We Care Solar
Solar Solutionaries

# Solar Exploration

## What Factors Affect How Much Electricity You Get From a Solar Panel?

August 2026

# What are some reasons for introducing solar energy to your students in a STEM class?

# How does solar power show up locally for you and your students?

# Minnesota's Innovative Leadership

Minnesota has been a national pioneer in **community solar.**

Minnesota is working to be **100% carbon-free electricity by 2040** for electric utilities

More than **3,000 MW of solar** has been installed statewide.

Solar has become one of Minnesota's **fastest-growing sources of new electricity** generation

1. Credit: RenewableEnergyWorld.com
2. Credit: iStock.com/MonthiraYodtiwong
3. Credit: Archigeek / Creative Commons
4. Far on Foot

# Notable Solar in Minnesota

**Solar Creates Local Jobs** beyond just electricity. It creates careers in:

- Engineering
- Electrical work
- Construction
- Manufacturing
- Data analysis
- Environmental science
- Project management
- Sales and customer engagement

## Sherco Solar Project (Becker)

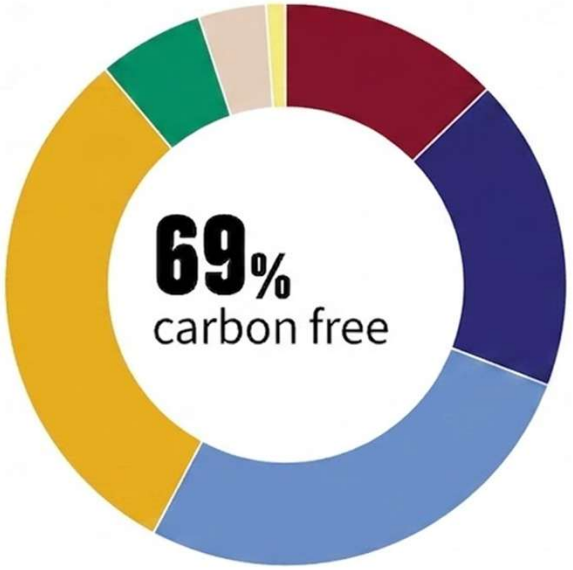
This is one of the largest solar projects in the Midwest.

- Built on land surrounding the retiring Sherco coal plant
- Will total approximately **910 MW** when complete
- Represents Minnesota's transition from coal to renewable energy

Credit: Robert Nickelsberg/Getty Images

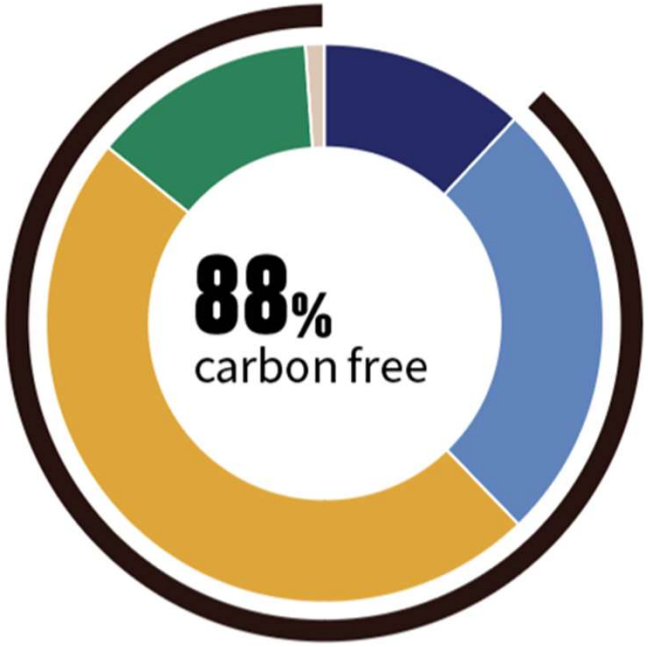
# Xcel Energy

## 2025 Energy Mix – Minnesota




- Coal
- Natural Gas
- Nuclear
- Wind
- Solar
- Other Renewable
- Other

## 2030 Projected Energy Mix



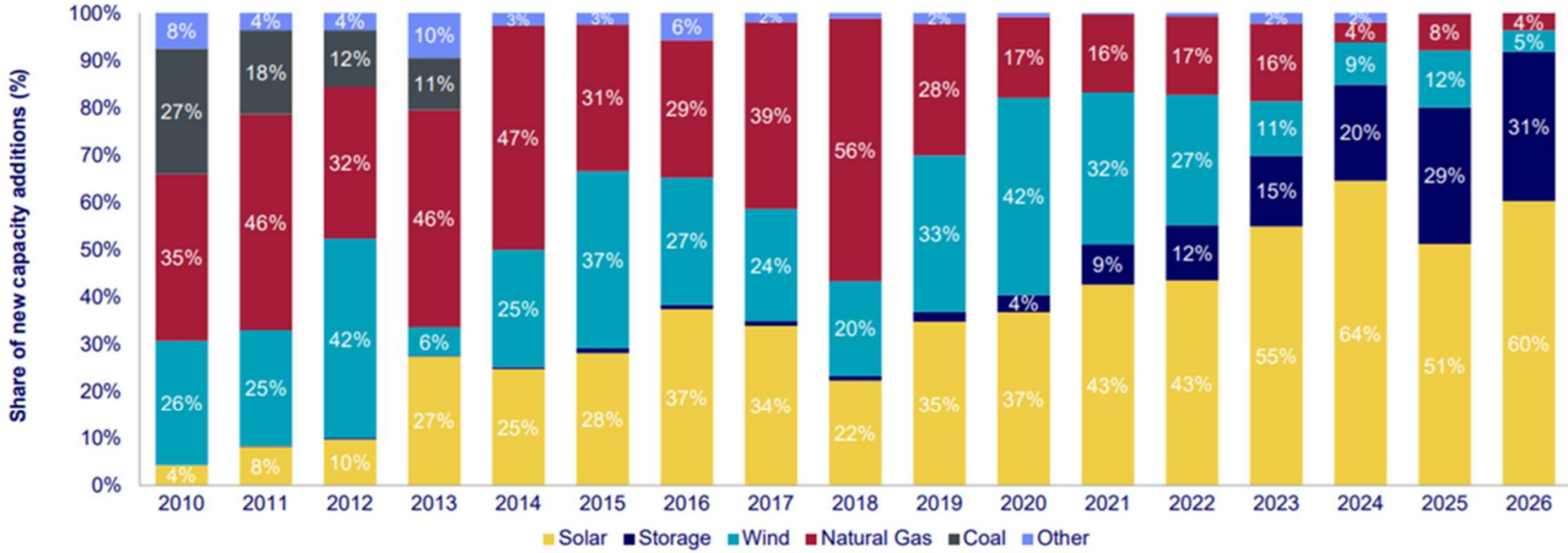

| | |
|---|---|
| Natural Gas | 12% |
| Nuclear | 26% |
| Wind | 48% |
| Solar | 13% |
| Other Renewable | 1% |

2030 projected energy mix values are based on a dispatch model that considers the regulatory cost of carbon.

