

An Illustrated Dictionary for

Solar Energy

A Publication of

www.clean-footprint.com





Introduction

We hope this dictionary is useful and helps you become more familiar with the basic terms and definitions of Solar Energy.

This complete A to Z reference is **A GIFT** from the Clean Footprint Team **TO YOU** in an effort to create a Clean Energy Economy.





What's happening?

An Energy Revolution....that's what's happening!

ONE new rooftop solar system is being installed every **FOUR** minutes in the USA.

Great for the **environment**. 😊

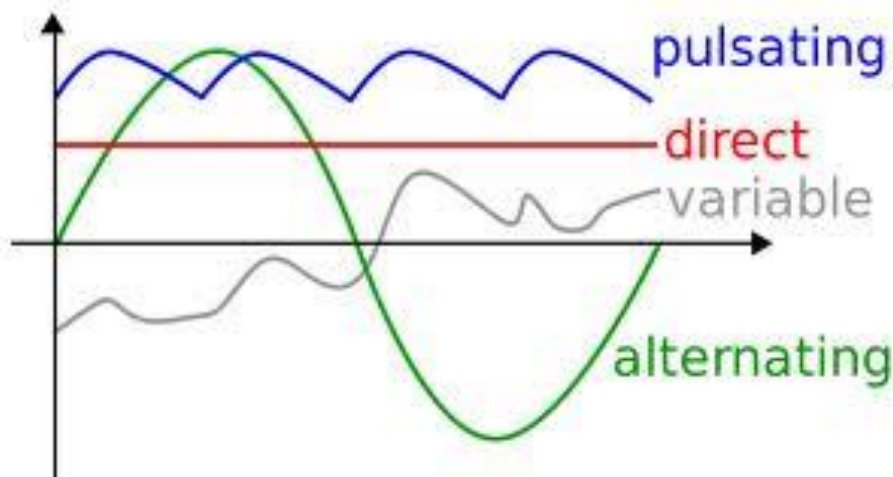
Not so good for the electric companies that happen to be in solar energy **hot spots**.

Let's Get Started!



Alternating Current Energy (AC)

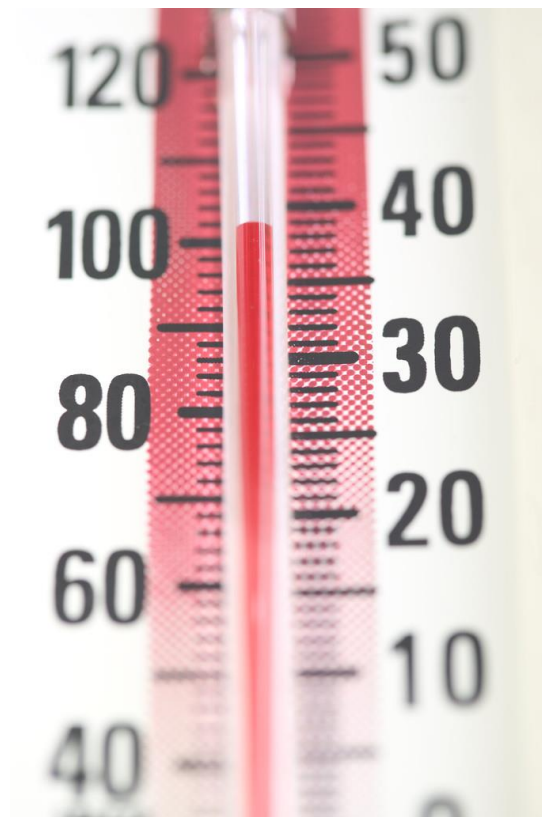
The flow of electricity that constantly changes direction between positive and negative sides. Almost all power produced by electric utilities in the United States moves in current that shifts direction at a rate of 60 times per second.





Ambient Temperature

The temperature of the surrounding area.

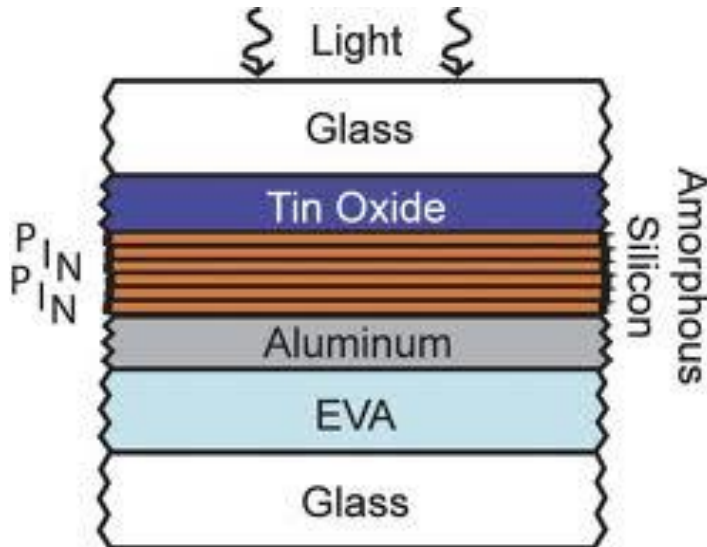


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Photo from
Microsoft

Amorphous Silicon

A thin-film, silicon photovoltaic cell having no crystalline structure. Manufactured by depositing layers of doped silicon on a substrate. See also single-crystal silicon and polycrystalline silicon.





Ampere (Amp)

The unit of measure that indicates how much electricity flows through a conductor. It is like using cubic feet per second to measure the flow of water. For example, a 1,200-watt, 120-volt hair dryer pulls 10 amperes of electric current (amps = watts/volts).

300w = 2.5 amps

600w = 5 amps

900w = 7.5 amps

1200w = 10 amps

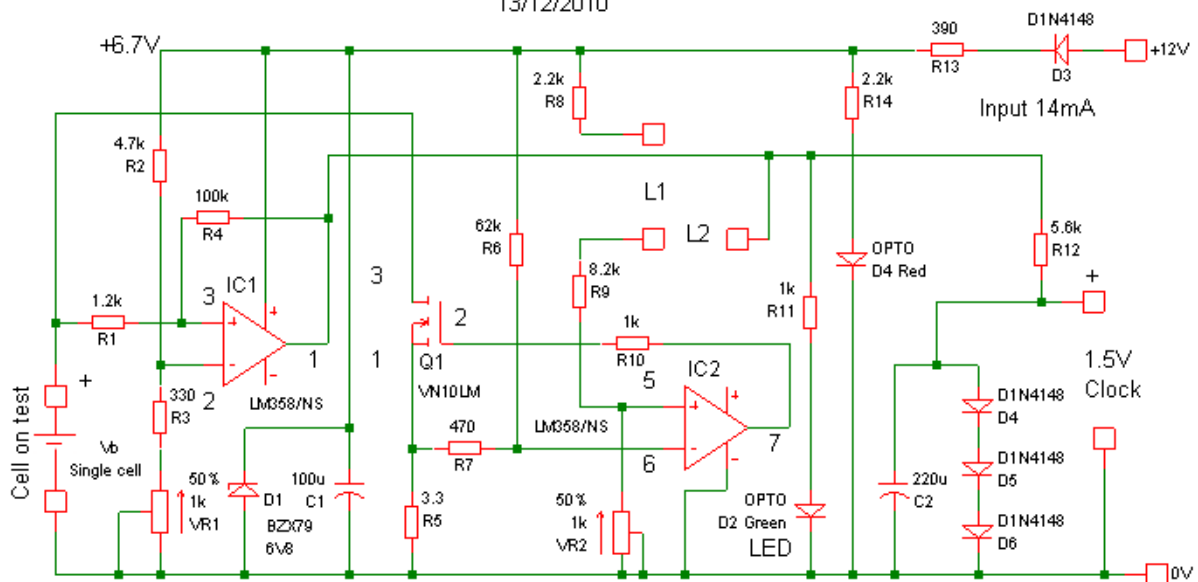
1500w = 12.5 amps

Ampere-Hour (Ah/AH)

A measure of the flow of current (in amperes) over one hour; used to measure battery capacity.

Fig. 3 Amp-hour Measurement

13/12/2010



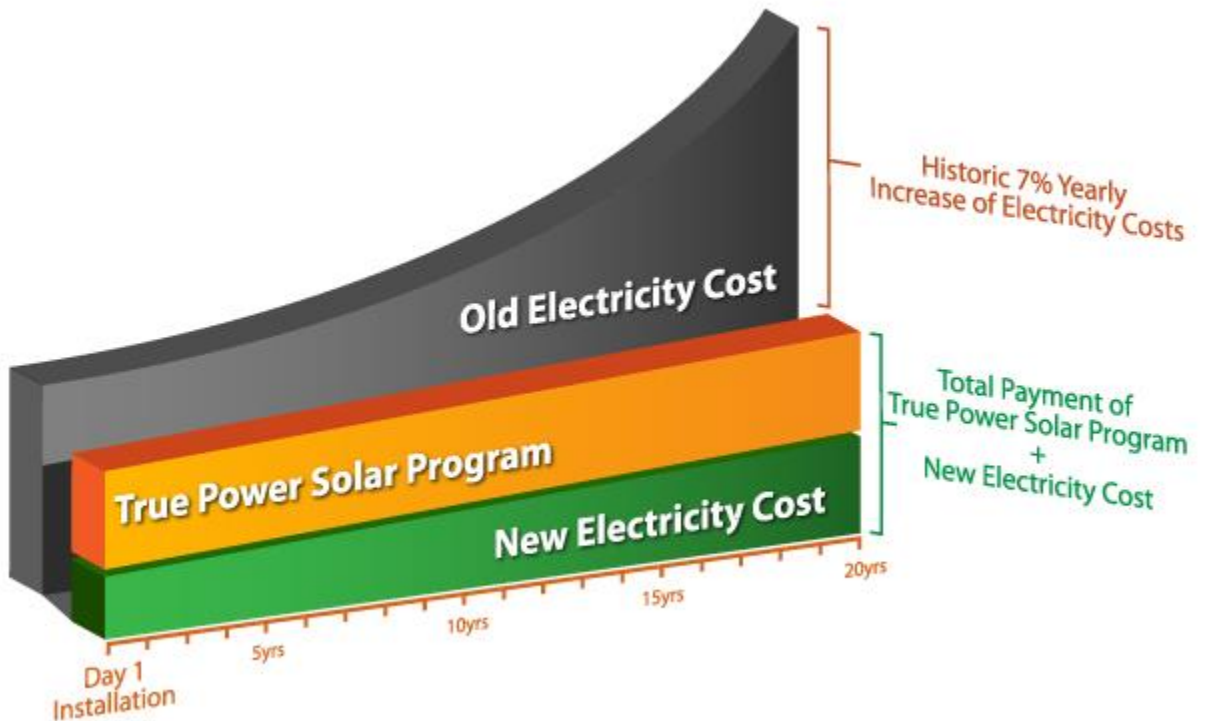
Set to battery discharge voltage plus 50mV.

