BrainStorm STEM EDUCATION

STEM KIT

BUILD & LEARN GUIDE

SOLAR RACER

SUSTAINABLE MATERIAL

NO GLUE OR MESS

SAFE AND EASY USE

STEMI AUTHENTICATED

SOLAR RACER OVERVIEW:

In this project, you'll be using the power of the sun—called solar energy—to build and power your very own solar car! Solar energy is just one type of renewable energy, which means it comes from natural sources that won't run out. Other examples include wind, water (hydroelectric), geothermal heat, biomass, and ocean tides. You'll learn how solar panels turn sunlight into electricity, how that powers your car, and what makes solar energy both helpful and sometimes tricky to use. Once you've learned the science, you'll build your solar-powered car and take it for a spin!

⚠ SAFTEY WARNINGS:

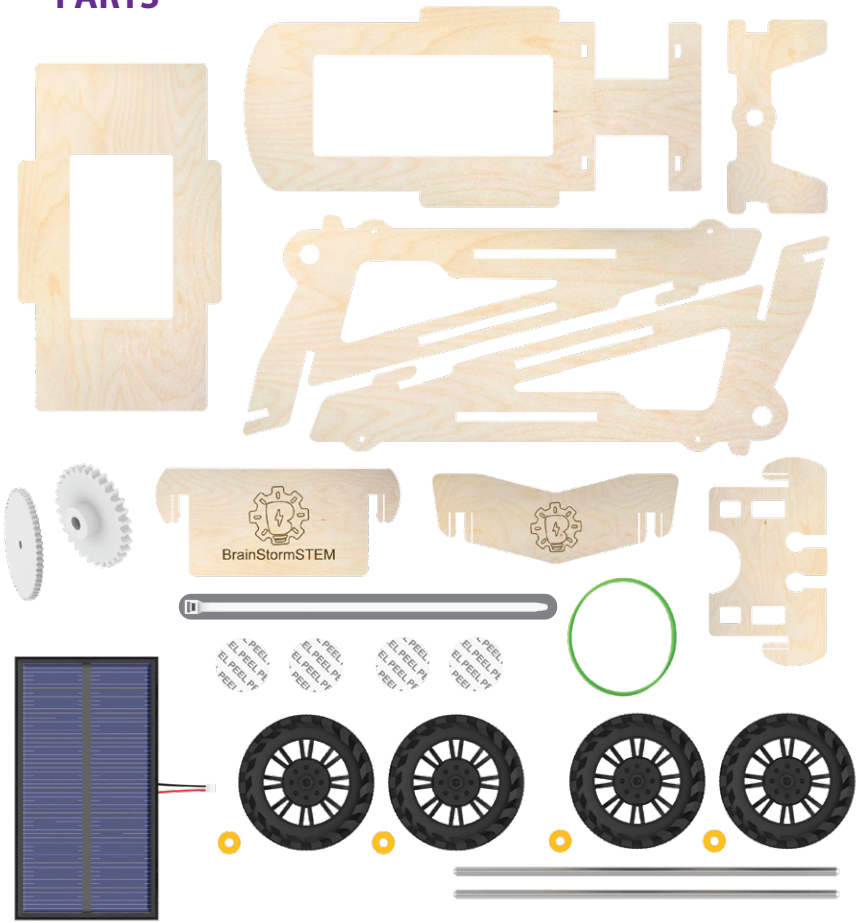
Please read all safety warnings before use.

- Choking Hazard – This kit contains small parts. Not suitable for children under 6 years of age or any individual who may place non-food items in their mouth.

- Caution! Surfaces may become hot during use. Always handle with care and avoid touching hot parts directly. Ask an adult for help if you're unsure.

- Adult Supervision Required – An adult must be present during assembly and use.

PARTS



Disclaimer: Colors and parts may vary slightly from those shown in images or instructions, depending on available materials. All variations function the same and do not affect the performance or assembly of the kit.

