Crash Course in Power
Terminology

- Electricity is a flow of electrons through a circuit
- Electricity has several characteristics that can be measured
- Voltage (volts), amperage (amps) and watts (watts)
Electricity moves like water

- Electrons are the H2O molecules
- Electrons (H2O molecules) flow through copper cable (pipe) to fill empty buckets (batteries)
- Electrons follow the path of least resistance - like water following gravity.
The voltage (V) measures the pressure with which electrons move through a circuit.

If a circuit has no voltage, then it has no flow of electricity.
Picturing Voltage

- Imagine the flow of water from a full bucket to an empty one
- The water will rush from the full bucket to the empty bucket due to pressure
- The more pressure (voltage), the more water flow
Amperage (Current)

The amperage (A) measures the rhythm of electrons with which electrons move in a circuit.

Fun Fact: One Ampere is 6 billion billion electrons per second!
Watts

1 watt = a single LED

1 kilowatt = (1,000 watts) a toaster

1 megawatt = (1,000,000 watts) 1,000 houses

1 gigawatt = (1,000,000,000 watts) 1,000,000 houses

Watts (W) measure system power.

https://www.hakaimagazine.com/features/watts-water/
To calculate the watt hours, two things must be known:

- The power demand in watts of the device at any given time.
- The total time the device uses power.
Review

- Volts are pressure
- Amps are current
- Watts are power
- Watt-Hours are power over time

Equations:

Watts = Amps \times Volts
\quad \circ \quad W = A \times V

Watt-Hours = Watts \times Hours
\quad \circ \quad Wh = W \times h
\quad \circ \quad 1000 \text{ Wh} = 1 \text{ kilowatt-hour (kWh)}

Amp-Hours = Amps \times Hours
\quad \circ \quad Ah = A \times h
Terminology

There are two different types of currents:

- Alternating current (AC)
- Direct current (DC)
Current Basics

- Current can flow in two ways
  - Direct Current
  - Alternating current

- DC flows in one direction
  - Batteries and solar panels naturally flow in DC

- AC flows rapidly back and forth
Device coupling

When choosing the devices to be used with a solar system there are two rules:
- The voltage of the appliance must match the voltage supplied to it from the solar system.
- The electrical appliance must operate with the type of current supplied to it, AC or DC.
Electrical circuits

In an electrical circuit there is uninterrupted flow of electrons from a voltage source, such as a battery or solar system, through a conductor, and back to the source.
Basic electrical circuit

12V Battery

Switch

12V Charge

12V Bulb

12V Battery

ON

OFF
Circuit connected in series

The volts are added and the amperage is kept constant

24 volts
3 amps
72 watts

Charge
Circuit connected in parallel

Volts remain constant and amperage is added

Charge

12 volts
6 amps
72 watts
Circuit connected in parallel

Volts remain constant and amperage is added

Charge

6 V
2 A

6 V
2 A

? volts
? amps
? watts
Charge

Circuit connected in series

The volts are added and the amperage is kept constant.