# Solar and storage made up 91% of all new generating capacity in Q1

## Solar accounted for 60% of new electricity-generating capacity additions in Q1 2026

**New US electricity-generating capacity additions, 2010 – Q1 2026**




Source: Wood Mackenzie, Note: additions for the solar, wind, and storage technologies are sourced from Wood Mackenzie data while all other technologies are sourced from the US Energy Information Administration. Solar and storage data includes utility-scale and distributed (residential, commercial, and community) projects.

# Equip teachers to educate and inspire the next generation of Solar Solutionaries®

Powered by our award-winning Solar Suitcase technology, we deliver clean energy solutions that inspire the next generation of solar leaders and equip healthcare workers with the power to save lives.

## We Care Solar

- 501(c)3 non-profit organization
- Light changes everything
- **Healthcare:** Light Every Birth
- **Education**: Solar Solutionaries

### SolarSTEM Education Program

- Launched in 2013
- Trained 680 teachers from 1,305 school programs across 8 states reaching over 101,000 students
- Provided 14 million hours of electricity to 500,000 students in schools in energy-scarce regions

## Saving lives, shaping futures.

**23M**

mothers and newborns supported through safer maternal care

**41k**

healthcare workers trained in use

**12k**

Solar Suitcases deployed to health facilities and schools

**95%**

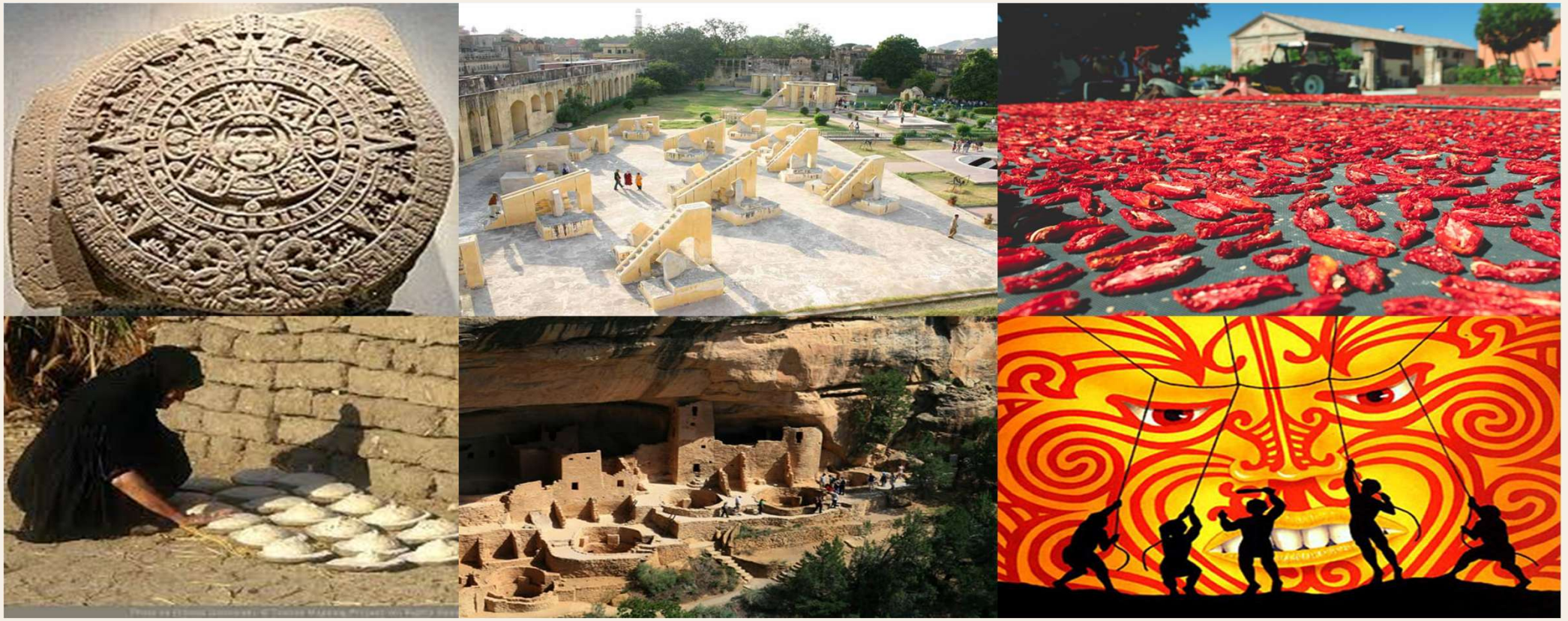
4-star Charity Navigator rating

**101k**

students engaged in hands-on solar learning

# Solar Exploration

Humans have been thinking about the Sun for thousands of years. We have used the Sun to tell the time; make measurements; stay warm and cool and to prepare food.



Take a minute when you go outside to feel the Sun on your face, just like your ancestors did many years ago.

# Using Solar Power

Solar power can be used to power a **water pump**.

These are useful in regions where water access is limited. Many children spend hours a day walking to collect clean water. A local, reliable source of clean water can have tremendous positive impacts on their lives.