Set battery discharge current to 100mA with 330mV across R5 or 380mV at pin 5.

R4, R1 provide 50mV up-lift hysteresis. IC1 pin 1 output: low = 0.72V, high = 5.4V

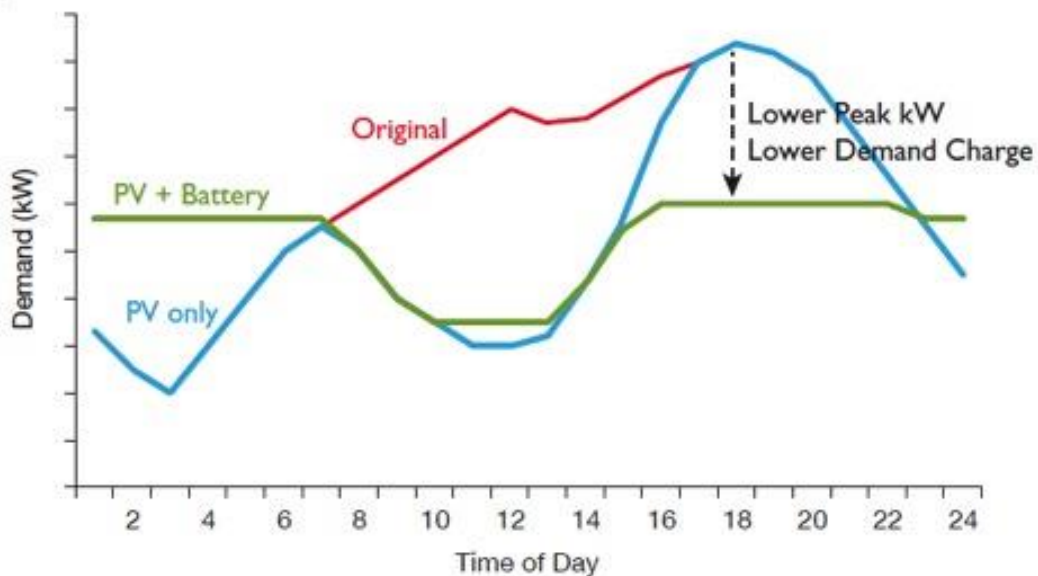
Annual Solar Savings

The annual solar savings of a solar building is the energy savings attributable to a solar feature relative to the energy requirements of a non-solar building.



Average Demand

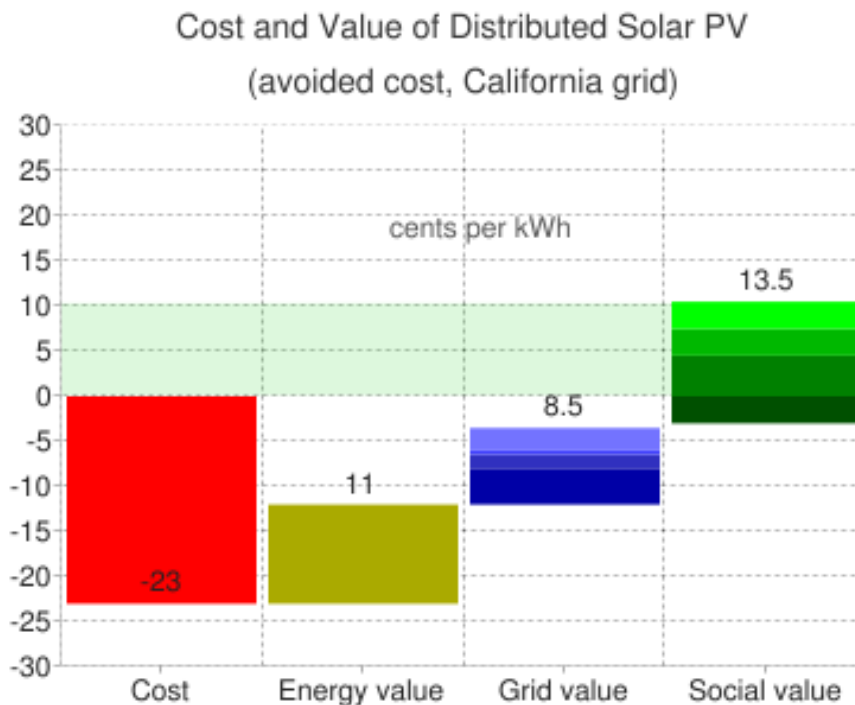
The energy demand for a given location over a period of time. For example, the number of kilowatt-hours used in a 24-hour period, divided by 24 hours, tells the average demand for that location in that time





Avoided Cost

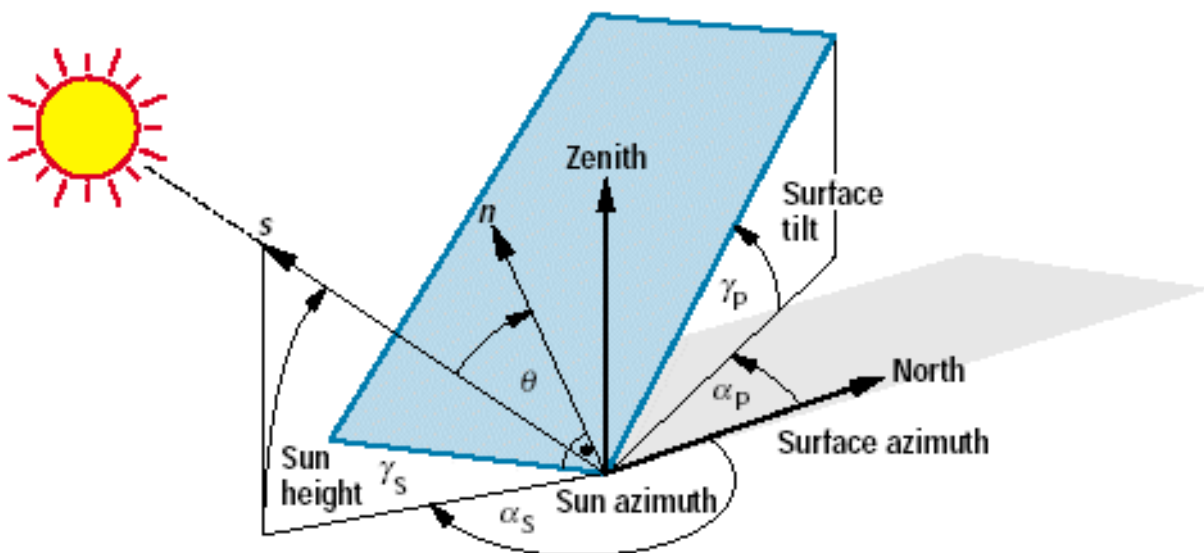
The amount of money an electric utility would need to spend for the next increment of electric generation to produce or purchase.





Azimuth Angle

The angle between true south and the point on the horizon directly below the sun.





Battery

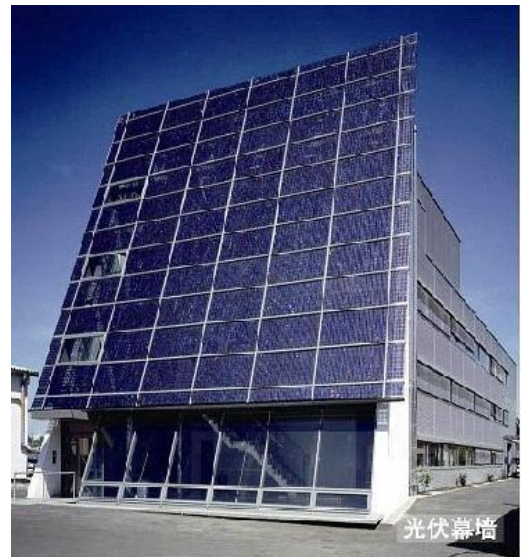
Batteries are often sold with a solar electric system. The primary purpose is to store the electricity not immediately used, which could be used at some later time.





