

## Renewable Energy Terms

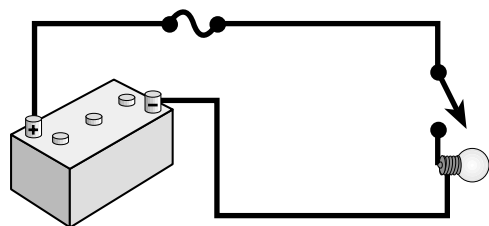
### Parallel—Side by Side

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*Derivation: From Greek para, beside, and allelon, of one another.*

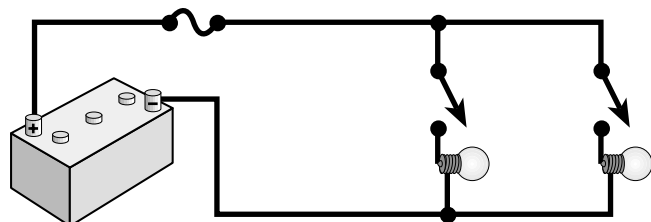
Series circuits are single loops, with all circuit components in a row, and no branches. The electrons in series circuits are like a simple toy train setup. All the cars in the train are connected, and whatever happens to one car happens to them all.



Series Circuit

Electrons in parallel circuits are like multiple trains traveling on more than one track. Or you could imagine bicycle commuters leaving the suburbs and heading for their jobs downtown. They can take many different routes to reach similar destinations.

In the simplest parallel electrical circuit, there will be a source of energy (battery, PV, or utility grid) and two loads. As an example, let's use a battery and two light bulbs.



Parallel Circuit

Some of the electrons in the circuit will flow through each bulb, and they will both light up. The two bulbs are operating independently, energized by one source. If one bulb fails, the other will still run. In contrast, if two bulbs are wired in series (all in one loop), when one fails, the circuit is opened and the other bulb will go out.

Just as multiple roads allow a greater traffic flow, parallel circuits allow greater electron flow (compared to a single series circuit with the same wire size). You are increasing the amount of conductor material, so more electrons can flow.

Parallel circuits also make using electrical energy much more flexible and convenient. You can wire multiple circuits and control them independently. Wiring and circuit components only need to be sized for the specific loads on each circuit. In the same way, having multiple roads allows our bicycle commuters to travel to a variety of places by different routes.

Renewable energy systems are full of parallel circuits. Most PV arrays are made up of series strings of modules that are paralleled together in a combiner box. Voltage remains the same when you wire in parallel, while amperage is the sum of the output of the sources. So if two 12 volt (nominal) PV modules that produce 5 amps are wired in parallel, the output will be 10 amps at 12 volts.

Batteries can also be wired in parallel. If you have two 12 volt batteries to use in a 12 volt system, they will be wired in parallel. Again, voltage will remain the same, while amp-hour capacity will increase. If each of your batteries is rated at 200 amp-hours at 12 volts, two wired in parallel will supply 400 amp-hours at 12 volts.

Conventional house wiring systems are made up of parallel circuits—it's the normal wiring mode for most electrical systems. The main energy supply can be the utility grid or a renewable energy system. The energy comes into a main circuit panel, where the wiring divides into multiple circuits. Each circuit leads to a group of loads, which are also wired in parallel within the circuit.

Parallel and series circuits are wired together in various ways to make up electronic devices and wiring systems. All circuits are either series, parallel, or some combination of the two. Series circuits are in a single loop. Parallel circuits are, as the original Greek says, "beside one another."

#### Access

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