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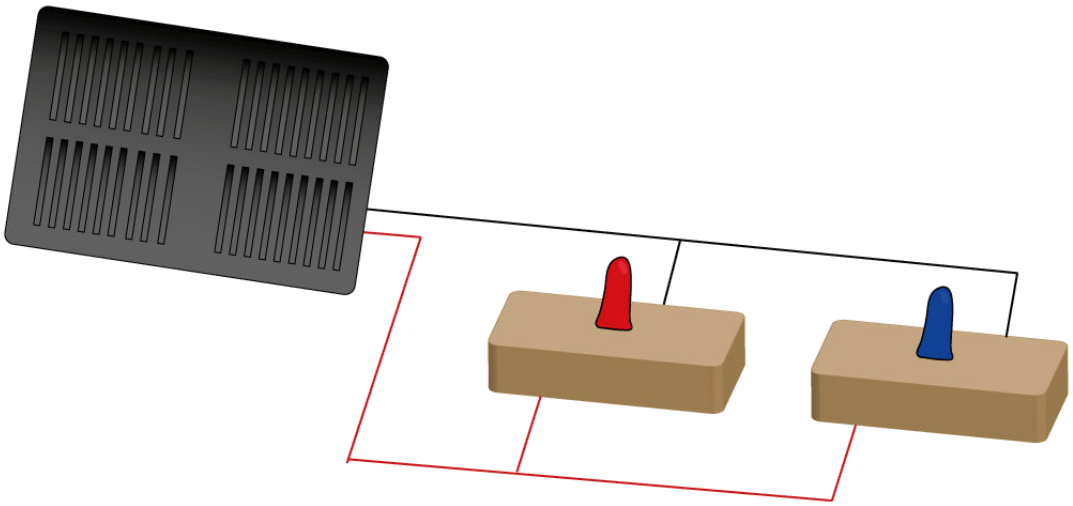
Category: STEAM

Topic: Renewable Energy | Duration: 120 Mins

Level: Beginner | Age Range: 10+

Activity Guide

Renewable Energy Circuits



Collectively creating opportunity for children, young people and their communities

Activity Description

This is a multiple activity guide to circuitry. Learn to build a simple circuit with an LED and advance to series and parallel circuits. You will learn about solar and battery power and you will build a spinning art project. Included in this activity are design challenges including design of a switch and solar powered circuits.

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Learning Outcomes

The outcome of this guide is to prepare you to design and build a town that relies on renewable energy. You will know how to build a simple circuit using an LED kit. You will learn about solar power, battery power and wind generated power using a hand crank turbine.

Competencies

Young people will develop 21st century skills:

- Collaboration
- Communication
- Creativity and innovation
- Critical thinking and problem solving

How To Use This Activity Guide

For Programme Planning and Logic Models

- The learning outcomes and competencies can help build programme plans, logic models, session and lesson plans
- The equipment list will help to catalogue the materials and resources you need
- Share with colleagues and volunteers to learn how to facilitate the activity

For Facilitating the Activity with Young People

- Print out the guide starting at the Step-by-Step Instructions for young people to follow the steps. You can focus on deepening their learning!
- Glossary of terms to help build young people's STEAM and Maker vocabulary

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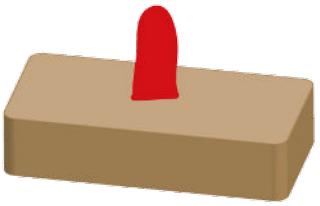
Step-by-Step Instructions

Equipment

LED kits
Fan kit
Hand Generator kit built (separate activity guide linked below)
Wires
Solar Panels
Battery packs
Batteries
Capacitor
Crocodile clips
Paper
Markers
Moter
Bluetack

