the house forward.

- Take one of the short pieces of wire and bend it into a "U" shape as shown, then thread it through the hole in the bottom of one of the walls.
- Insert the wall into the base, with the ends of the wire going into the two holes on each side of the wall.
- After the wall is in place twist the wire together to hold the wall securely against the base.
- Repeat this process with the second wall.

## Step 7 — Add Front of House




- With the side walls in place you can now add the front wall of the house.
- The front of the house will slide down towards the base, locking into the tabs sticking out from the edges of the side walls.
- The front wall will be held down against the base after we add the roof in the next step.

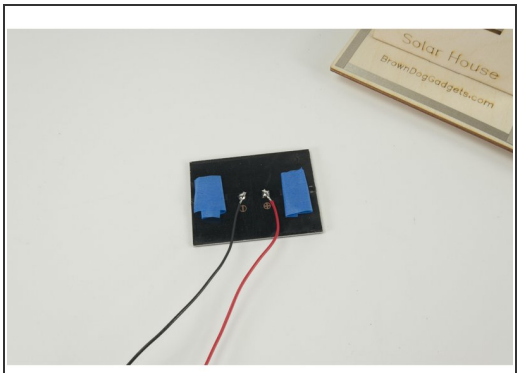
## Step 8 — Add Roof of House




- With the walls of our house up, we can now add the roof.
- Just like the front wall of the house, the roof slides into place on the tabs on the edge of the walls.
- The roof will slide in place sticking out just past the front wall of the house, to help hold it in place.
- Your house now has three walls and a roof, and should stay in place on the base.