*If you were an **environmental engineer** designing a **solar powered water pumping system** for a community, what **variables** would you need to consider in your design?*

*Extension: Would this water pump work at nighttime? What might you need to add to your system if you wanted it to?*

# Global Energy Access

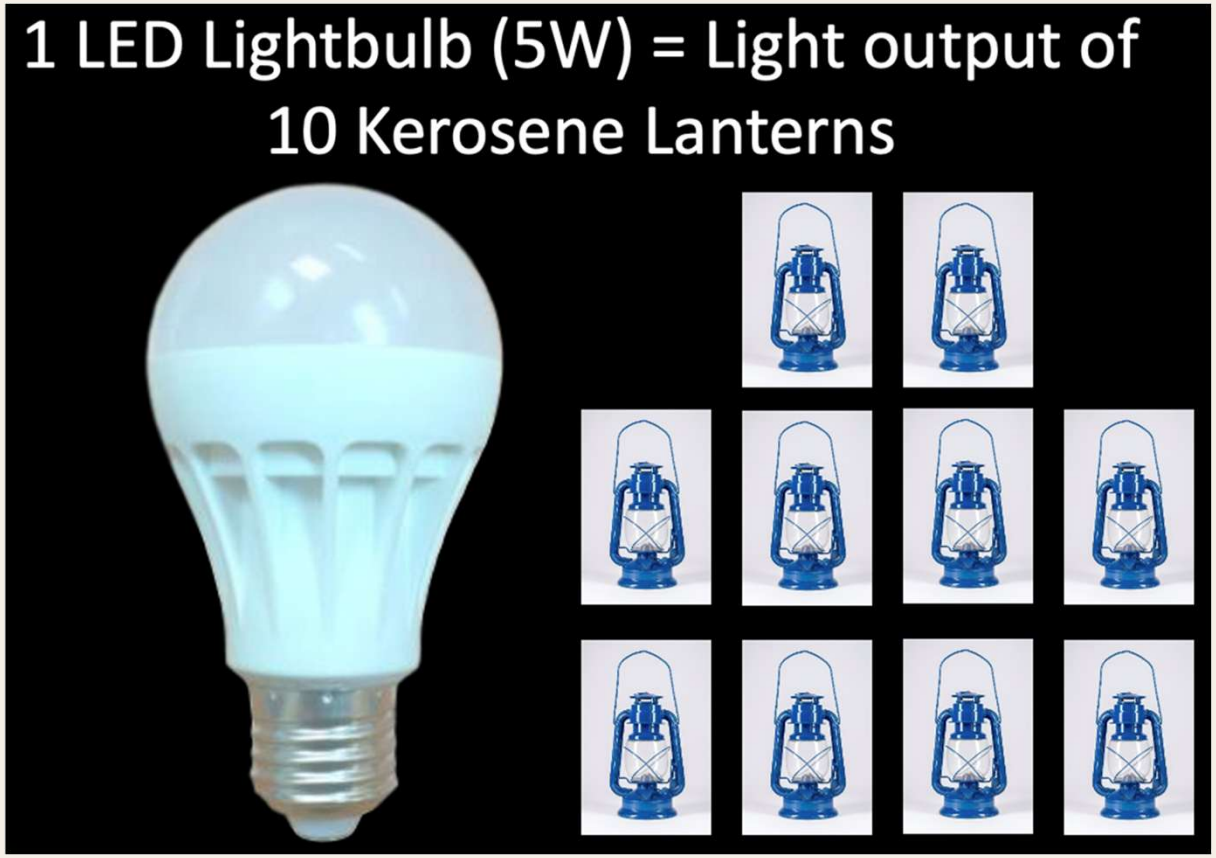
There are 655 million people in the world—560 million in sub-Saharan Africa—without access to electricity. International Energy Agency, 2026 data

# Impacts of Energy Scarcity on Education

Many students have to use dirty and dangerous kerosene to provide light for studying after the sun goes down

# What can Solar do?

In places where electricity is unavailable or unreliable solar can replace fossil fuels (like kerosene) used for lighting indoor areas.




This can:

- Reduce $CO_2$ emissions
- Improve indoor air quality
- Reduce the risk of fire
- Reduce energy costs - once a solar system is installed it is free to power (the Sun!) and cheap to maintain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# A working model of a larger real-world system

## Solar Suitcase Learning Kit

*designed to help students learn about solar*

10 W Solar Panel


5 W Light bulb


60 Wh Battery

## We Care Solar Suitcase®

*designed to light health clinics in energy scarce areas*

x10

100 W Solar Panel

Charge Controller

x5

x4

240 Wh Battery

Four 6 W LED lights = 24 W

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# Compare and Contrast Solar-Electric Systems

## PV Direct

*(PV stands for **photovoltaic**, a technical term for solar powered)*

## Stand Alone Solar

These are both **direct current** (DC) systems. A solar panel produces **DC electricity**; batteries provide DC electricity and need it to charge; loads such as light bulbs, cell phones and water pumps use DC electricity in these systems. You cannot safely connect a **solar panel** directly to a **battery** which is why a **charge controller** is needed in a stand alone system. Devices with batteries inside (like cell phones) shouldn't be charged directly from a solar panel.

***Installation of We Share Solar Suitcase at Migodomani Secondary School, Kilifi, Kenya 2024***

*Credit Brian Inganga*

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# Challenge!

This international challenge, serves as an opportunity for students to apply the engineering design process to solve local challenges and develop solutions that support both people and the planet.

## Challenge Overview

Design projects should be completed **individually or in groups of up to 4**

Exceptional entries will compete for **cash prizes of up to $150 per student** as well as a **classroom celebration**

All students participating in **We Care Solar programs** are eligible to participate

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# Questions?

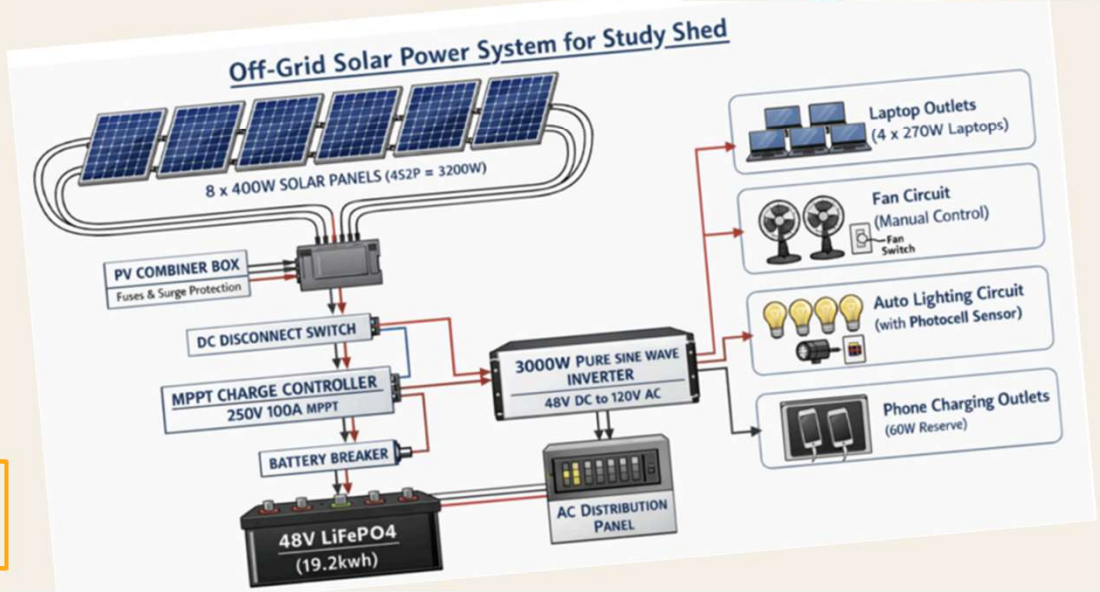
Contact Anna Gomberg, anna@wecaresolar.org