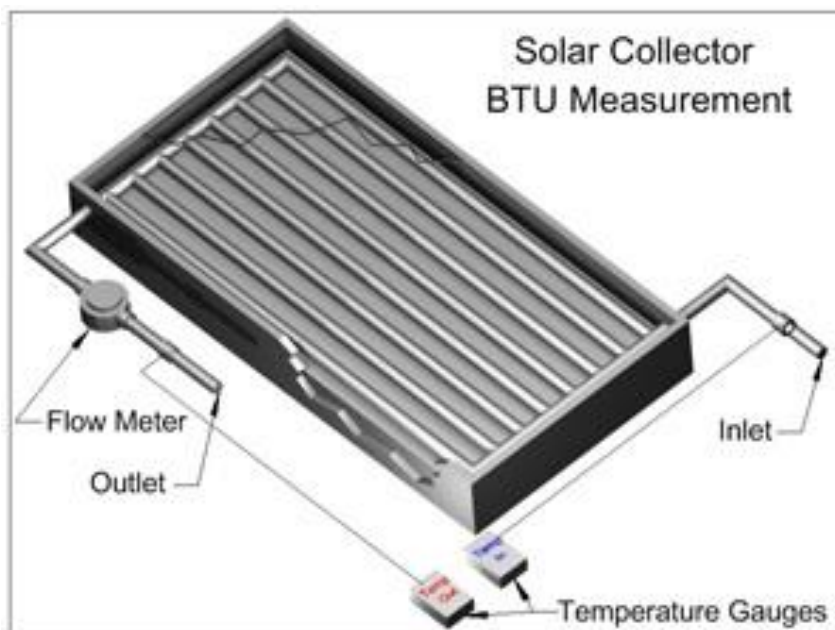
BIPV (Building-Integrated PV)

A term for the design and integration of photovoltaic (PV) technology into the building envelope, typically replacing conventional building materials. This integration may be in vertical facades, replacing view glass, spandrel glass, or other facade material; into semitransparent skylight systems; into roofing systems, replacing traditional roofing materials; into shading "eyebrows" over windows; or other building envelope systems.



Btu (British Thermal Unit)

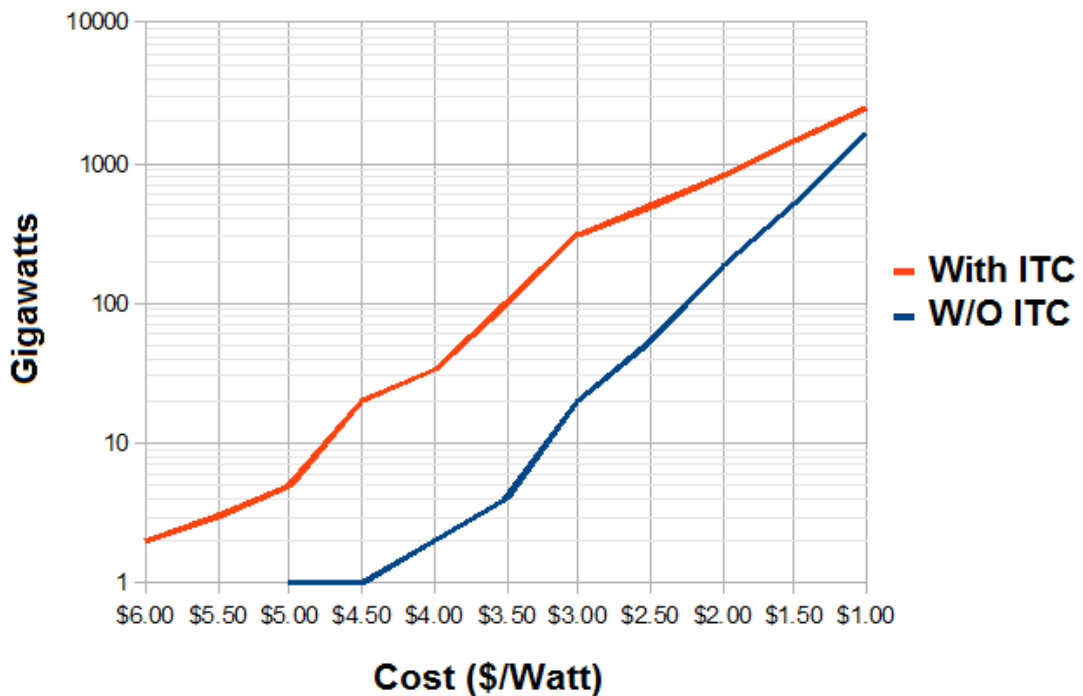
The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit; equal to 252 calories.



Capacity Factor

The ratio of the average load on (or power output of) an electricity generating unit or system to the capacity rating of the unit or system over a specified period of time.

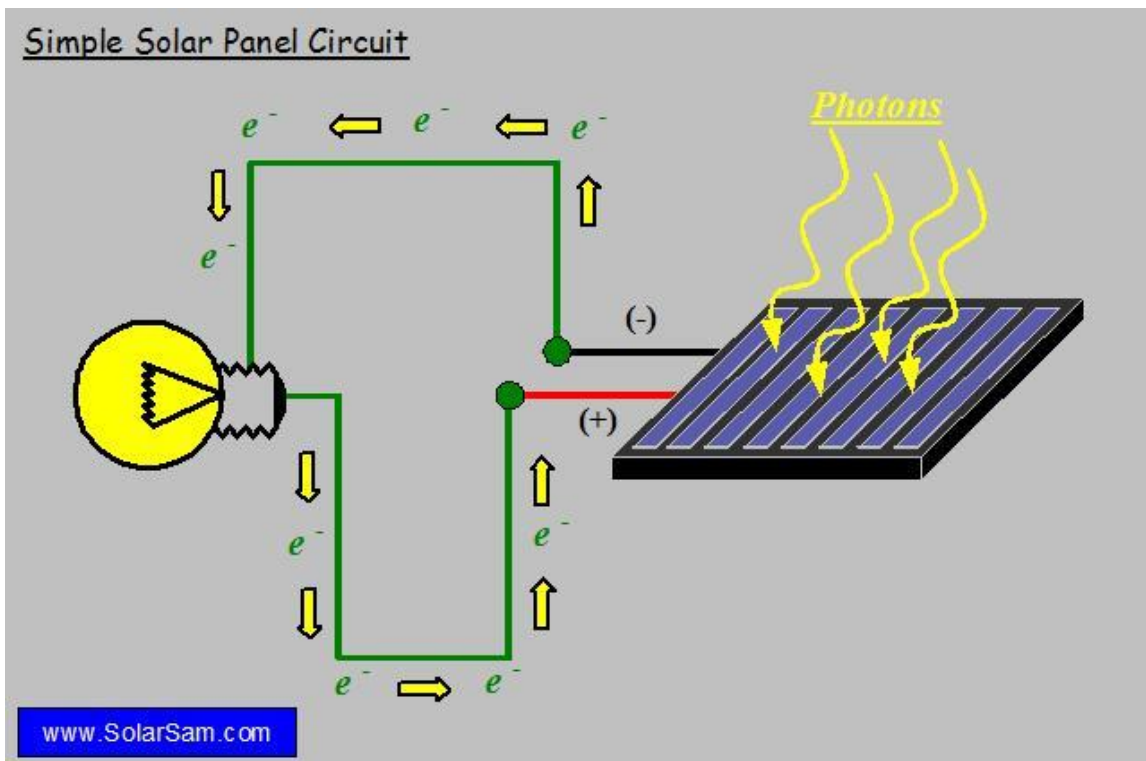
U.S. Economic Solar PV Capacity





Circuit

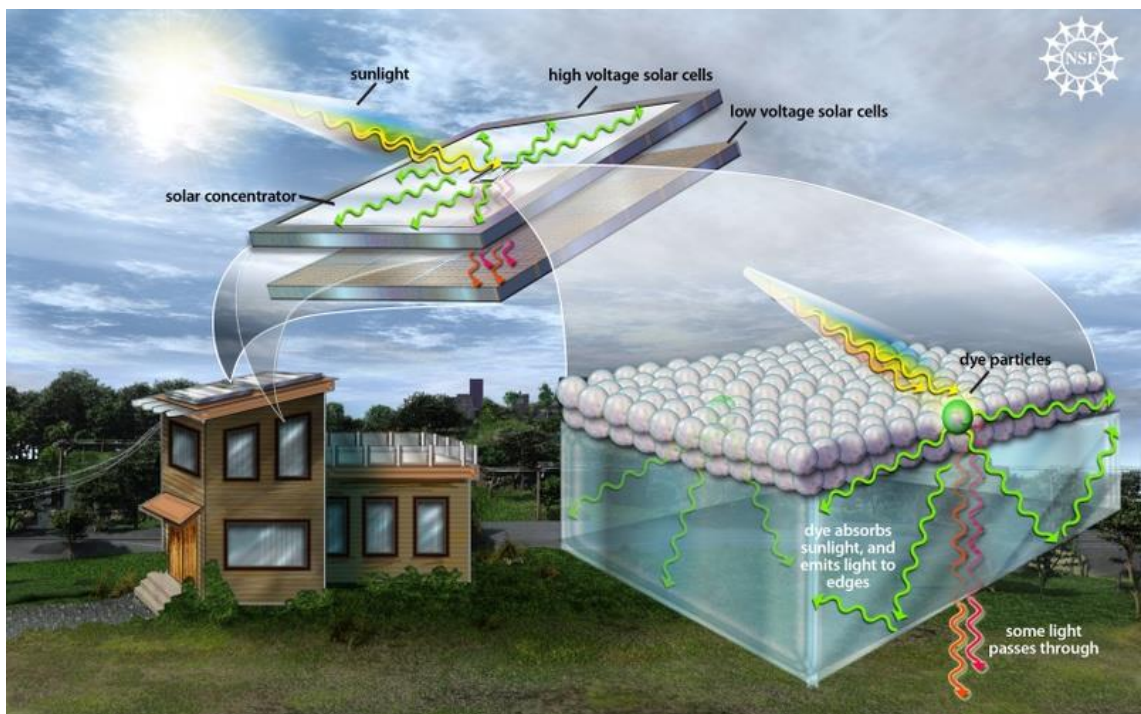
One or more conductors through which electricity flows.





Concentrator

A photovoltaic module, which includes optical components such as lenses (Fresnel lens) to direct and concentrate sunlight onto a solar cell of smaller area. Most concentrator arrays must directly face or track the sun. They can increase the power flux of sunlight hundreds of times.



Converter

An electrical apparatus that changes the quantity or quality of electrical energy.