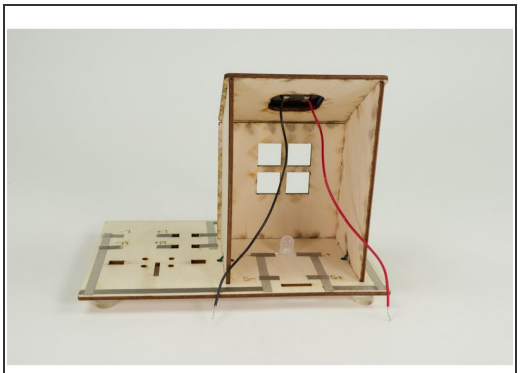

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## Step 9 — Add Solar Panel





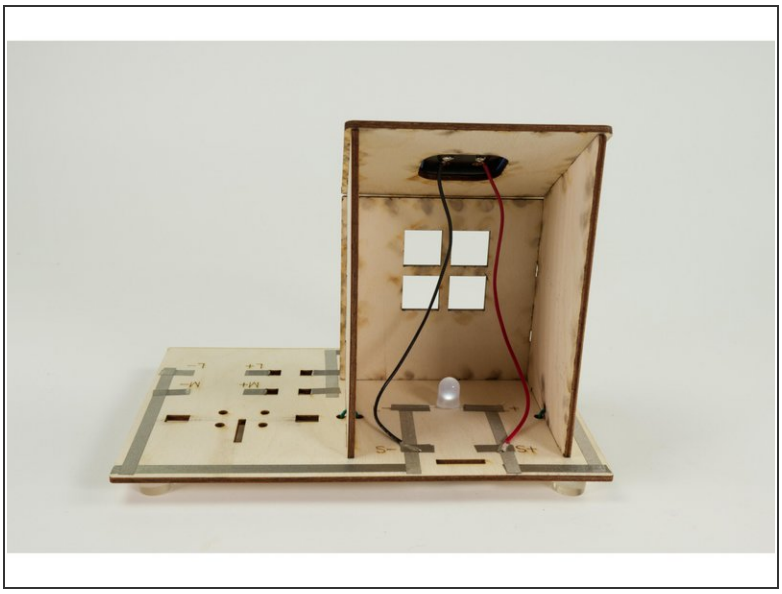


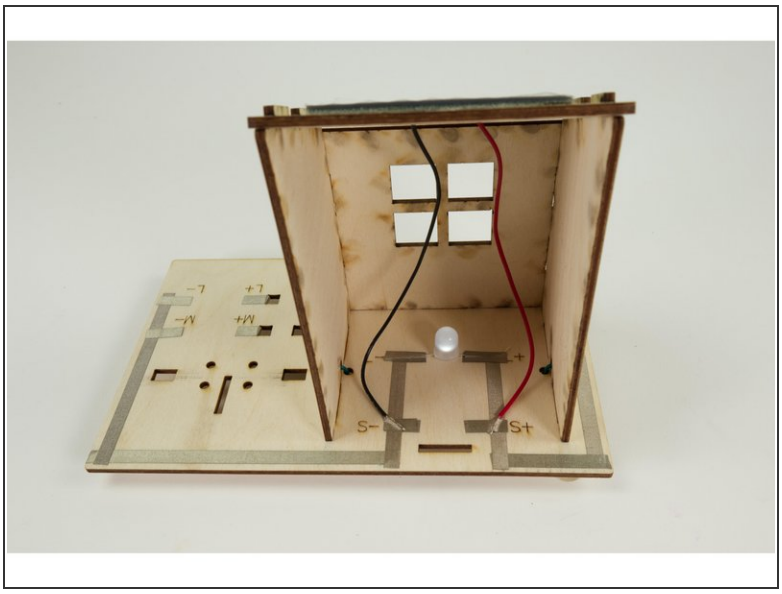


- The solar panel will have two wires attached to it, a **red** wire for **positive**, and a **black** wire for **negative**.
- Place the panel face down and apply the two pieces of tape to the left and right side of the panel as shown.
  - You can use masking tape, painters tape, or any low-tack tape that is easily removable.
- Thread the wires through the hole in the roof, line up the panel with the etched outline, and press it into place so the tape sticks to the wood.

If you haven't removed the clear protective film from the solar panel yet you can do that now.

## Step 10 — Attach Solar Panel Wires

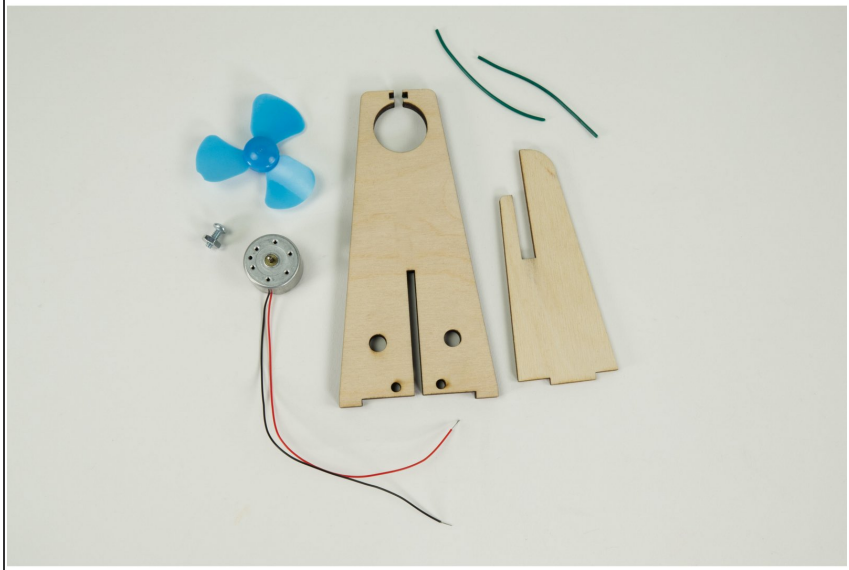





- Cut a short piece of Maker Tape and use it to stick down the **red** (positive) wire to the spot marked **S+**.
- Cut another piece of Maker Tape and stick down the **black** (negative) wire to the spot marked **S-**.
- At this point you may see the white LED inside the house light up!

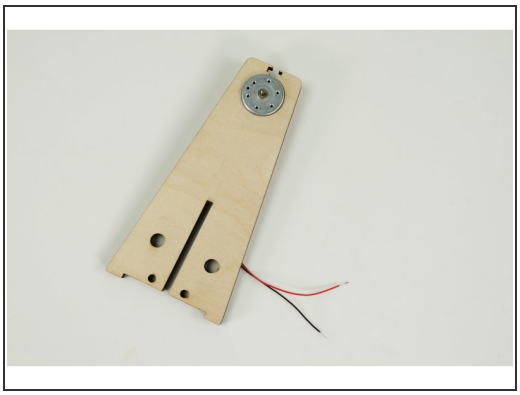
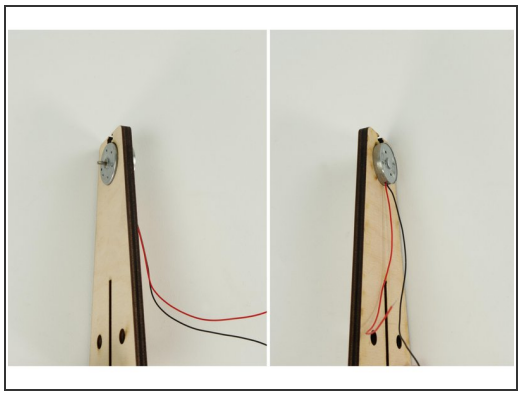
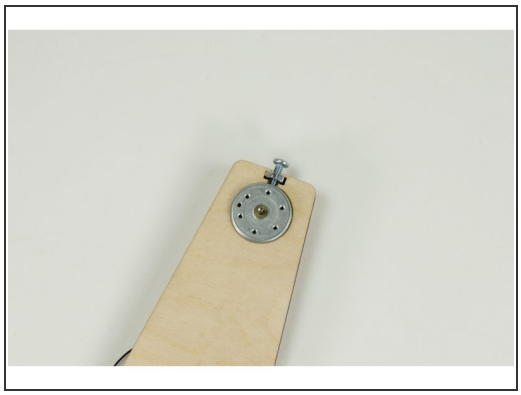
ⓘ Even though the solar panel is meant to produce energy from sunlight you may find that some lights in your home/school/office will produce the right kind of light to power the house enough to light up the LED.