## See previous entries by visiting

wecaresolar.org/solar-solutionaries-challenge-2026/

First Place - High School

First Place - Middle School



# What are your plans for introducing **solar energy** to your students in a STEM class?

Anna Gomberg - anna@wecaresolar.org
www.wecaresolar.org

# Extra slides for reference

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# Understanding Voltage and Current

We can use analogies to help us understand **voltage** and **current**; they are both values that we can measure and describe but not directly see

## VOLTAGE (V)

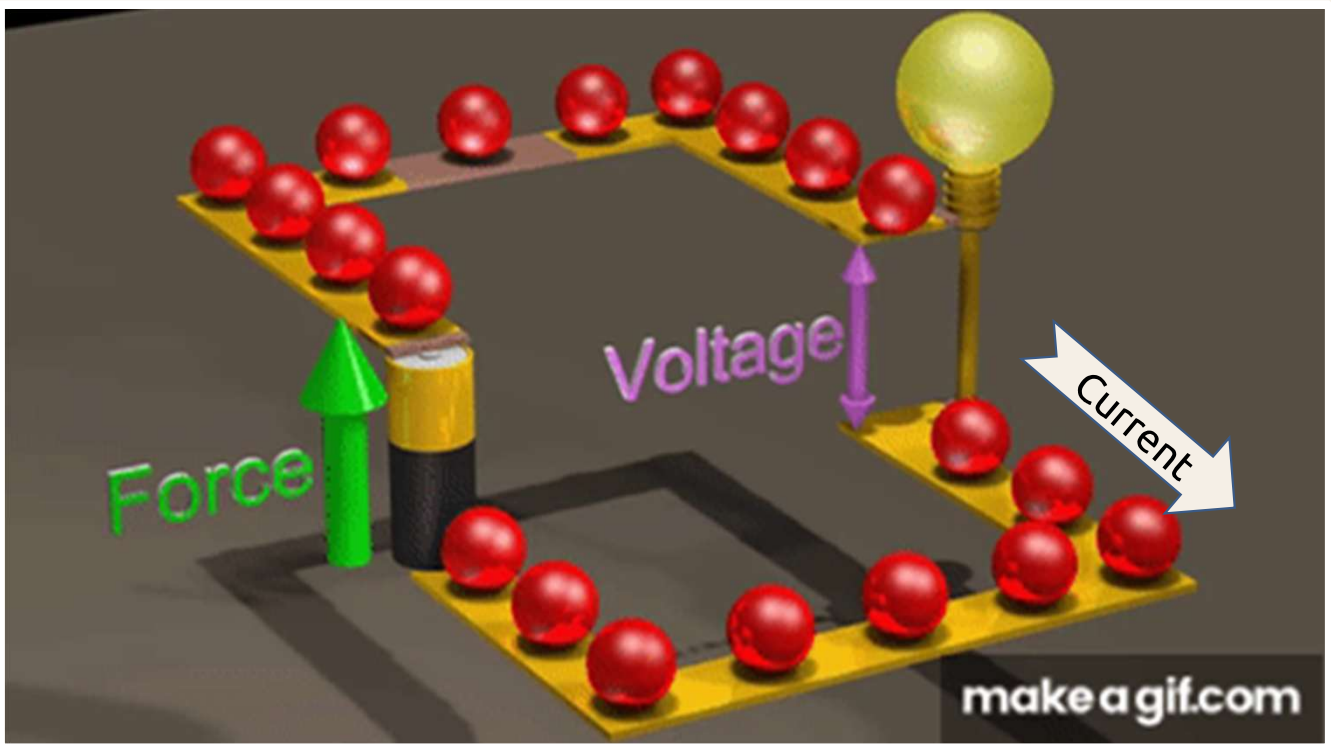
MEASURED IN VOLTS

This is the force or push on the moving electrons through a circuit.

## CURRENT (A)

MEASURED IN AMPS

This is the rate of flow of electrons through a circuit.



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# Understanding Voltage

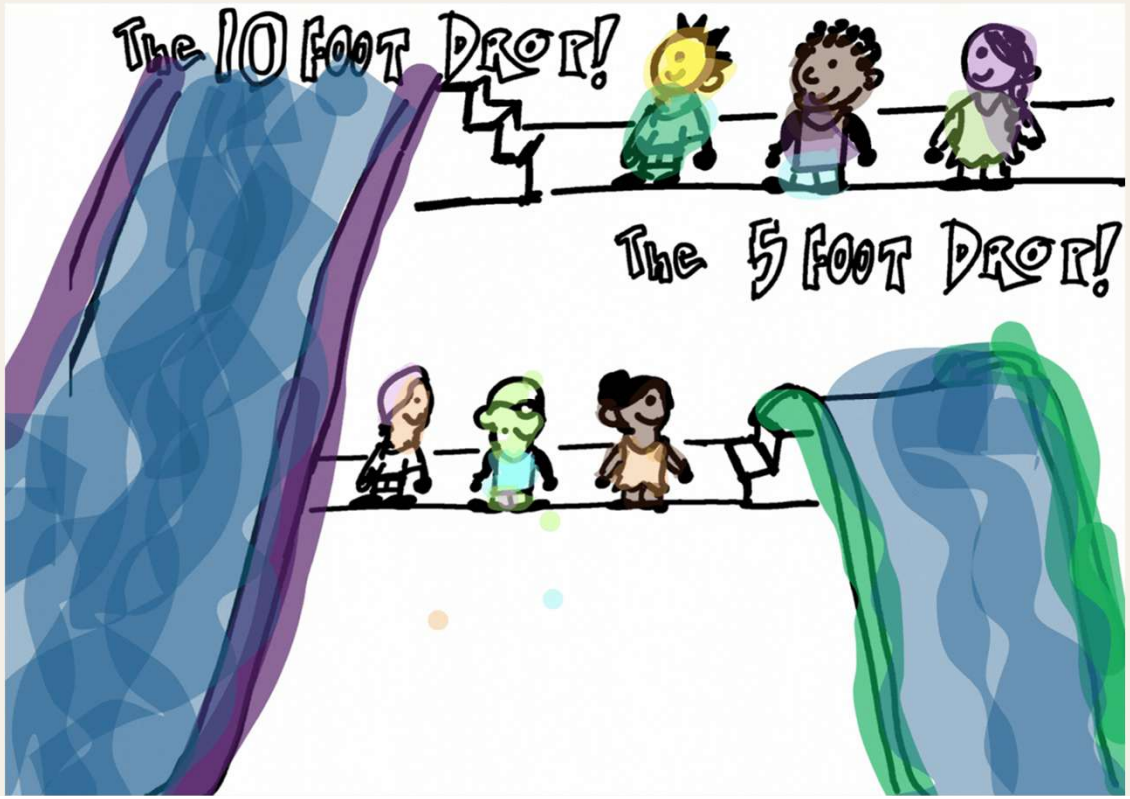
## VOLTAGE (V)