Step 1: Make and LED Block

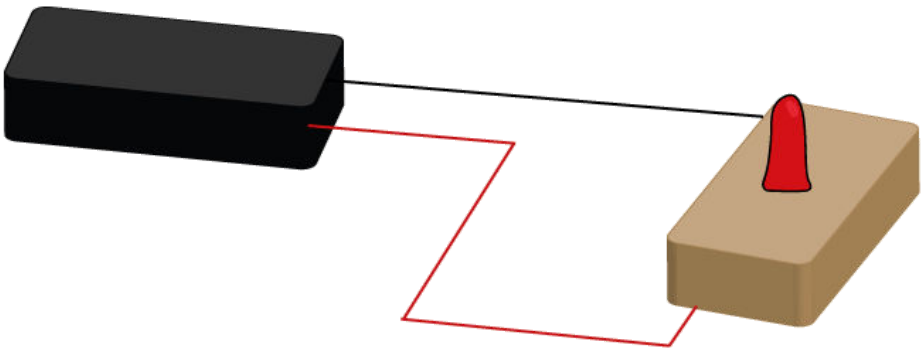


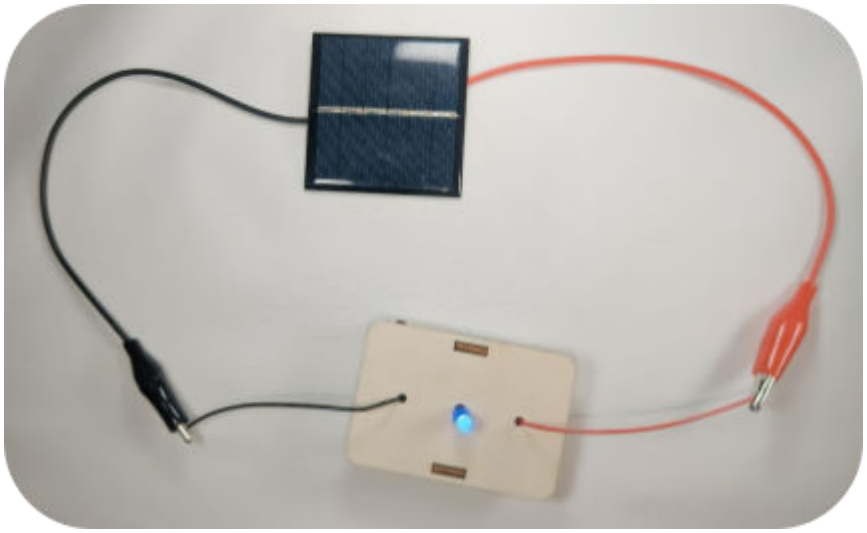
Please be careful when opening the material package to avoid the sudden loss of small materials. Loss of small materials may cause your small production to fail!

You should have 5 wooden panels to construct a little platform for your LED. Pop them out of the outer casing and piece them together. Your LED is placed on the top side in the center circle of the block. The LED legs can be separated apart on the underside.

Step 2: Construct a circuit

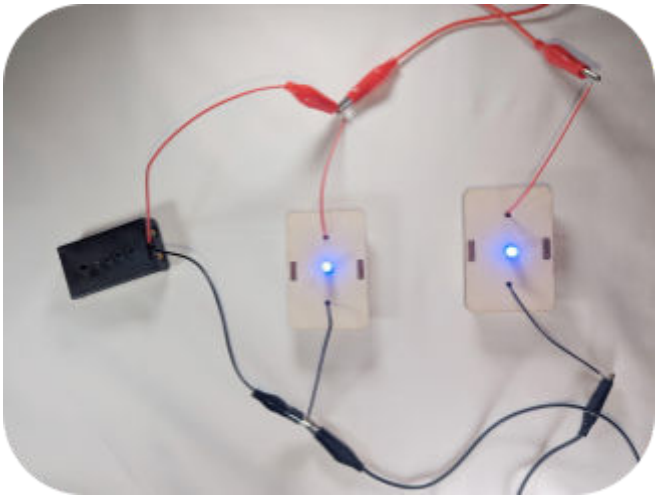
Using your 3v battery pack some crocodile clips and an LED lets create a simple circuit. The red wire is connected to the positive side of the battery and should connect to the long leg of the LED which is considered the positive side.The diagram below shows a closed circuit.