## Step 11 — Assemble the Windmill



- Next we'll build our windmill.
- Calling it a "windmill" is a bit misnomer, since we'll be powering it from the solar panel to act as a fan.
- But don't worry, we've also got an activity where you'll use the windmill to generate enough electricity to light up an LED.

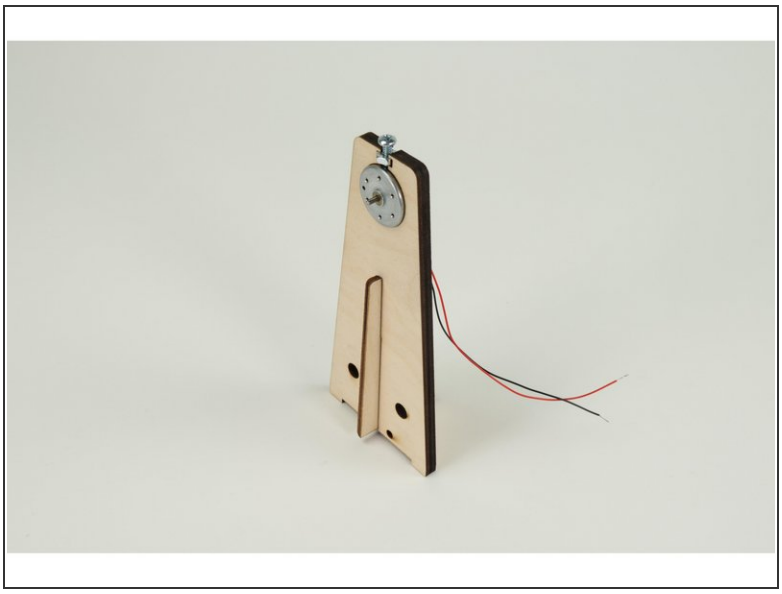
## Step 12 — Press Motor into Tower

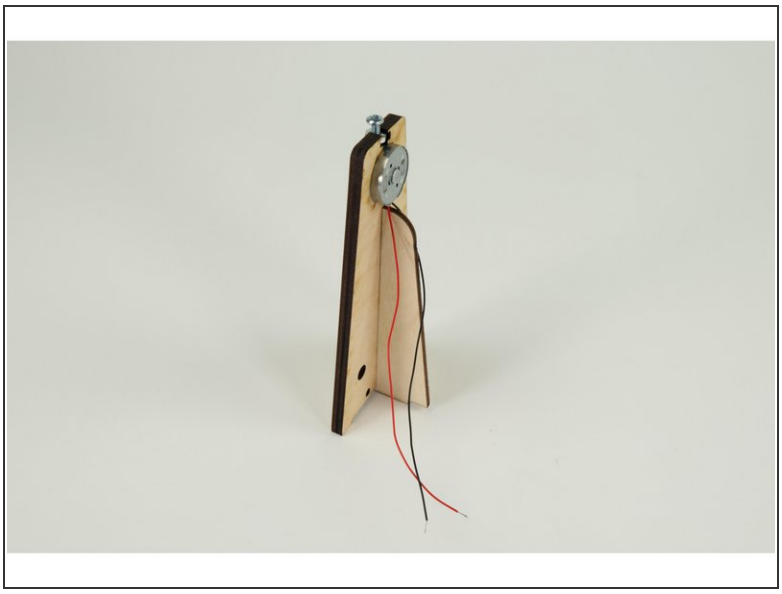




- The motor should press fit into the round hole at the top of the windmill frame. (Press the *front* of the motor in place through the hole.)
- Press the motor in no more than half way.
- We want to make sure the attached wires on the back of the motor don't press up again the wood, and than they are oriented towards the bottom.
- The motor should stay in place but if you find it fits a bit loose you can add the included nut and bolt at the top to help hold the motor in place.

⚠ The screw should not be overtightened! In fact you can probably just make it "finger tight" for it to hold the motor in place. (No screwdriver needed!)