MEASURED IN VOLTS

This is the force or push on the moving electrons through a circuit.

The **height** of the water slide represents **voltage**.

The kids sliding from a higher point have a higher potential or **voltage**.



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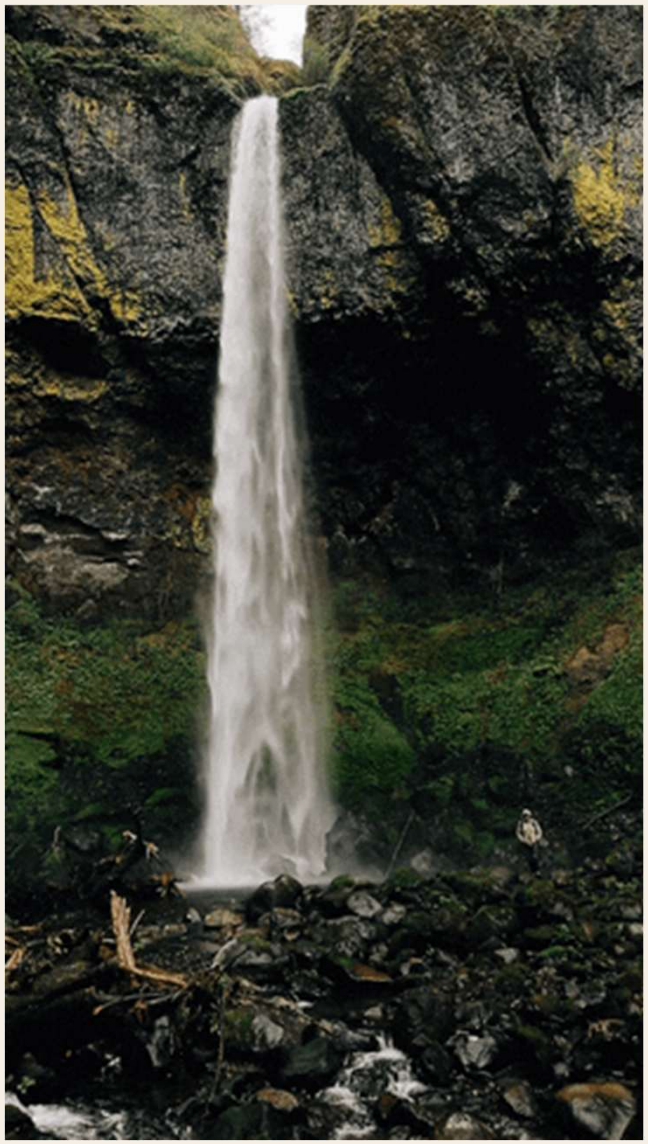
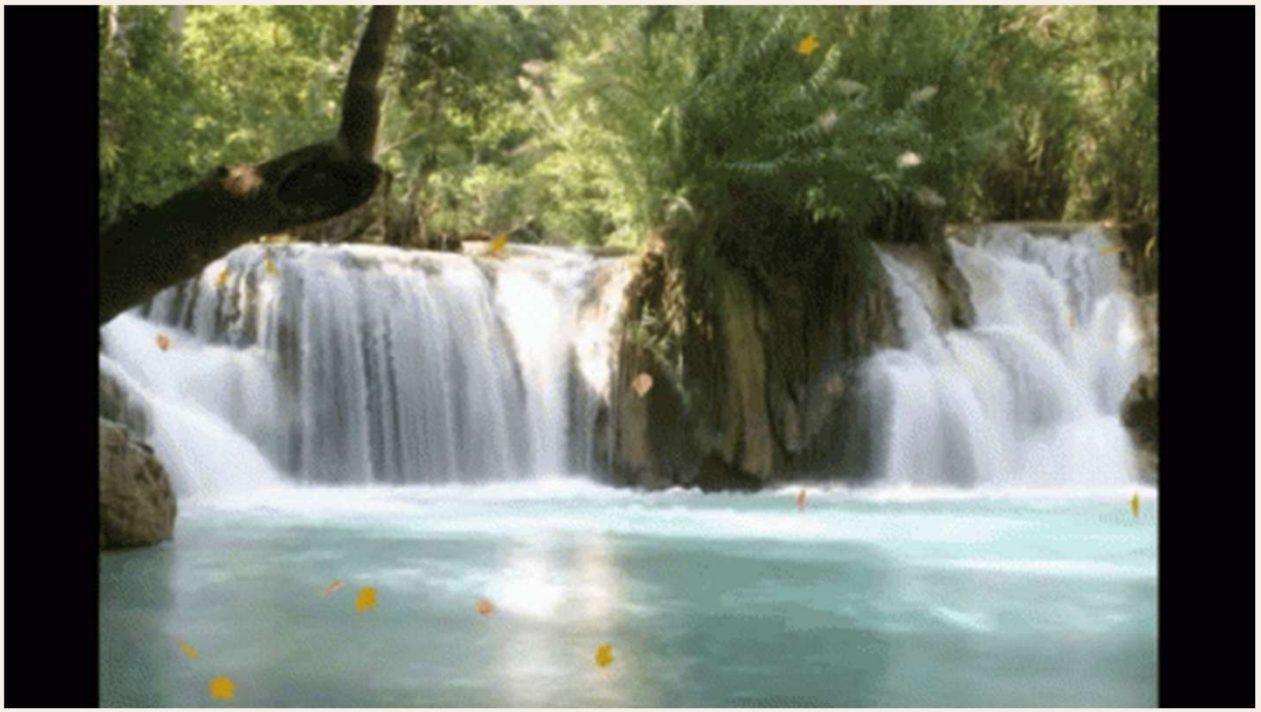
# Understanding Voltage



Which waterfall represents the higher voltage? Why?