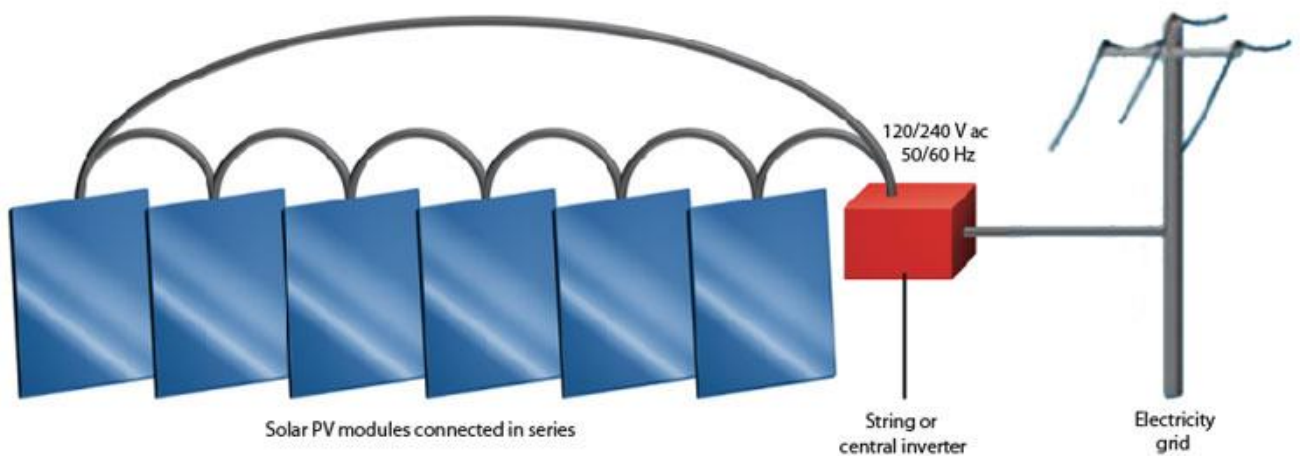


Figure 1. In conventional string architectures, the poorest performing solar module limits the output of the whole system as the domino effect can knock out all of the string inverters.

Crystalline Silicon

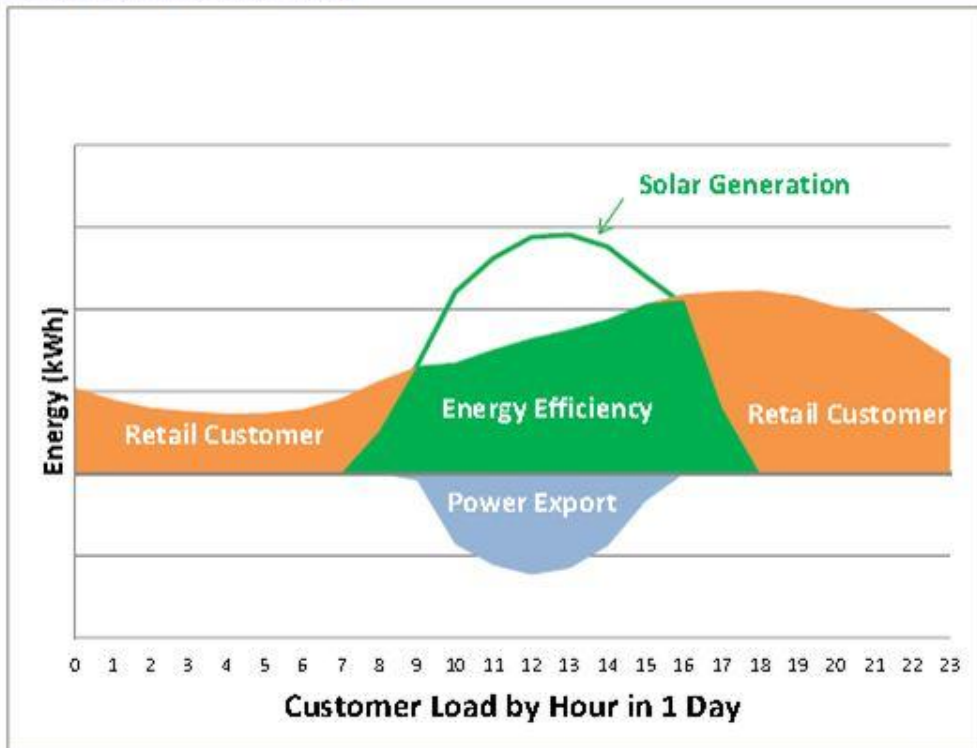
A type of photovoltaic cell made from a slice of single-crystal silicon or polycrystalline silicon.



Customer Load

The amount of power your site uses. Load may be expressed in kilowatts (capacity) or kilowatt-hours (energy). A site's peak kilowatts generally refers to when electric demand requirements are highest.

The Three States of Net Metering



(Source: CrossborderEnergy)

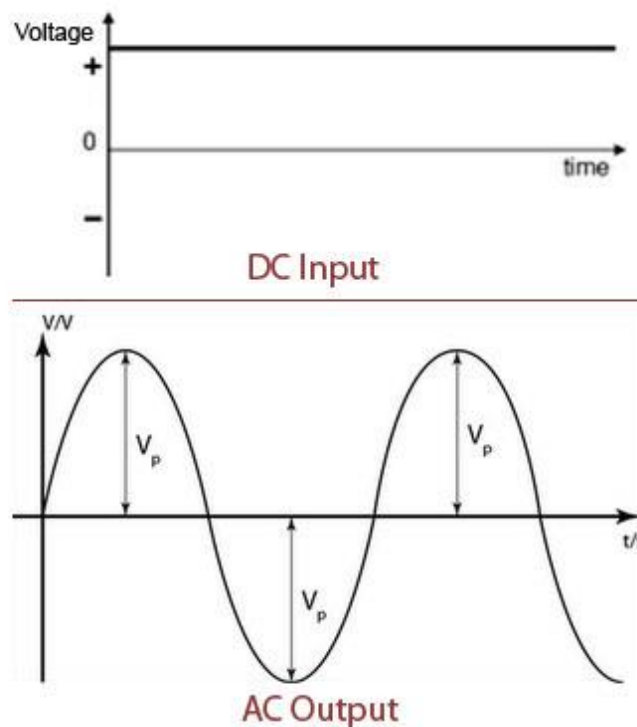
Demand

The level at which electricity is delivered to end-users at a given point in time. Electric demand is measured in kilowatts.



Direct Current (DC)

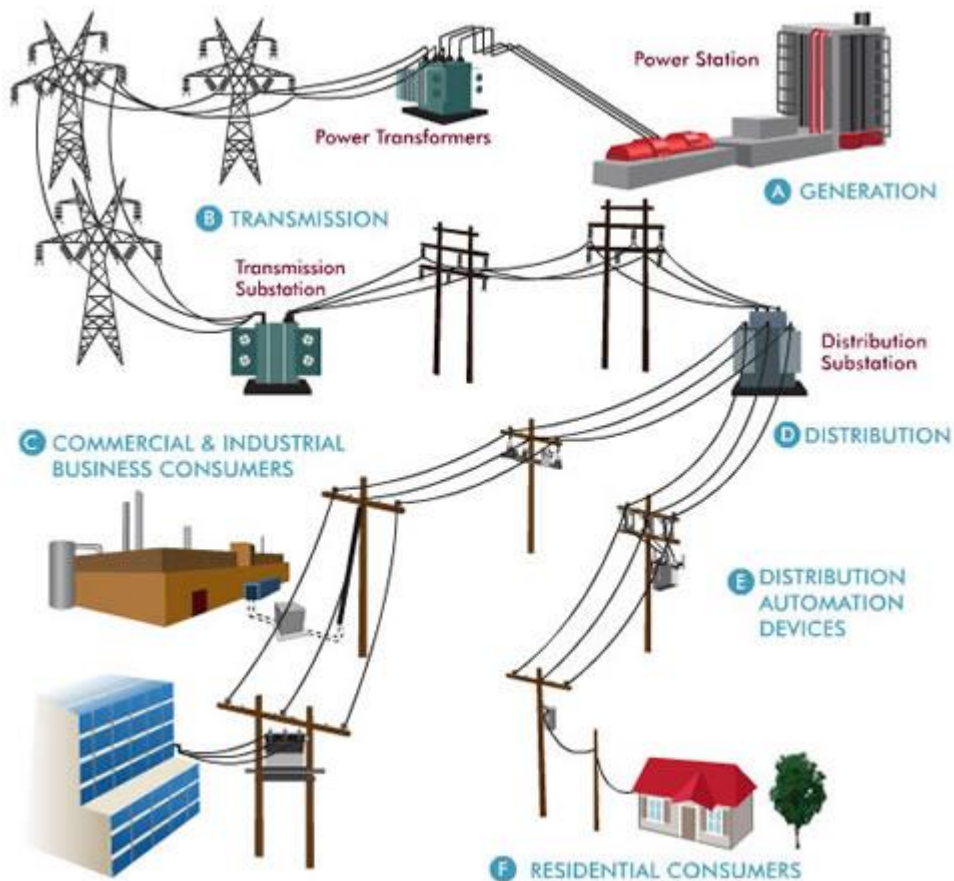
The flow of electricity that flows continuously in one direction