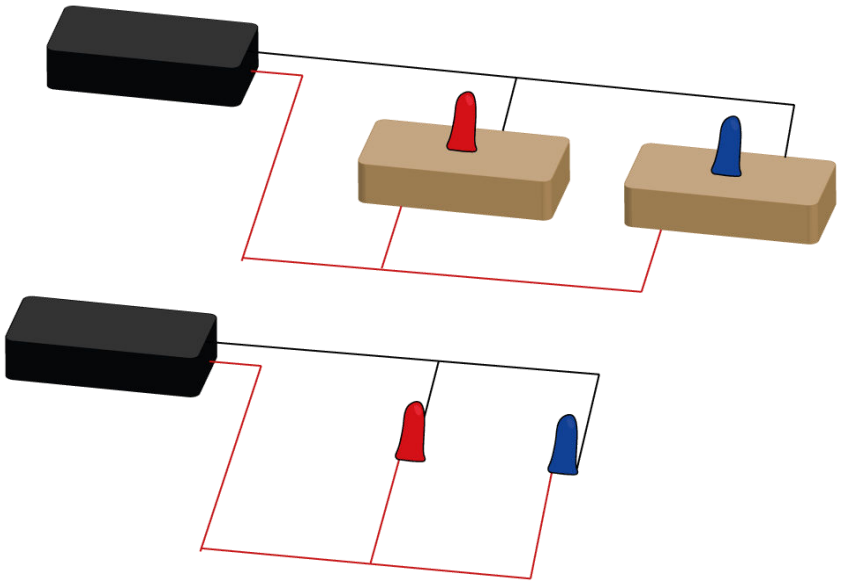




Step 3: Connect LEDs in parallel

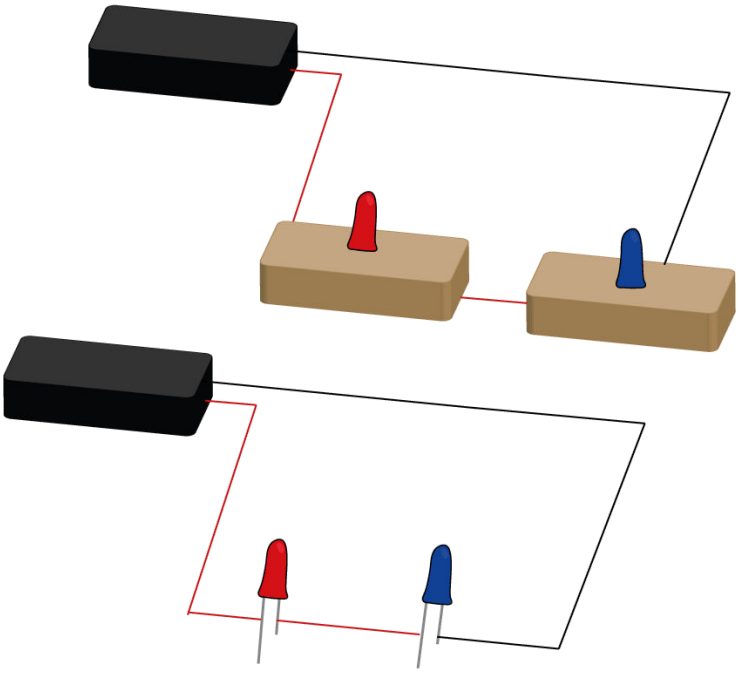
- What if you want to add more LEDs to our circuit? We can either create a parallel circuit or a series circuit. Firstly, a parallel circuit distributes the voltage across the circuit evenly so all LEDs will shine the same.
- If one of our LEDs breaks the circuit can still distribute electricity unlike a series circuit and this is because a parallel circuit has multiple pathways or branches to allow electricity to flow.





Step 4: Connect LEDs in series

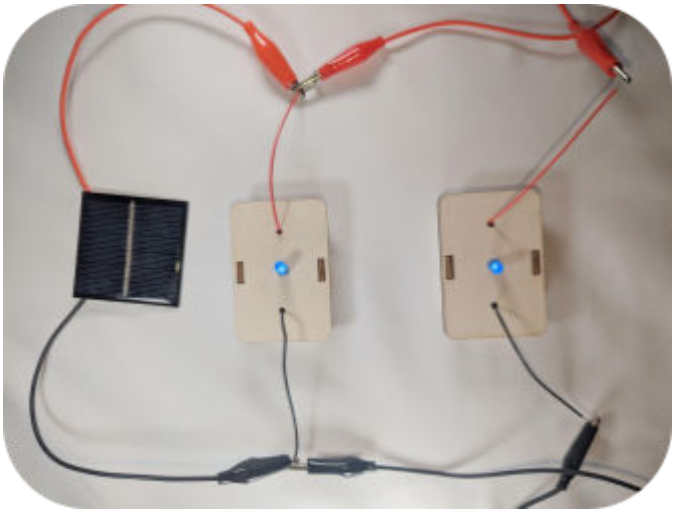
Let's take a look at a series circuit, a series circuit is a simple pathway that allows electrons to flow to one or more resistors. It's called a series circuit because the resistors or LEDs are arranged in series. A series circuit has the same current at all points in the circuit but the voltage will drop which will cause your LEDs to dim. If you are creating a circuit in series, consider adding a second battery pack or a higher voltage battery.