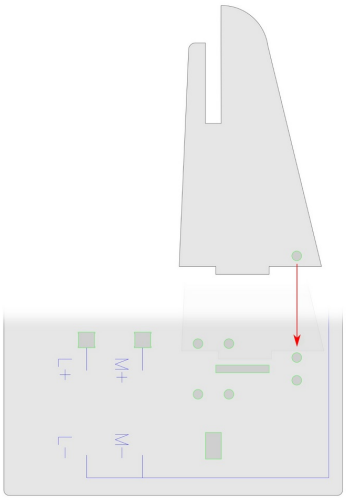
## Step 13 — Slot Windmill Together





- With the motor in place you can now slide the thinner piece of the windmill into place.
- It just slots together loosely, but the entire assembly will be held down to the base using twisted wire, just the like side walls of the house.

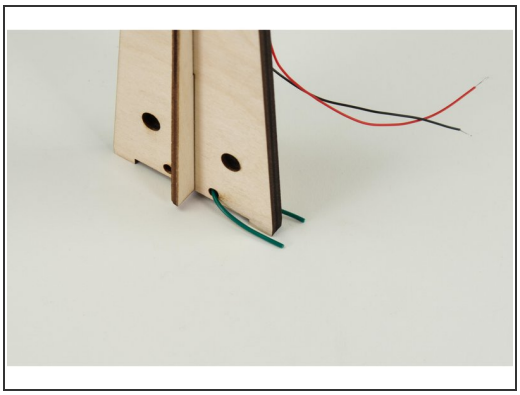
## Step 14 — Note on the Windmill

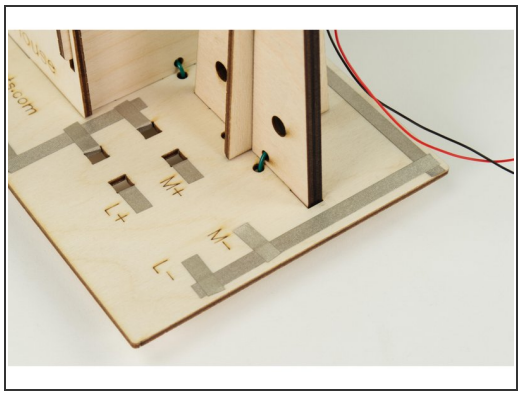


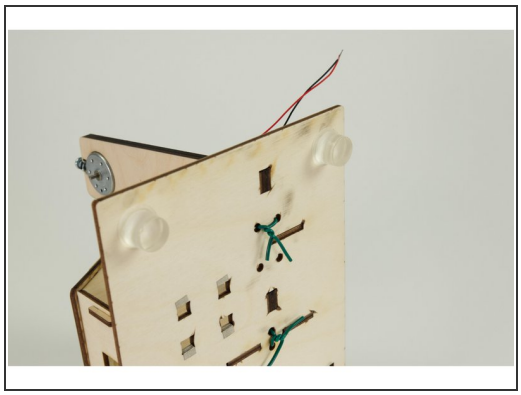
⚠ The thinner piece of the Windmill has been updated and now has an additional hole. You will secure this to the base the same way the thicker piece is secured.

The hole will not appear in the photos of this guide until the next revision, but the illustration shows the location.