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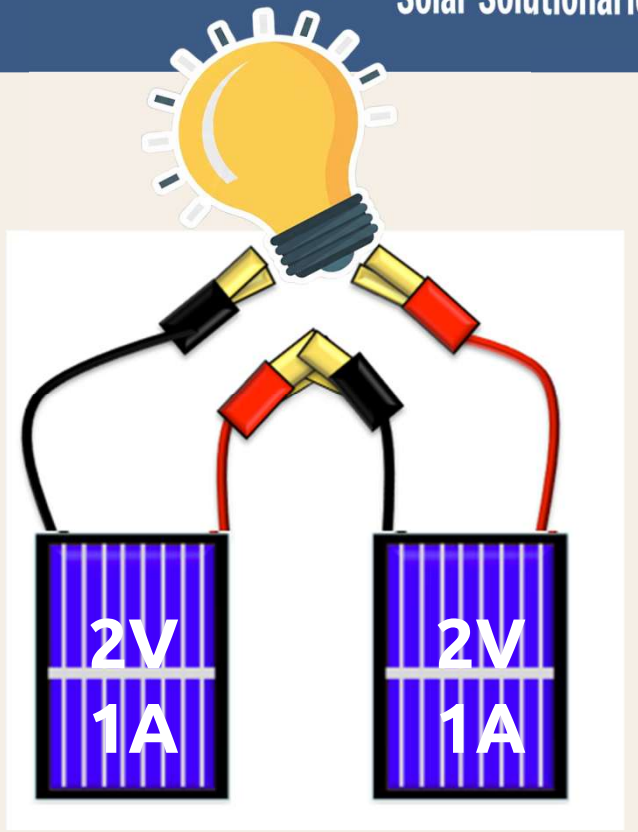
# Understanding Voltage

We can **increase voltage** in solar systems by using **series wiring**




(the current stays the same)

**Fun Fact:**
This is how old holiday lights were wired and why if one bulb went out, the whole strand stopped working!

*These two solar panels **in series** will provide:*

***4V and 1A***

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# Understanding Current

**CURRENT** (A)

MEASURED IN AMPS

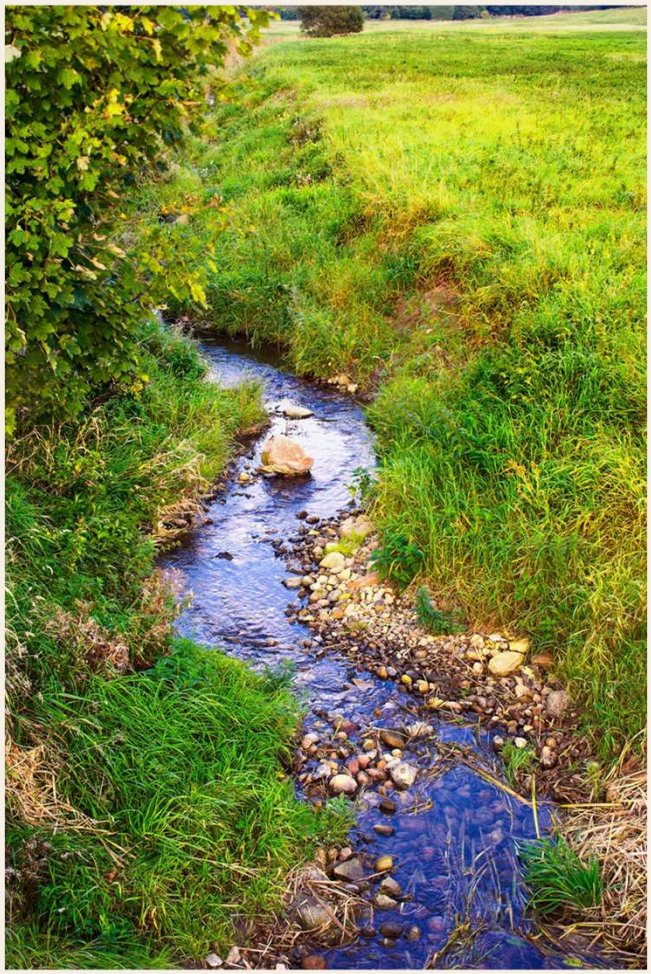
This is the rate of flow of electrons through a circuit.

For electrons to flow, there must be a difference in potential… **a flat slide isn't fun!**

The **number of people** going down the water slide represents **current**.

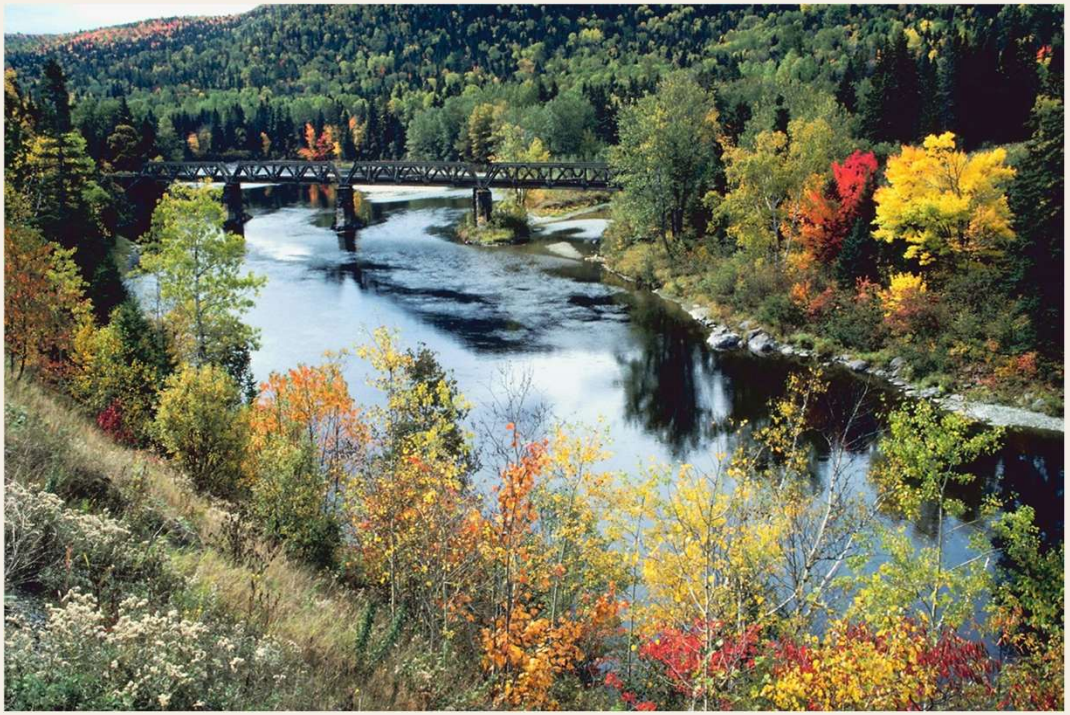
More kids sliding down at once increases the **rate** of kids going down the slide… increasing **current**.