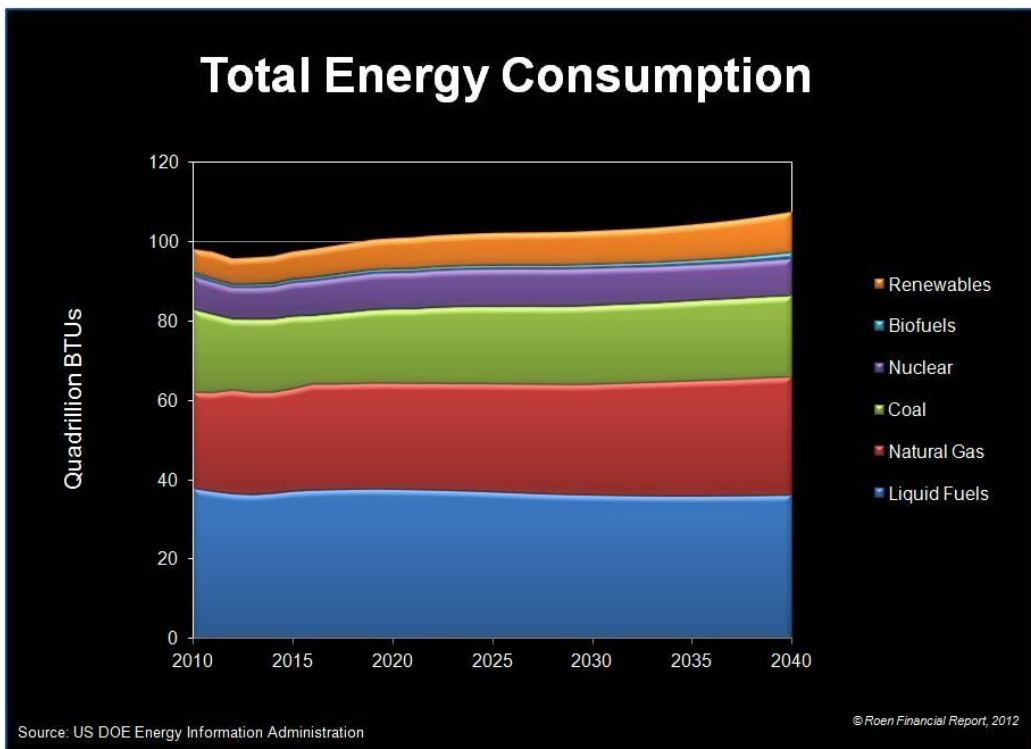
Electrical Grid

The electricity transmission and distribution system that links power plants to customers through high-power transmission line service.



Energy

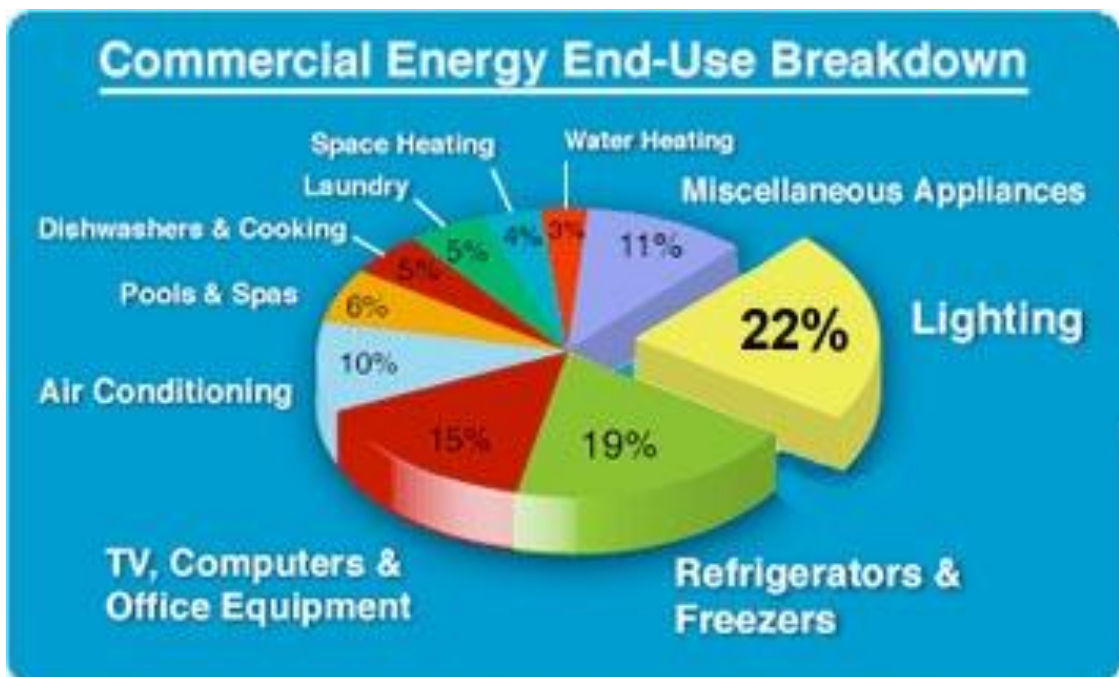
The capability of doing work; different forms of energy can be converted to other forms, but the total amount of energy remains the same.





Energy Audit

A survey that shows how much energy used in a home, which helps find ways to use less energy.

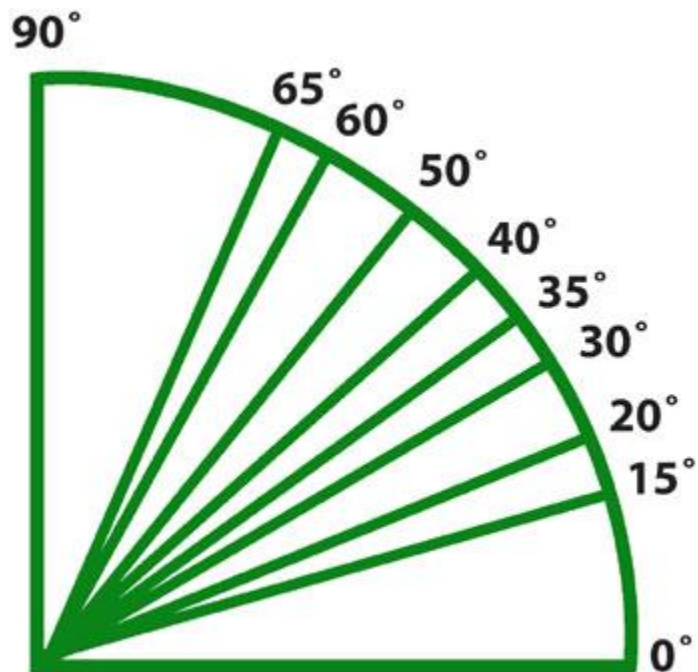




Fixed Tilt Array

A photovoltaic array set in at a fixed angle with respect to horizontal.

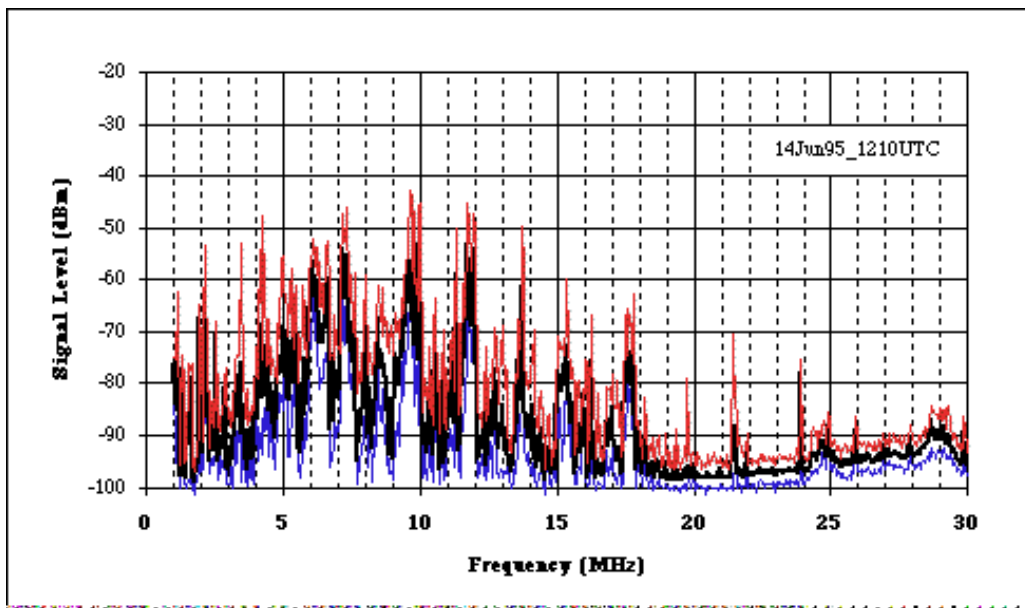
Month	Tilt
Jan	60°
Feb	50°
Mar	40°
April	25°
May	15°
June	15°
July	15°
Aug	20°
Sept	35°
Oct	50°
Nov	60°
Dec	65°





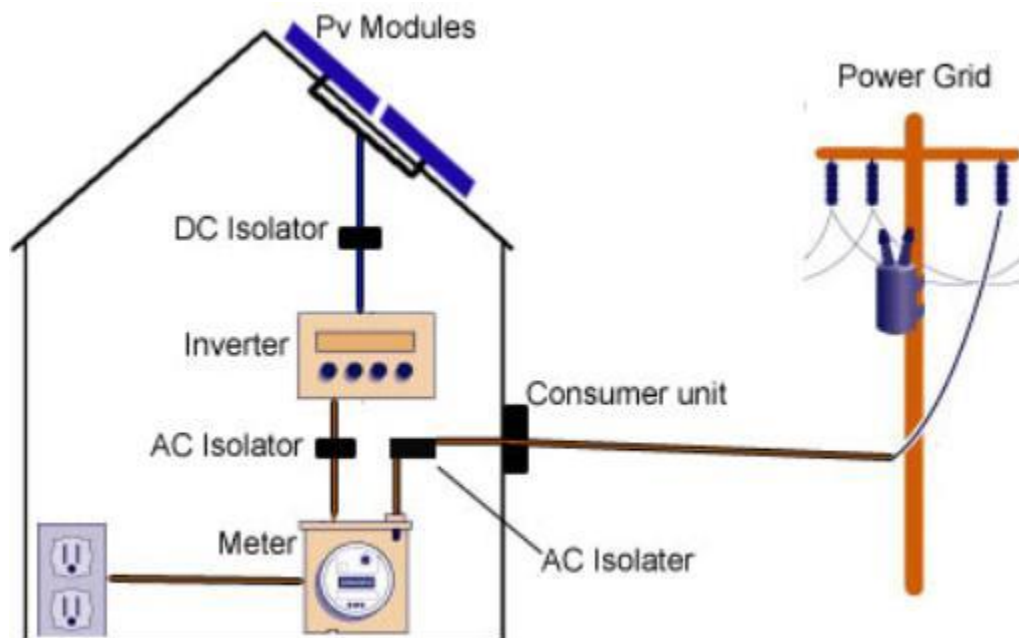
Frequency

The number of cycles through which an alternating current moves in each second. Standard electric utility frequency in the United States is 60 cycles per second, or 60 Hertz (Hz).