## Step 15 — Add Tower to Base



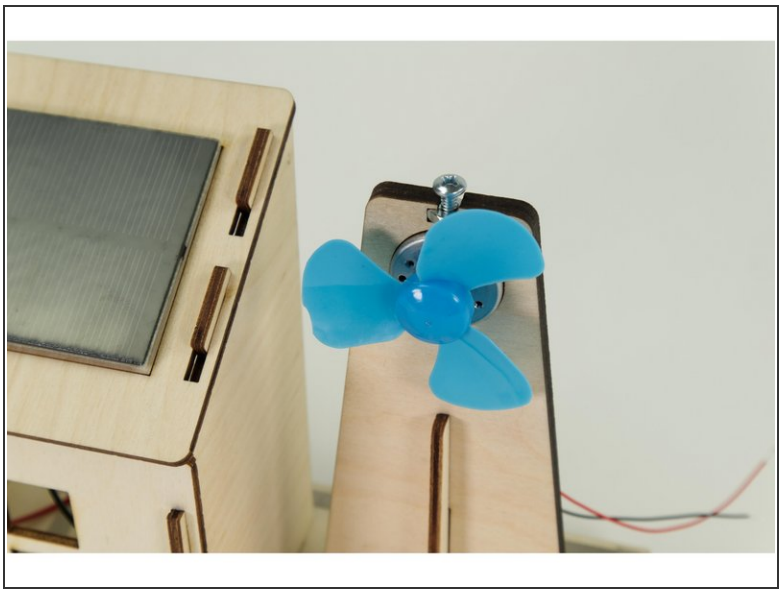


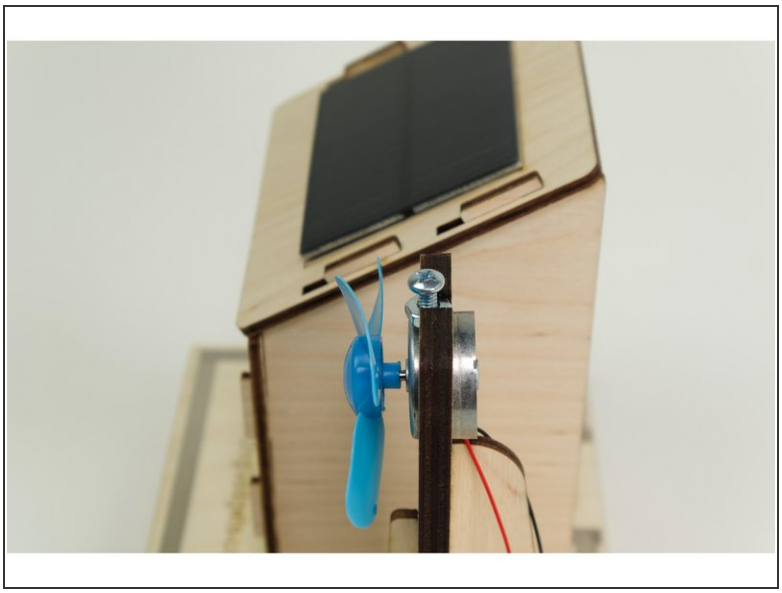



- Take another short piece of wire and bend it into a "U" shape, then thread it through a hole in the bottom of the windmill assembly.
- Insert the windmill assembly into the base, with the ends of the wire going into the holes on the base.
- After the windmill is in place twist the wire together to hold it down against the base.

[Not Shown] Add the third wire to the thinner piece to hold it down to the base.

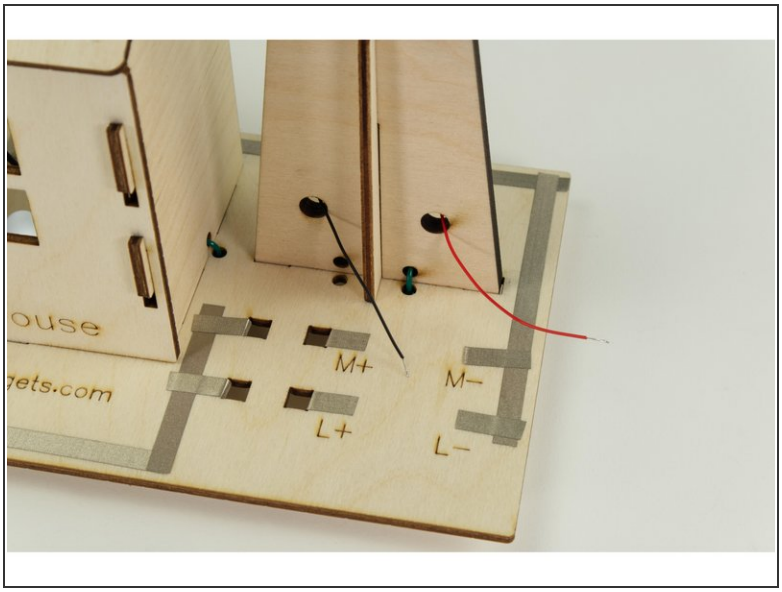
## Step 16 — Add Fan Blade

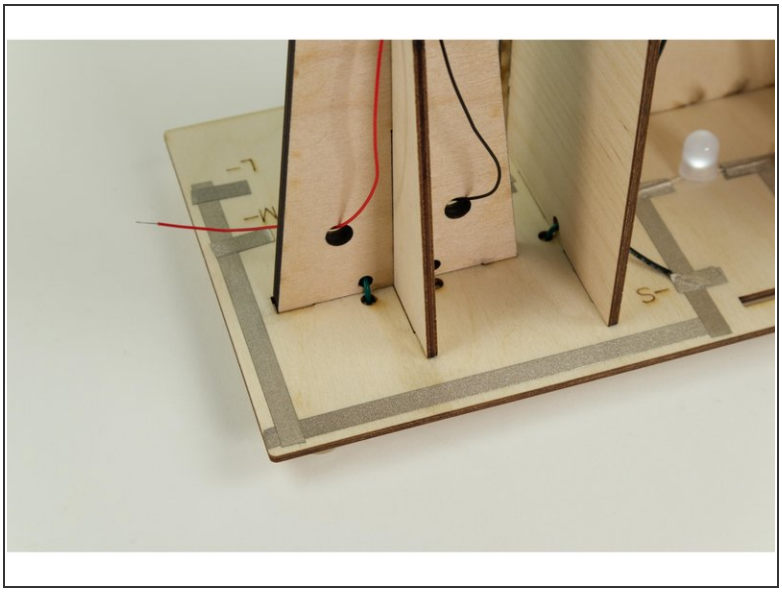




- With the windmill in place you can now press the fan blade onto the shaft of the motor.
- The blade should spin freely. If it does not, it may help to press it onto the shaft leaving a small gap between the fan blade and the motor housing.
- Give the fan blade a spin with your finger, or try to blow on it, and make sure it spins.