# Understanding Current



Creek

Which body of flowing water represents the higher current? Why?



River

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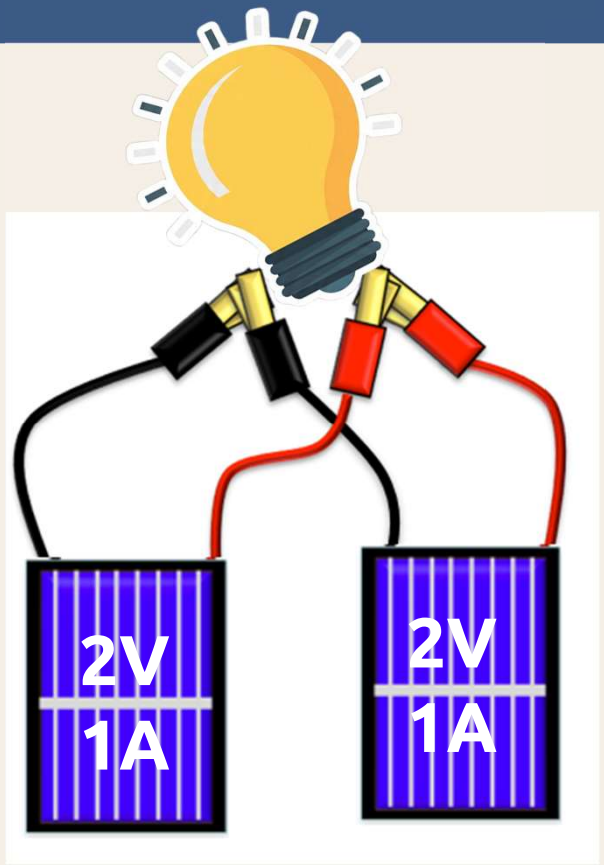
# Understanding Current

We can **increase current** in solar systems by using **parallel wiring**

(the voltage stays the same)




If you block a panel wired in parallel, the whole circuit doesn't stop. **Why not?**

*These two solar panels **in parallel** will provide:*

***2V and 2A***

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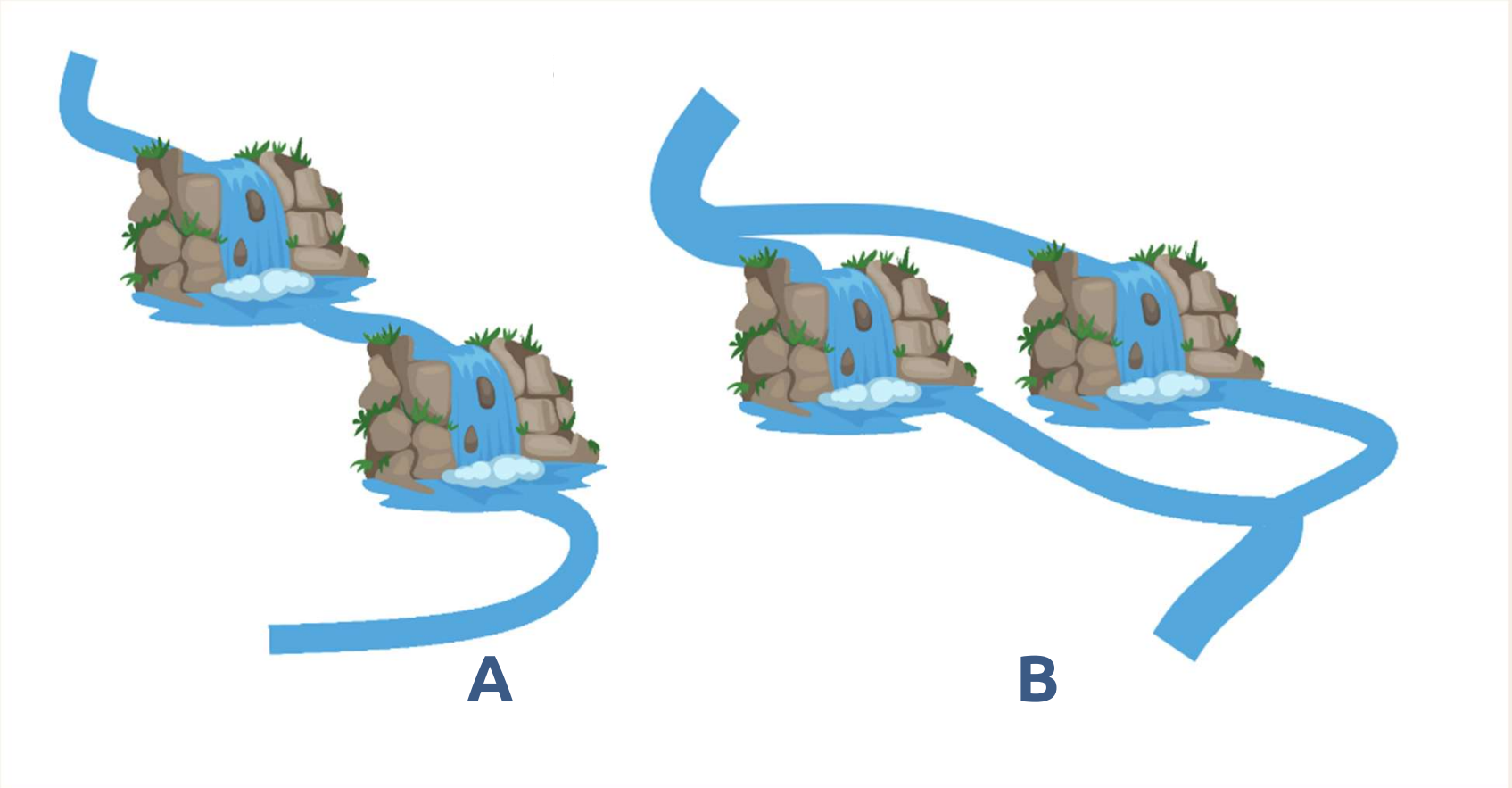
# Understanding Voltage and Current

Which set of waterfalls is in **parallel**? Which set of waterfalls is in **series?**



# How do Solar Panels Work?

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# Get to know your digital multimeter!