1

NOTE: *If any wooden pieces are hard to remove, use a blunt tool to carefully punch them out, and ask an adult for help if needed. Use the sanding stick included in your kit (it looks like a small nail file) to smooth out any rough edges or spots where pieces don't fit together easily. Just find the tight spot and gently sand the edge until it fits just right.*

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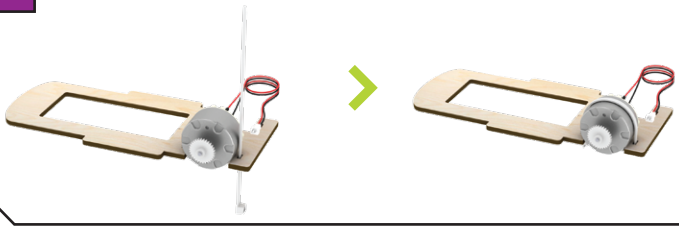

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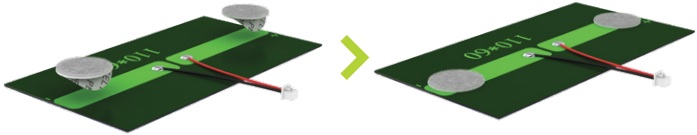

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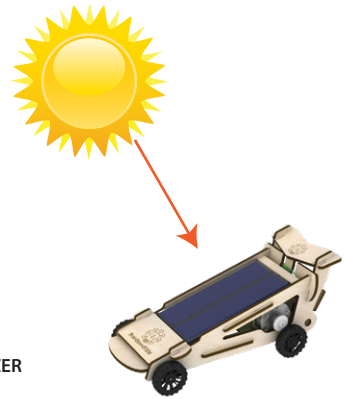
HOW TO USE



1. PLACE KICKSTAND IN THE DOWNWARD POSITION.

2. PLACE THE SOLAR RACER IN DIRECT SUN LIGHT.

3. CAREFULLY PUSH THE SOLAR RACER TO DISENGAGE THE KICKSTAND.

If you enjoyed this STEM Kit, check out some of our other Kits!

SOLAR OVEN

WIND TURBINE

EARTHQUAKE ENGINEERING

AND MORE

TERMINOLOGY

RENEWABLE ENERGY

Often referred to as clean energy, comes from natural sources or processes that are constantly replenished.

NON-RENEWABLE ENERGY

Often referred to as "dirty" energy, this energy is made of resources that are only available in limited amounts and take a very long time to replenish. Common examples of non-renewable energy are fossil fuels and coal. These sources of energy, often carbon-based, release particles that pollute the air, water, and land. The release of these particles also plays into the Earth's "carbon budget," which is an overall budget for the distribution of carbon among the land, sea, and air. Because of the use of these carbon-based energies, the Earth's carbon budget is unbalanced.

PHOTOVOLTAIC

The process of converting light energy into electricity through the use of semiconducting materials. (photo meaning light and voltaic meaning electric)

PHOTOVOLTAIC CELLS

Also known as solar cells, convert the sun's energy into electrical power by absorbing sunlight. While it is easier said, the way these cells convert sunlight to electrical power is through something called the Photovoltaic Effect. This effect uses semiconducting material to convert sunlight to electrical power. Semiconducting materials, such as silicon, are often used in these cells.

SEMICONDUCTOR

Material that can sometimes act as a conductor, or sometimes act as an insulator.

FOSSIL FUELS

Carbon-based materials formed through Earth's crust acting on organic matter, such as that produced through photosynthesis. Examples include coal, oil, and natural gas.

RENEWABLE ENERGY 101

What is Renewable Energy?