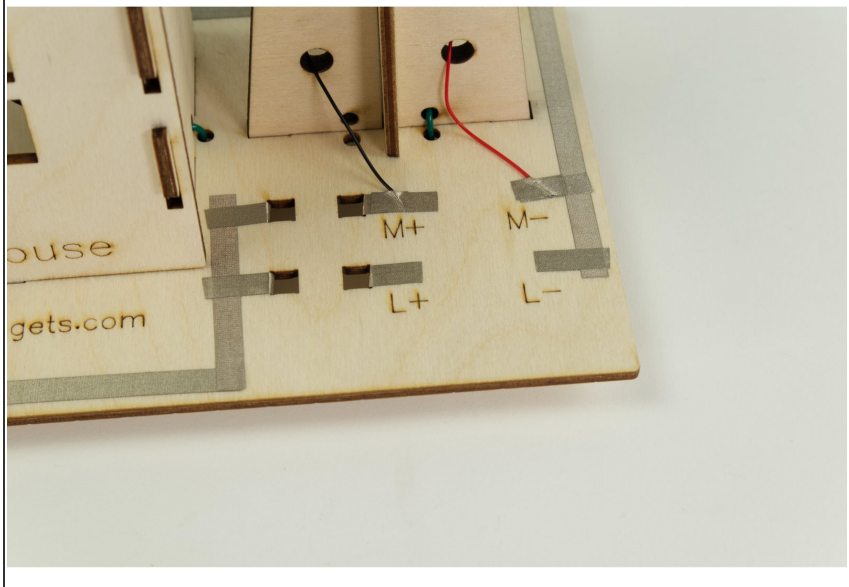
## Step 17 — Thread Motor Wires through Large Holes



- The wires attached to the motor will get connected in front of the windmill, so we'll thread the wires through the holes as shown.

## Step 18 — Attach Motor Wires



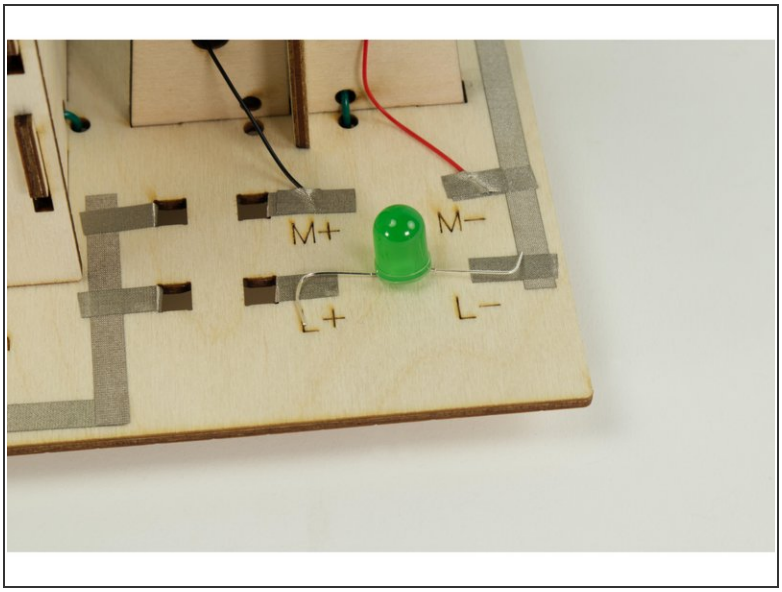

- We're going to connect the **red** wire to **M-** and the **black** wire to **M+**