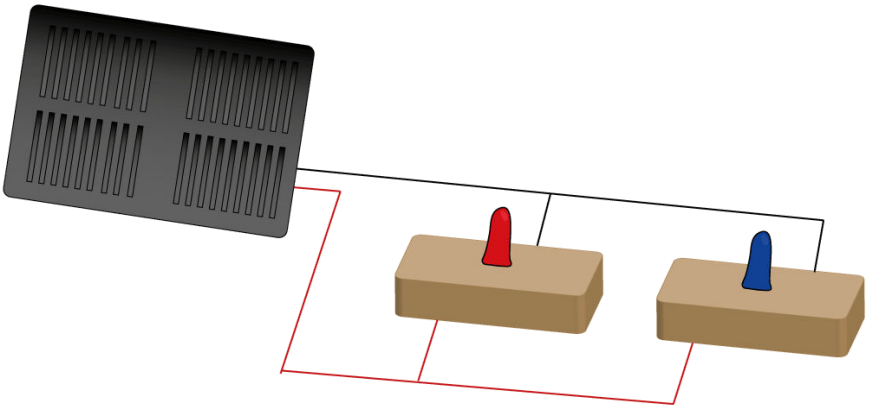


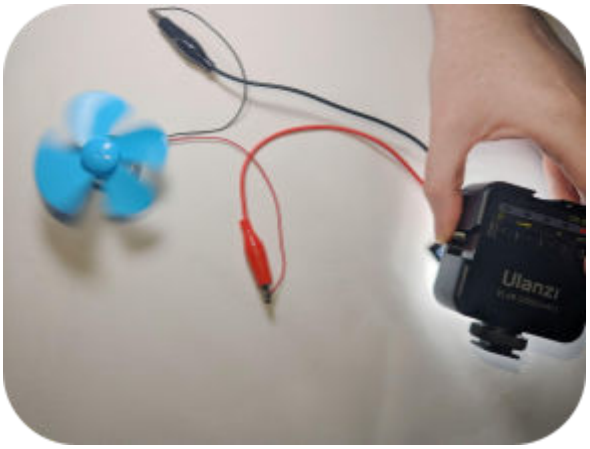
Step 5: Adding solar power

Solar energy is radiant light and heat from the sun that can be used to create electricity. It is a power source.

Switch out your battery pack for a solar panel, you may need a second panel depending on how many LEDs are in your circuit.



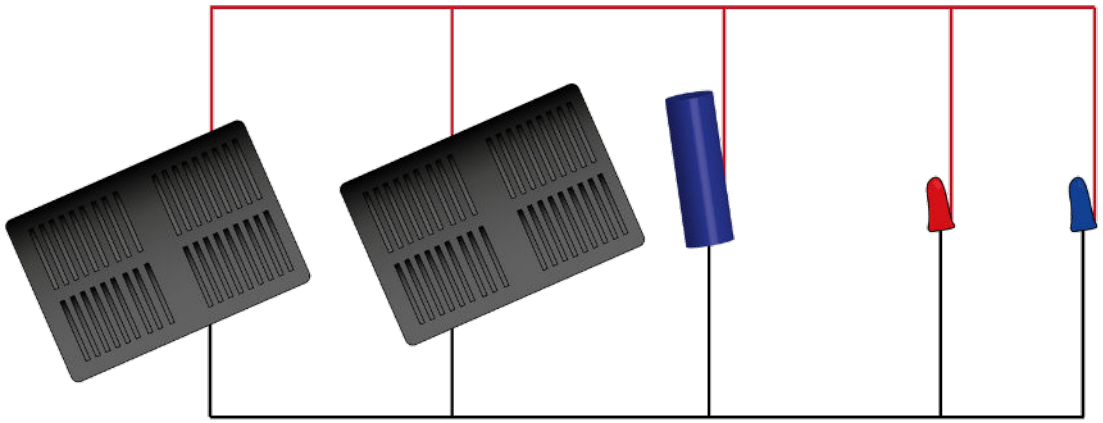




You can test your solar circuit on a rainy day too! Use your flashlight to power the circuit!