Often referred to as "clean energy", it comes from natural sources or processes that are constantly replenished. The idea of renewable energy has been around for many years, for example, Ancient Rome was the first to use geothermal energy to heat their homes. Now there are entire countries where nearly 100% of their energy use is in renewable energies, such as Iceland. There are 6 types of renewable energy with the most notable being solar and wind energy:

Solar - Energy produced by sunlight

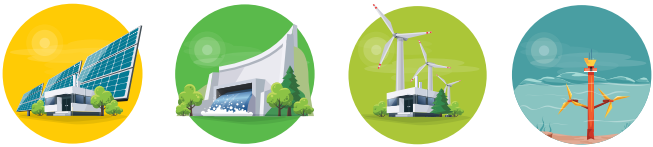
Wind - Energy produced through harnessing wind power.

Water - Also known as hydroelectric power, is energy produced through harnessing the natural flow of water.

Tidal - Energy produced from the rise and fall of water due to tides.

Geothermal - Energy produced through pumping heat and steam from below Earth's surface.

Biomass - Energy produced through living and non-living organisms.



SOLAR HYDRO WIND TIDAL

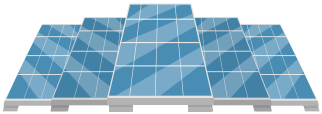
Why is Renewable Energy Important?

Renewable energy is using resources that are constantly being replenished. The alternative to using renewable energy is using nonrenewable or "dirty" energy such as fossil fuels or coal. These dirty energies cause pollution and are a finite resource. Although some renewable energy sources impact the planet, they are overall much less harmful than using nonrenewable resources. Scientists are working on constantly improving renewable resources to make them more effective and available to the general population. The increase in renewable energy production also creates more jobs and statistically sees more jobs for women than the fossil fuel industry. As renewable resources improve over time, humans need to start using them to make sure we all take care of our planet so it can thrive for years to come.

SOLAR ENERGY

WHAT IS SOLAR ENERGY?

Solar energy is light, heat, and other forms of energy that are given off by the sun. Solar energy is collected using an electronic instrument called a solar cell to convert light energy into electricity. When the solar cells are connected they form a module that can be placed together in a solar array called a solar panel.



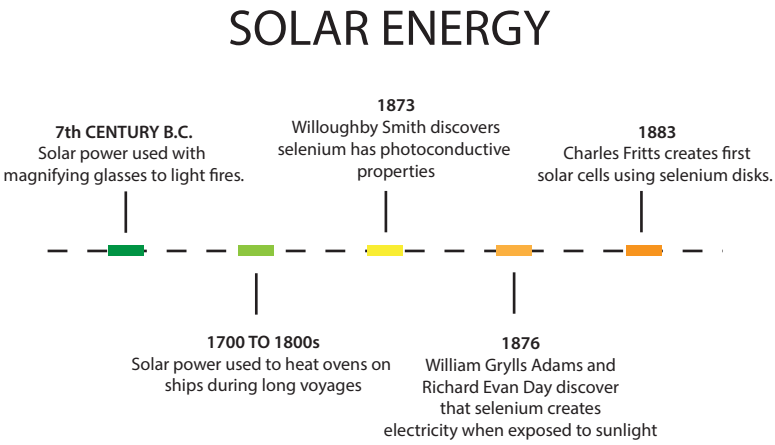
Solar Panels also known as photovoltaic (PV) panels are often composed of silicon (a semiconductive material). When sunlight hits the panels, electrons in the silicon break free and can become part of an electrical current, creating electrical power. Solar panels work best in strong sunlight and provide the most power when the Sun is at its highest point. More electricity can be produced during the middle of a summer day, and less during early and late points on a winter day. Solar energy is used for more than just supplying electricity to a house, but can also be used to power food trucks, boats, office buildings, and spacecrafts!

Benefits of Solar Energy

There are many benefits to solar energy making it one of the most used renewable energy sources. While fossil fuels can be used up, there is a limitless supply of sunlight. Whenever the sun is shining, solar energy can be collected. Solar energy also doesn't cause pollution like burning fossil fuels. Solar panel systems do not contain any moving parts which allows them to be long-lasting, up to 20 + years with little maintenance. And solar panels can be placed on roofs to collect solar energy in urban environments, unlike other renewable resources that take up more space to collect energy.