Grid-Connected System

Solar electric or photovoltaic (PV) system in which the PV array acts like a central generating plant, supplying power to the grid.

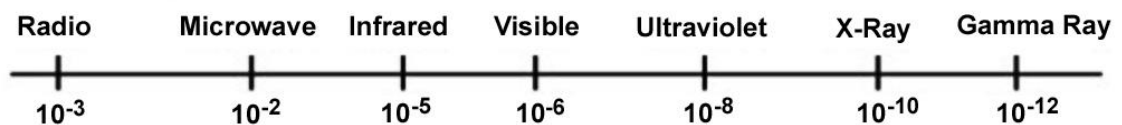


Hertz

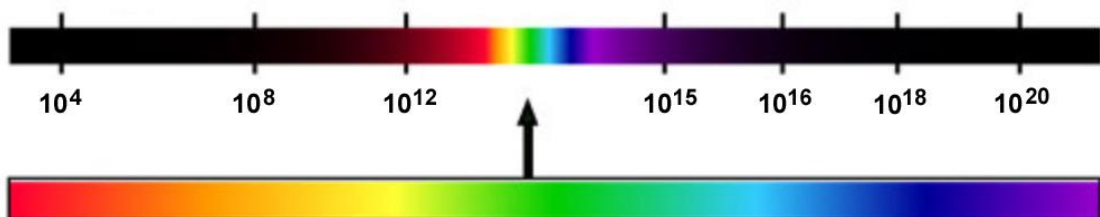
The unit of electromagnetic frequency that is equal to one cycle per second.

THE ELECTROMAGNETIC SPECTRUM

Wavelength (meters)



Frequency (Hz)



V I S I B L E L I G H T

Interconnection

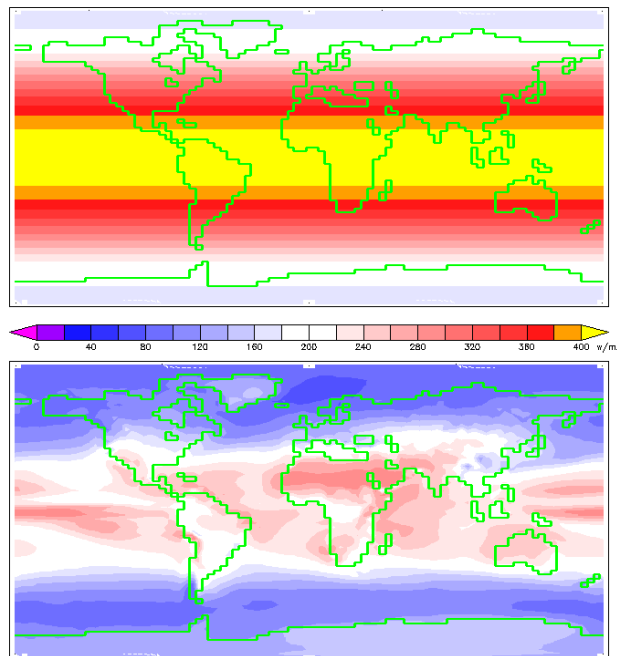
The linkage of transmission lines between two utilities, or between a utility and an end-user, enabling power to be moved in either direction.





Insolation

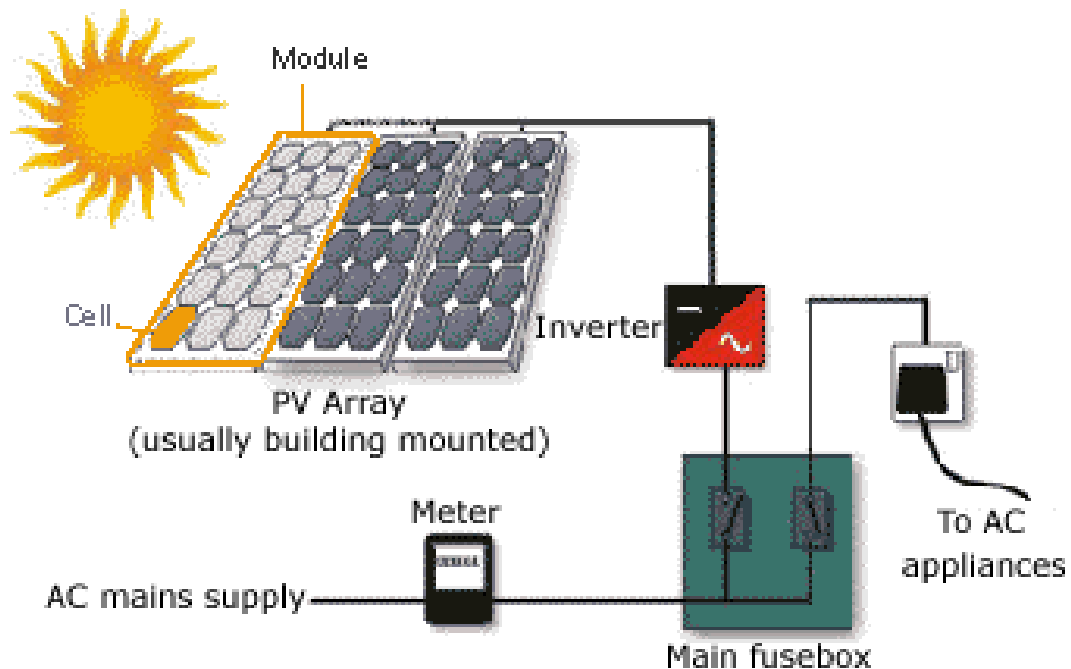
The solar power density incident on a surface of stated area and orientation. It is commonly expressed as average irradiance in watts per square meter (W/m^2) or kilowatt-hours per square meter per day ($\text{kW}\cdot\text{h}/(\text{m}^2\cdot\text{day})$) (or hours/day). In the case of photovoltaics it is commonly measured as $\text{kWh}/(\text{kWp}\cdot\text{y})$ (kilowatt hours per year per kilowatt peak rating)





Inverter

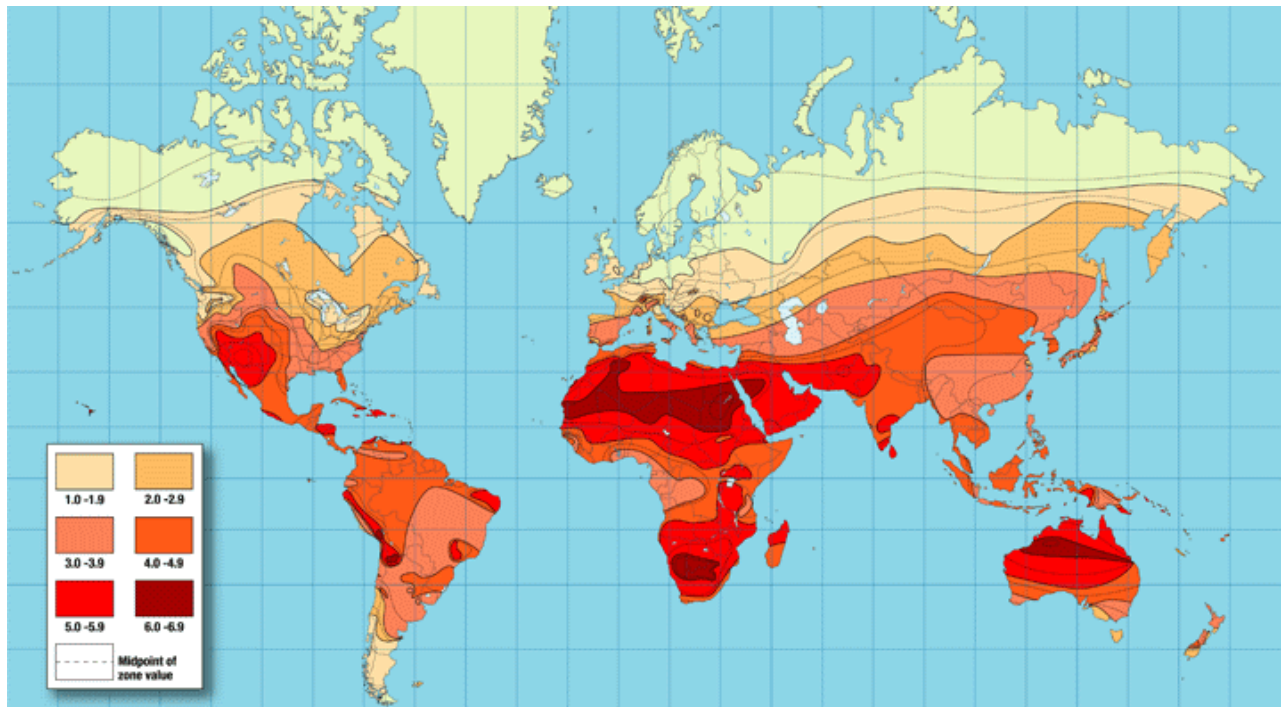
A device that converts direct current electricity to alternating current either for stand-alone systems or to supply power to an electricity grid.





Irradiance

The direct, diffuse, and reflected solar radiation that strikes a surface. Usually expressed in kilowatts per square meter. Irradiance multiplied by time equals insolation.





Kilowatt (kW)

1,000 watts. A unit of measure of the amount of electricity needed to operate given equipment. For example, a one kW system is enough power to illuminate 10 light bulbs at 100 watts each. (volts x amps = watts)



Kilowatt-hour (kWh)

The amount of kW produced over a period of time, or one kilowatt of electricity supplied for one hour. For example, a one kW system, if operating at full capacity for 5 hours will produce (or use) 5 kWh of electricity.