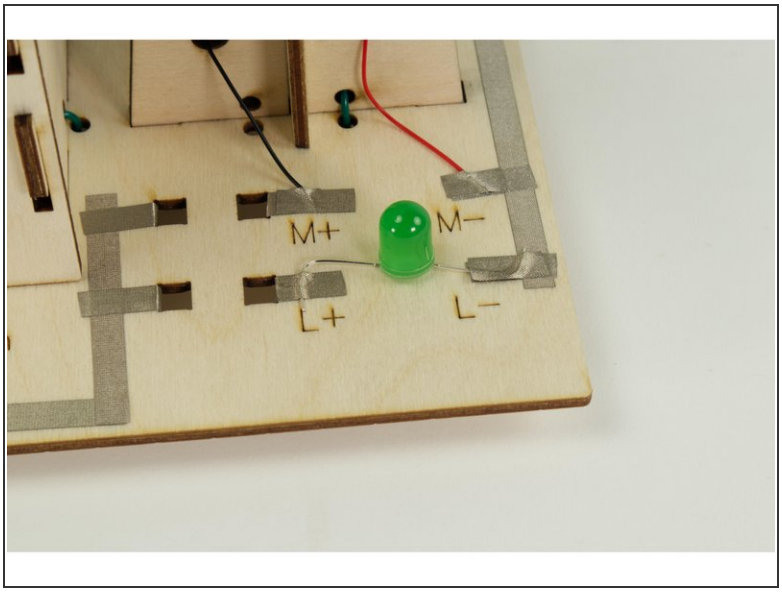
⚠ Wait, isn't red positive and black negative? Usually that is true! But for this motor we'll connect it with the polarity reversed.

  - The nice thing about a standard DC motor is that reversing the polarity just reverses the direction the motor will spin.

- Attach the **red** wire using a short piece of Maker Tape, then do the same with the **black** wire.

## Step 19 — Add Green LED



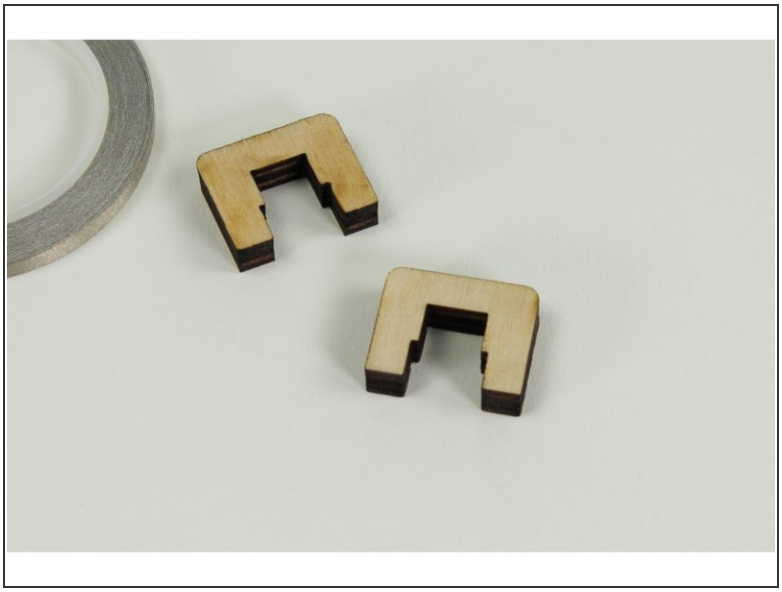

- Next we'll add the Green LED.

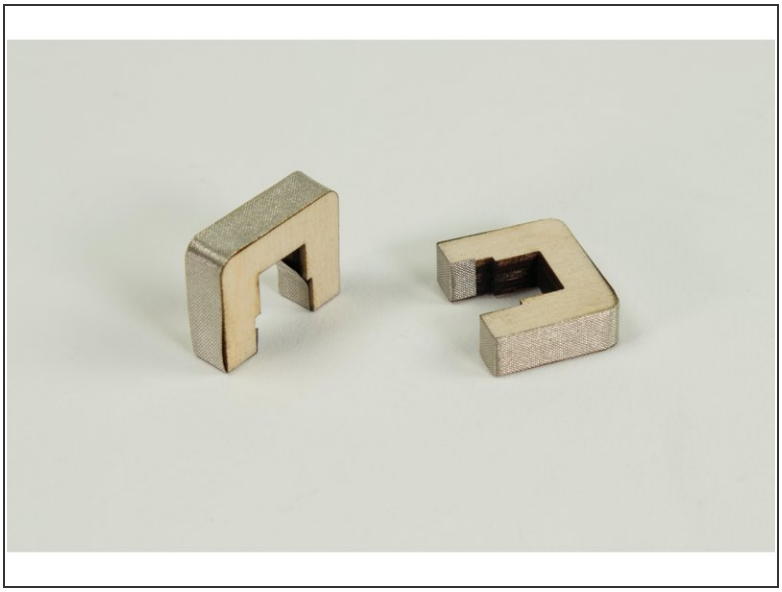
Remember, the longer leg of an LED is **positive**, and the shorter leg is **negative**.

- Using Maker Tape attach the **positive** leg to the **L+** spot, and the **negative** leg to the **L-** spot.

⚠ Make sure the positive LED leg does not go over the hole area. Bend the end slightly if needed.