HISTORY OF SOLAR

Solar energy has been harnessed for much longer than just after the invention of solar panels. The road to inventing solar panels was riddled with a variety of scientific contributions. The first recorded instance of the photovoltaic effect was witnessed by Edmond Becquerel, a French scientist, he was believed to be the first to observe this effect when he noticed that sunlight increased electricity when two electrodes were placed in a conductive solution. Scientists Daryl Chapin, Calvin Fuller, and Gerald Pearson were able to create solar cells from silicon in 1954 and is believed to be the first true invention of a solar cell. Since its true invention in 1954, solar cells, or photovoltaic cells (PV), have been used in a variety of ways. One of the first ways they were used was in space. In 1958 the Vanguard I satellite had one solar panel that powered the satellite's radios, and in 1964 NASA launched the Nimbus spacecraft that used a solar array to power the entire ship.



THE ADVANTAGES OF SOLAR-POWERED CARS

As gasoline prices rise, society is always looking for a way to save money. An option for this may be to have a car that doesn't rely on gasoline at all. Besides eliminating the need for gasoline, there are many other pros to solar-powered vehicles. Due to running on electricity, solar-powered vehicles have lower charging costs for their batteries. Also, because of running on electricity, these vehicles are considered environmentally friendly and sustainable. Conventional, gasoline-powered vehicles, contribute to air and noise pollution. With solar-powered vehicles, air and noise pollution would be a thing of the past. A fear for some may be that the car won't run at night, but with the electricity being stored in the battery, driving at night is possible. As technology progresses, lighter and more efficient batteries and PV panels may also promote the use of solar-powered vehicles. A final perk, for some drivers, is that solar-powered vehicles are splendid for those who live in sunny areas and drive short distances.

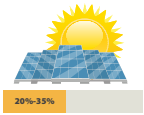
Save Money

Store Power

Less Pollution

THE DISADVANTAGES OF SOLAR-POWERED CARS

Although purchasing a solar car may sound like the best thing to do to help the environment, there are several cons to consider before making the decision. One major disadvantage is the rate that solar panels convert sunlight into electrical energy. Solar panels are only able to convert sunlight at about a 20-35% efficiency; so much more would be required to get some serious power. There are also design issues with solar cars. Because of the amount of space required for the solar panels, there are limits to the overall design of the vehicle. The weight and efficiency of the solar panels also affect the design, as lighter solar panels may be a better option for the design, they may not be as effective as heavier ones. There are technical issues as well when dealing in solar cars. Due to the amount of technical parts, getting the cars serviced may be difficult. While the energy stored in the car's battery would allow it to drive without sunlight, for it to be ideal, sunlight would need to be present; this would make it a poor choice for those in regions where the climate is cold and there is minimal sunlight.



Not Fully Effective

Heavy Materials

Relies on the Sun

THE FUTURE OF SOLAR CARS

The future of solar-powered cars is truly bright. Of the variety of advancements in solar power, from more efficient systems to space-based solar power, there have also been advancements in solar-powered vehicles. A Dutch company, Lightyear, produced the first production car featuring solar panels in the fall of 2022. The car, titled Lightyear 0, features curved solar panels along the roof, hood, and trunk. It will use the electricity generated to top up the battery while driving, or parked. On sunny days with a full 12 hours of exposure, the 53 square feet of solar panels can generate up to 84 miles total. While the car is in production ready, the first run only produced a total of 946 vehicles which were only produced in Europe. The listed price for one Lightyear 0 is $169,000.00 in U.S. currency. This advancement has sparked more interest in solar-powered or solar-assisted vehicles, and society may be able to see more coming to the market in the future.

STEM KIT

SOLAR RACER BUILD BOOKLET

For more information on our STEM Kits visit:

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