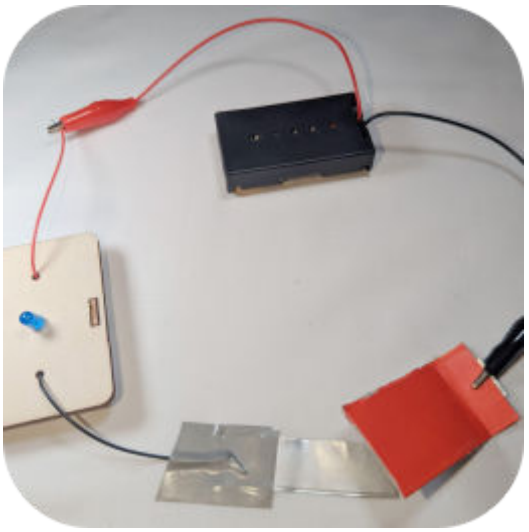
Step 6: Adding a capacitor

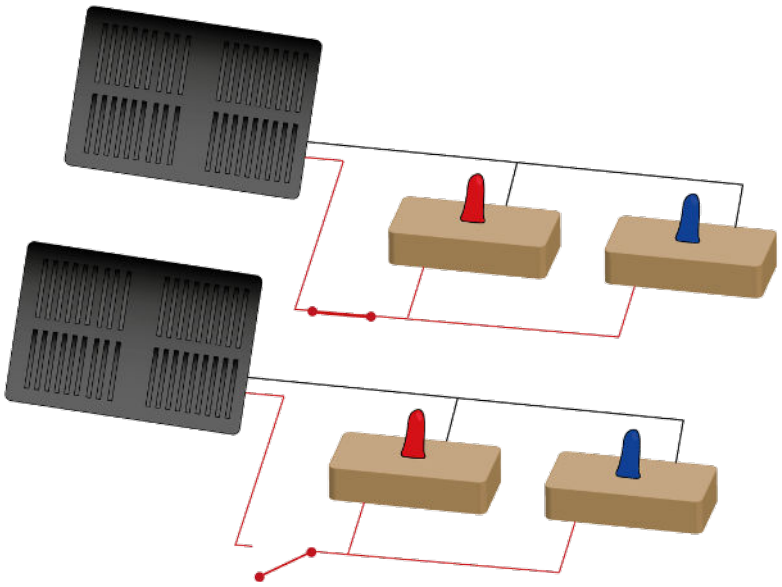
A capacitor stores electrical energy like a battery. We can charge it using the solar panel and rely on it when we have no sun. The diagram below shows two solar panels powering two LEDs with a capacitor in parallel.



Step 7: Design a switch

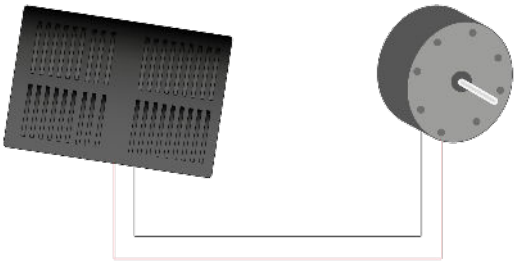
A switch controls the opening and closing of a circuit and so far we have only created a closed circuit. We could just break the circuit by disconnecting a wire but that isn't ideal. You can use a combination of insulators and conductors to create a simple switch. For example the outer switch can be a cardboard flap and line the bottom or inside with tinfoil so when the switch is flat it connects the circuit thus creating a closed circuit. When the switch is up or the flap is folded back it creates a break in the circuit.