Usually listed on the power cord. This is the rated power your appliance uses when turned on.

Time appliance is "on". If minutes or seconds, convert to hours first.

$$kWh = \frac{\text{Watts} * \text{Time}(hrs)}{1000}$$

kilo-Watt-hour. This is what you are billed for by the utility. Usually in the form of "cents/kWh". I pay 9 cents/kWh or \$.09/kWh.

Need to divide total by 1000, otherwise it would just be Wh, not 'kilo-Wh'.

Maximum Power Point (MPP)

The point on the current-voltage (I-V) curve of a module under illumination, where the product of current and voltage is maximum. For a typical silicon cell, this is at about 0.45 volts.

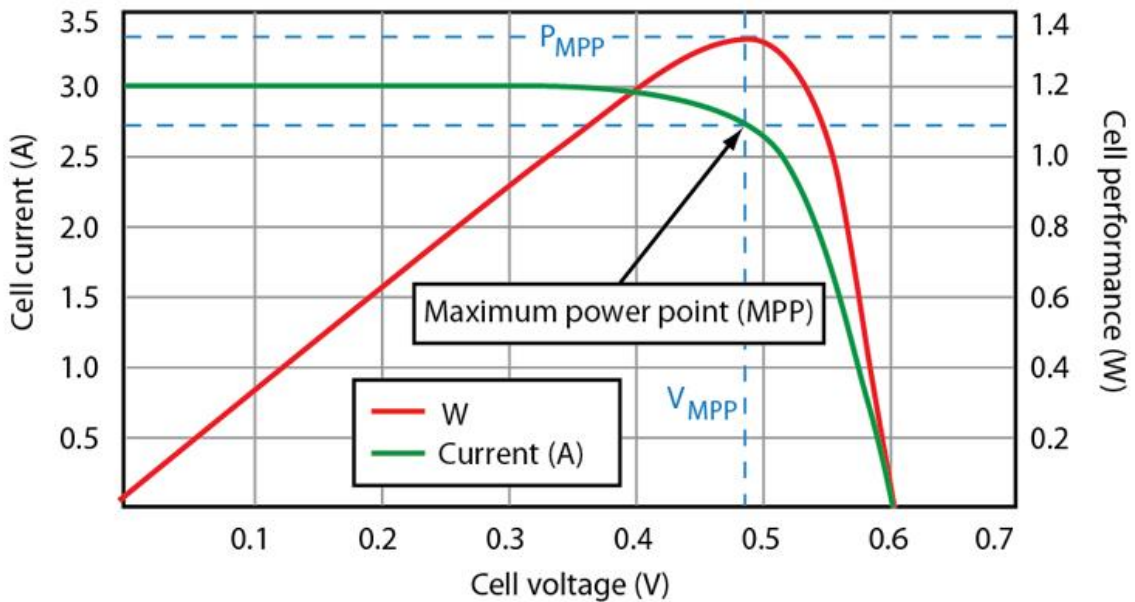


Figure 4. A PV cell's exponential relationship between current and voltage results in the maximum power point at the knee of the current-versus-voltage curve.



Megawatt

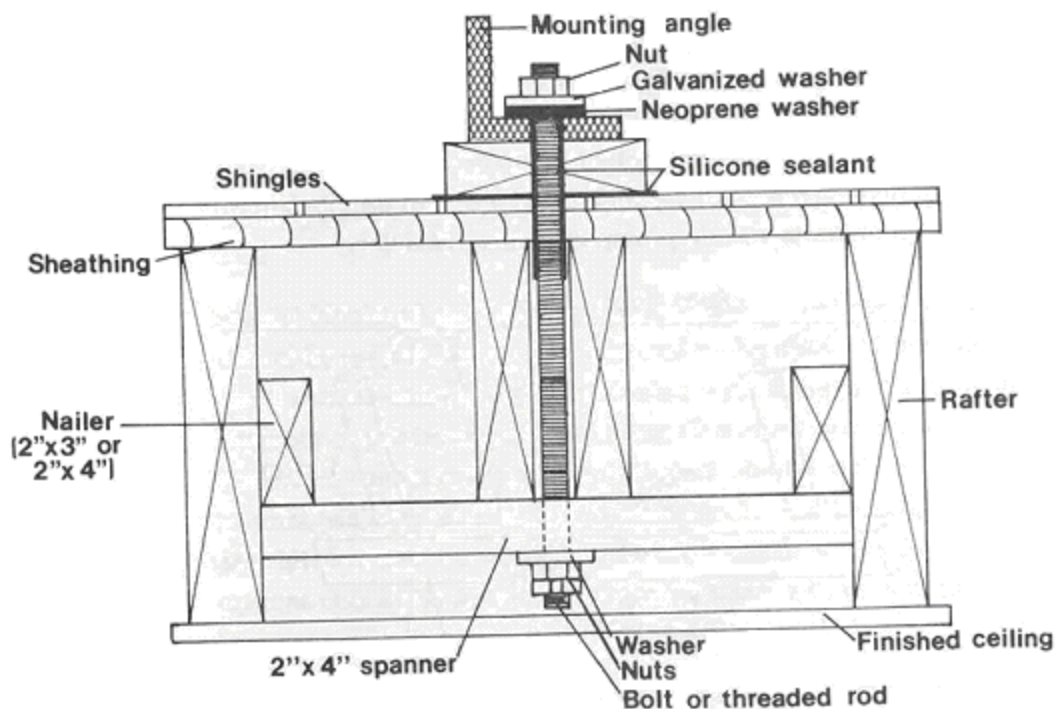
One thousand kilowatts or one million watts. One megawatt is enough to power 1,000 average California homes. Meter - A device that measures levels and volumes of customer's electricity use.





Mounting Equipment

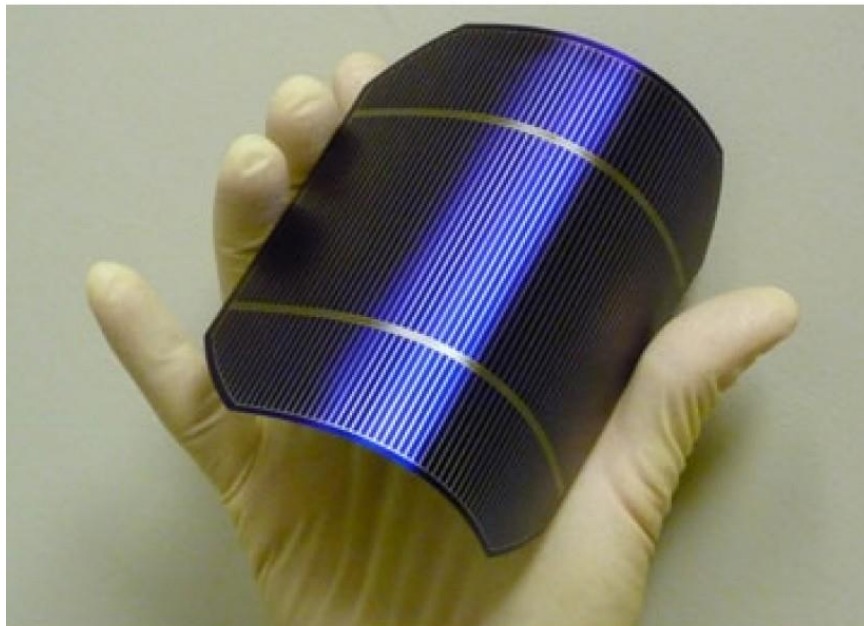
Equipment/apparatus used to fasten solar (PV) modules to the roof. Peak Load - The highest electrical demand within a particular period of time.





Multi-crystalline

A semiconductor (photovoltaic) material composed of variously oriented, small, individual crystals. Sometimes referred to as polycrystalline or semi-crystalline.





National Electrical Code (NEC)

Contains guidelines for all types of electrical installations. The 1984 and later editions of the NEC contain Article 690, "Solar Photovoltaic Systems" which should be followed when installing a PV system.





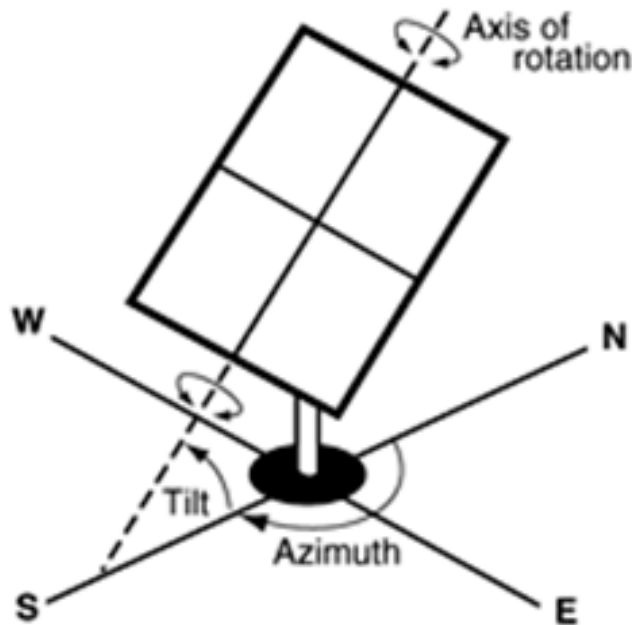
Net Metering

In the fall of 1998, New York State Governor George Pataki signed the Solar Choice Act, which requires all the investor owned electric utilities in NYS to allow residential customers to interconnect PV (solar electric) systems to the utility's distribution systems. These grid-connected PV systems allow residential customers to run their electric meters backwards, offsetting their normal utility bill. Other than the renewable energy system, no special equipment is needed.



One-Axis Tracking

A system capable of rotating about one axis.