Find the following symbols on your multimeter and match them to the meanings (you can guess!)

1. 
2. 
3. 
4. V
5. A

A. Volts

B. Amps

C. Direct Current

D. Alternating Current

E. Continuity Testing

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# Get to know your digital multimeter!


## ANSWERS

1. 
2. 
3. 
4. V
5. A

E. Continuity Testing

D. Alternating Current

C. Direct Current

A. Volts

B. Amps

# Direct Current and Alternating Current

| Direct Current (DC) | Alternating Current (AC) |
|---|---|
| Flows in one direction only, positive to negative | Flows in both directions, alternates very quickly |
| Produced by solar panels, stored and released by batteries | Produced by spinning a turbine, either using heat (burning fossil fuels; nuclear power) or wind |

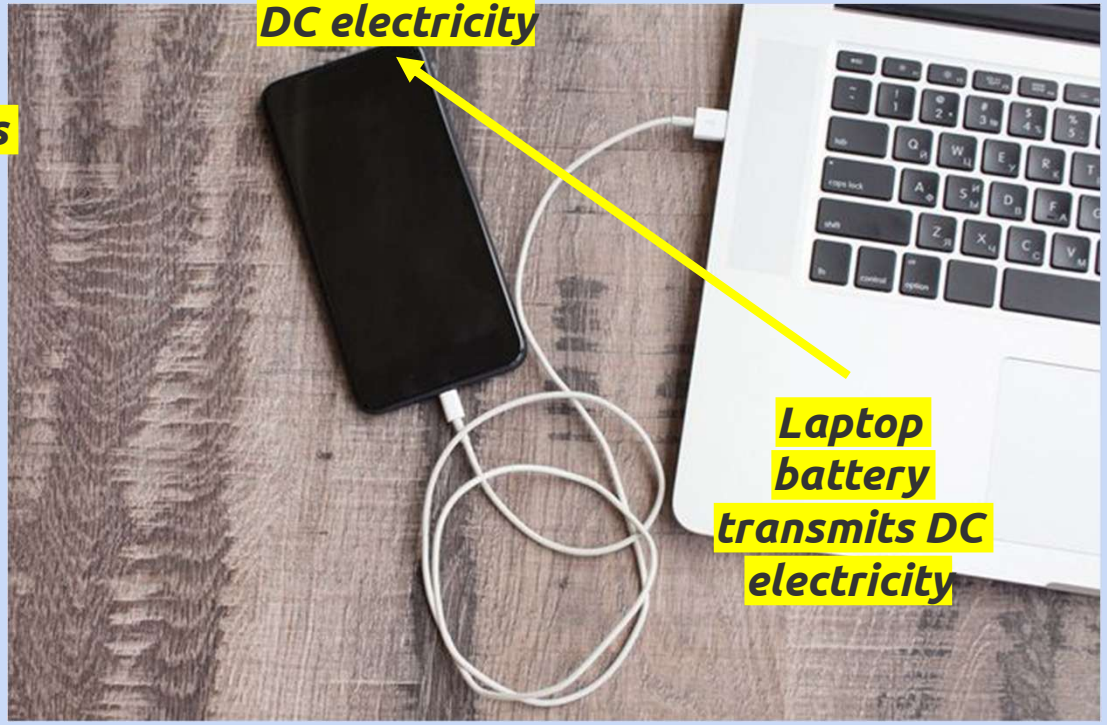
- Generally we use **AC electricity in our homes** because **transmission** (sending electricity from one place to another) is more efficient
- Most appliances run on AC electricity, but those that use **batteries** need **DC electricity**
- **Inverters** convert DC electricity to AC
- **Rectifiers** convert AC electricity to DC

# Direct Current and Alternating Current

*AC electricity from the outlet is converted to DC electricity by the charging block*

*Phone battery receives DC electricity*

*Phone battery receives DC electricity*



*Laptop battery transmits DC electricity*

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# Get to know your digital multimeter!


## Settings you will be using:

V ⎓ 60
to measure voltage

A ⎓ 10
to measure current

**Twist the dial to each setting. The lights show you where to put the leads. It is important to put them in the correct jacks.**

## You already used:

**The probes have plastic covers on them - remove them to measure voltage and current**

# Measuring Voltage and Current

## Measuring Voltage ***Volts (V)***


## Measuring Current ***Amps (A)***


***Current should NEVER be measured directly on a battery!***

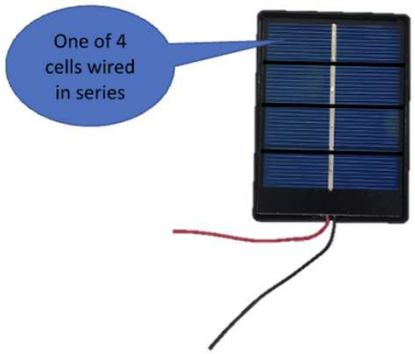
***This will discharge the battery through the multimeter, blowing the fuse***

***Find the warning sign on the Solar Suitcase Learning Kit***

**Electrician pro tip**
Always check that the test leads are in the correct jacks before taking a measurement
Look for the lights to help you

# Exploring Photovoltaic (PV) Cells

Each mini solar panel is composed of four 0.5 volt solar cells wired in-series to create a 2-volt solar panel that can provide 0.2 Amps of current.




**Power** (Watts) = **Voltage** (Volts) **x Current** (Amps)

- **Current** = flow of electrons
- **Voltage** = electrical potential ("pressure" acting on the current)
- **Power** = doing work

**Panels wired in Series** (multiplies Volts)

**Panels wire in Parallel** (multiplies Amps)

## Introduces:

- Vocabulary
- Using a Digital Multimeter (DMM)
- Measuring Voltage
- Measuring Current
- Wiring in Series
- Wiring in Parallel