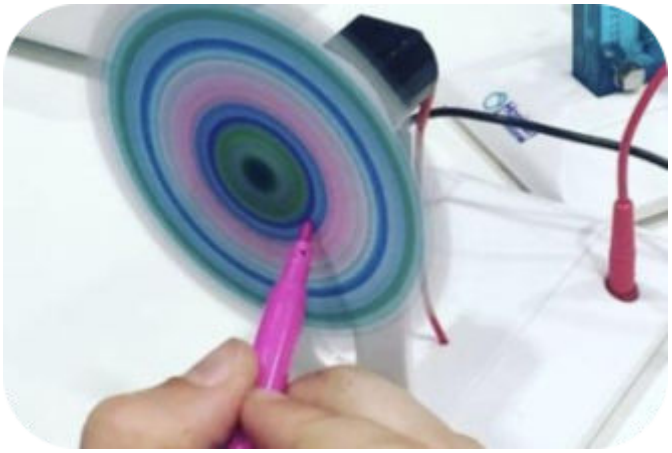




Step 8: Connect motor and create spinning art

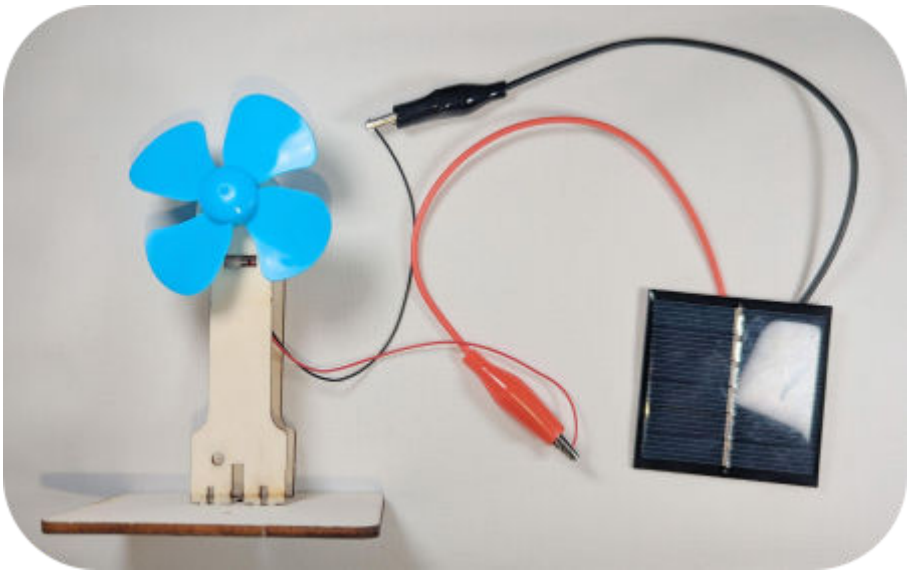
Add a paper disk to the axis of the motor and stick it with bluetack. Now you have created a spinning canvas, grab your markers and start coloring!





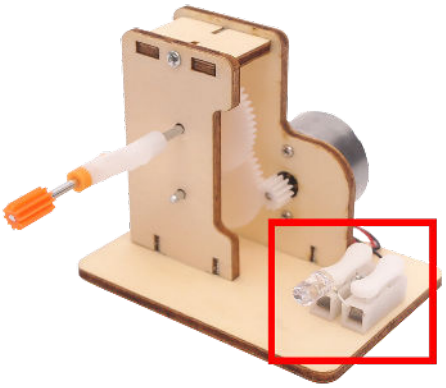
Step 9: Build a Solar Fan

Pop out your five wooden pieces from the flat pack and construct using your motor, fan and power source. You can choose either your battery pack or your solar panel.

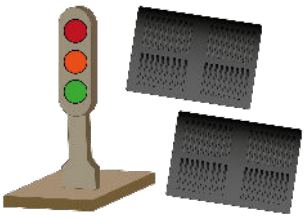


Step 10: Connect hand crank generator

Check out the hand crank generator activity guide to build. Once built, connect it to your circuit, switch out your solar panel or battery packs and connect your circuit to the terminal block situated on the generator board.



Step 11: Connect vertical traffic light



Check out the vertical traffic light activity guide to build. Once built, you can try it with your hand generator or solar panels. Move on to step 12 to find a design challenge that will allow you to bring all of your experiments together.

Step 12: Student design challenge

Design a solar power parallel circuit with a switch and two LEDs. Start by drawing a diagram and testing your components. Incorporate your traffic light project, fan and generator. Check out the virtual circuits activity for more help. Link here

Glossary of Terms

Terms	Descriptions
Solar power	Solar energy is radiant light and heat from the sun that can be used to create electricity. It is a power source.
Voltage	Voltage, also known as electric pressure, electric tension, or potential difference, is the difference in electric potential between two points. (Wikipedia)
Generator	A generator is a device that converts motive power (mechanical energy) (Wikipedia)
LED	Light emitting diode. LEDs have only two wires. One wire is the anode (positive) and another is the cathode (negative). The two wires have different names because LEDs only work in one direction and we need to keep track of which pin is which. One goes to the positive voltage and the other goes to the negative voltage. Electronic parts that only work in 'one direction like this are called Diodes, and that is what the last letter of LED stands for (Adafruit.com).
Renewable energy	Renewable energy is energy that is collected from renewable resources that are naturally replenished on a human timescale. It includes sources such as sunlight, wind, the movement of water, and geothermal heat. (Wikipedia)

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Where To Next?

Further Resources

Build on this activity with:

1. Hand Generator activity
2. Vertical traffic light activity
3. Light up house activity 1
4. Light up house activity 2

Further Training, Support and Hardware

- If you would like to learn more send an email to info@kinia.ie
- Training Courses: See www.kinia.ie
- Join the Online Network: www.kinia.ie/network
- Purchase Computers and Equipment: contact sales@kinia.ie