## Step 20 — Make Switches





- Our motor and Green LED are in place, but they will not get any power until we add a switch to allow current to flow.
- Cut a piece of Maker Tape long enough to wrap around the outside, and part of the inside, of the small "U" shaped pieces.
- When the switch is placed in the holes it will bridge the gap in our circuit and allow current to flow, turning on the motor or the LED.

ⓘ If the switch doesn't fit tight against the Maker Tape on the base when inserted you can always add another layer of tape to the switch or to the base.

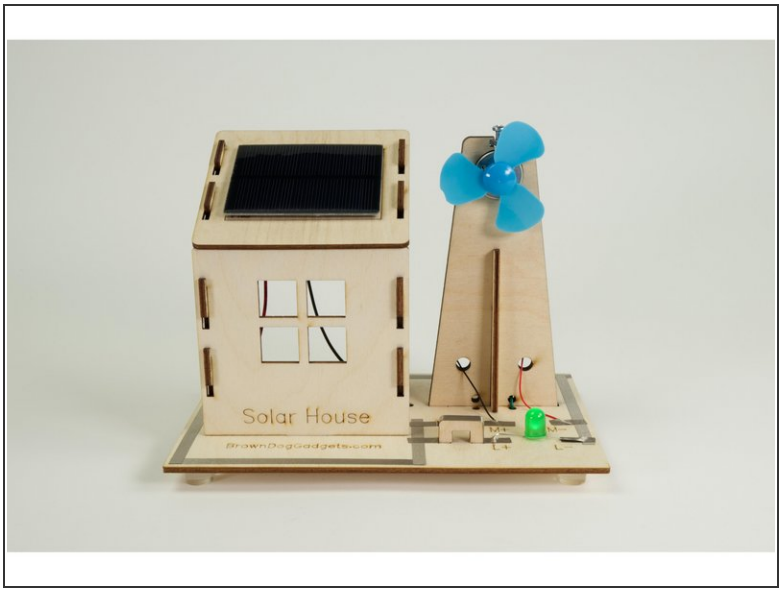
## Step 21 — Test it Out!

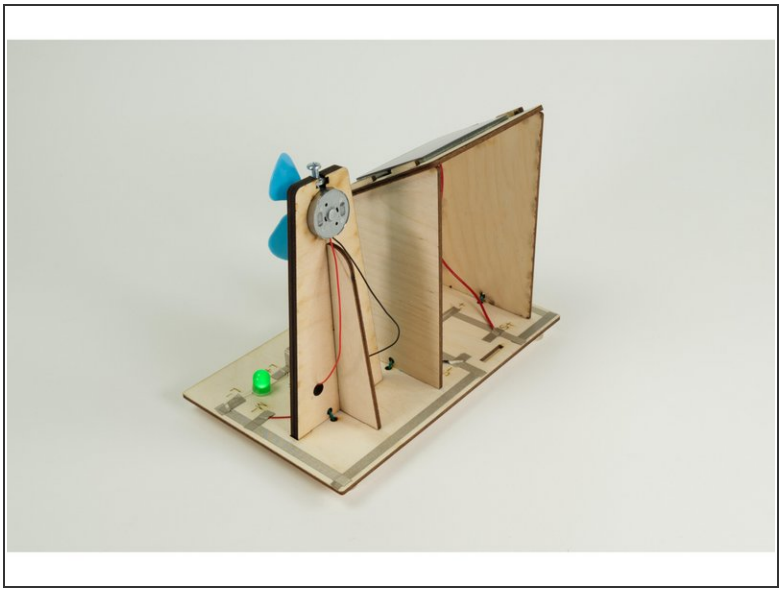


- Is it a sunny day? Are you ready to head outside? Let's test our Solar House!
- We'll start with the switches removed. If sunlight is hitting the solar panel the white LED inside the house should turn on!
- It's brightness will be determined by how much energy the solar panel produces from light hitting it. On a sunny day it should be very bright, and on an overcast day you might be barely able to see it.
- Now let's put a switch in next to the green LED. Does it turn on?
- Now try adding the switch next to the motor wires. Does the fan start spinning?
- Head back indoors and test some of the light inside. Try with the switches out and in, and see how much power is created from indoor lights, and if you can get both LEDs to light up.
- You probably won't get the fan to spin without sunlight, or a **very** bright light indoors. (It is possible with some indoor lights, but most will not work. Thank goodness for the sun!)


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## Step 22 — The Results



- What did you discover about your Solar House? On a nice sunny day could you get both LEDs to light up and the fan to spin?
- On an overcast or cloudy day could you get at least one LED to light up? How about two LEDS? Did you get the fan to spin?
- You can repeat your tests each day and write down the results to get an idea of how much energy your house can produce from solar power.