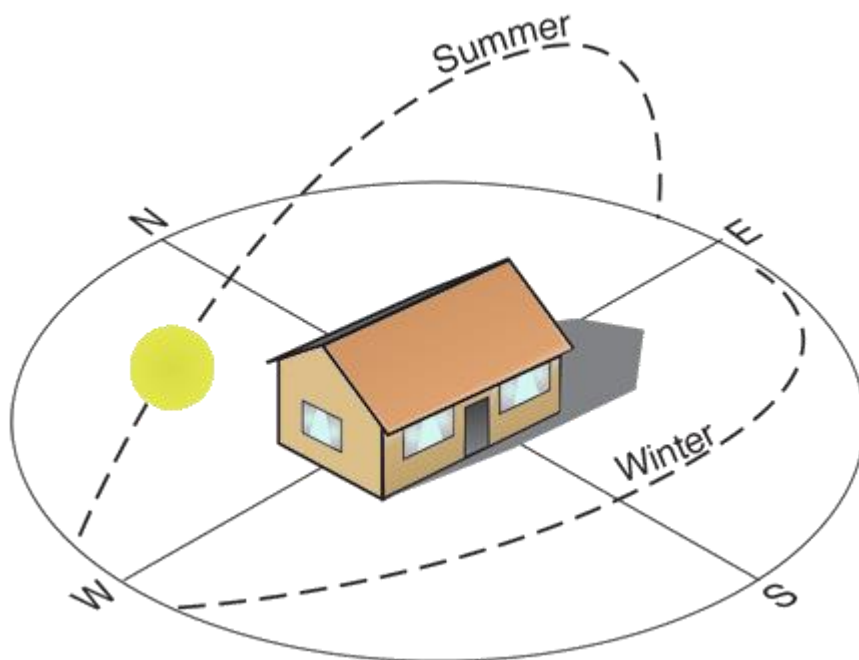


Tilted one-axis tracking system



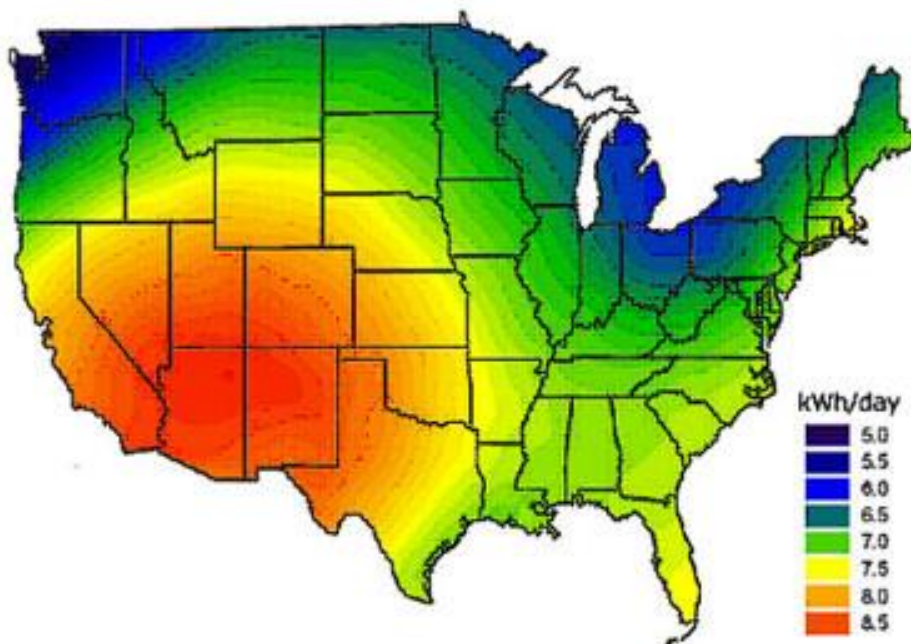
Orientation

Placement with respect to the cardinal directions, N, S, E, W; azimuth is the measure of orientation from north.



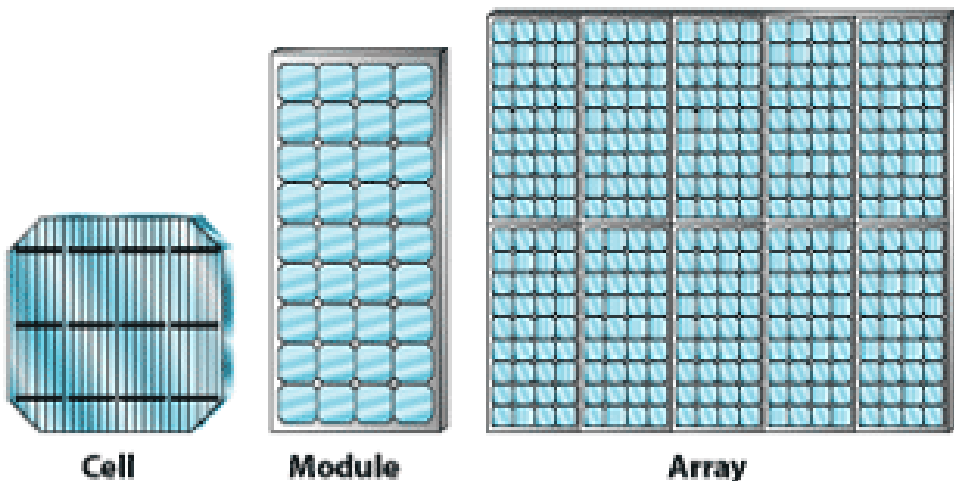
Peak Sun Hours

The equivalent number of hours per day when solar irradiance averages 1,000 w/m². For example, six peak sun hours means that the energy received during total daylight hours equals the energy that would have been received had the irradiance for six hours been 1,000 w/m².



Photovoltaic Cell or Module or Panel (PV)

A device that produces an electric reaction to light, thereby producing electricity.





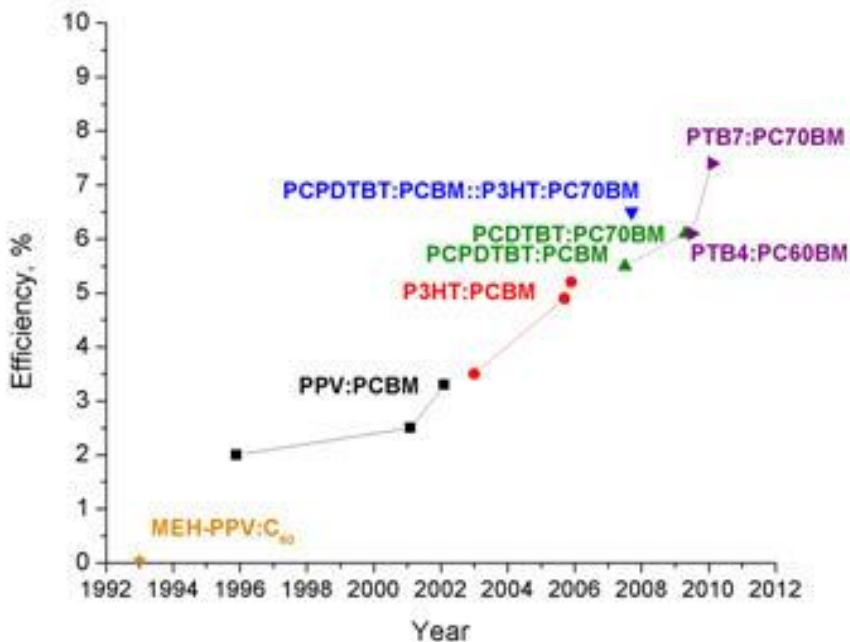
Photovoltaic (PV) Array

An interconnected system of PV modules that function as a single electricity-producing unit. The modules are assembled as a discrete structure, with common support or mounting. In smaller systems, an array can consist of a single module.



Photovoltaic (PV) Conversion Efficiency

The ratio of the electric power produced by a photovoltaic device to the power of the sunlight incident on the device.





Polycrystalline Silicon

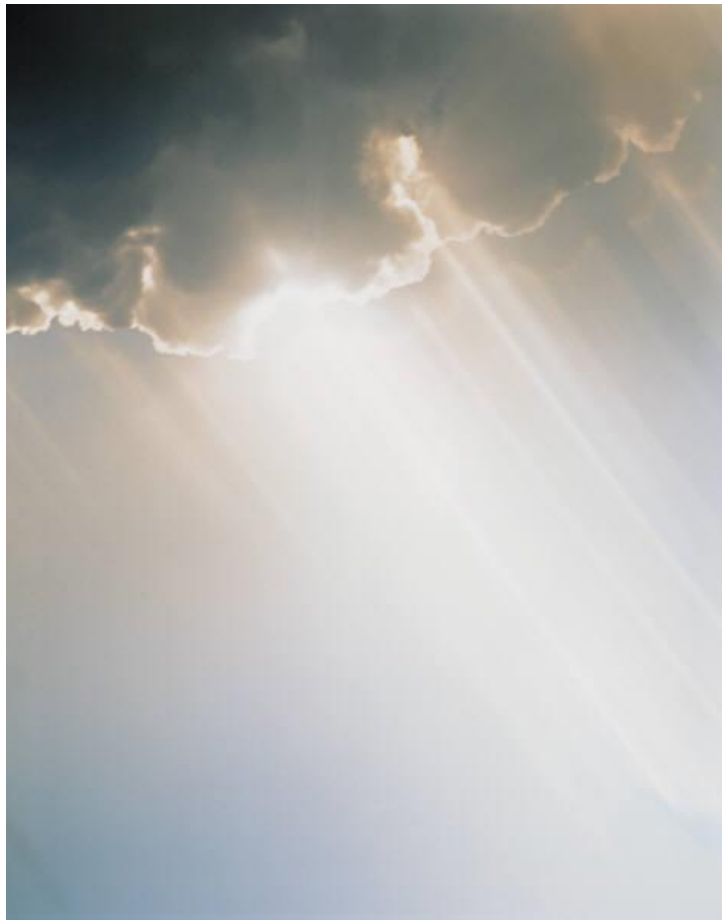
A material used to make photovoltaic cells, which consist of many crystals unlike single-crystal silicon.





Solar Energy

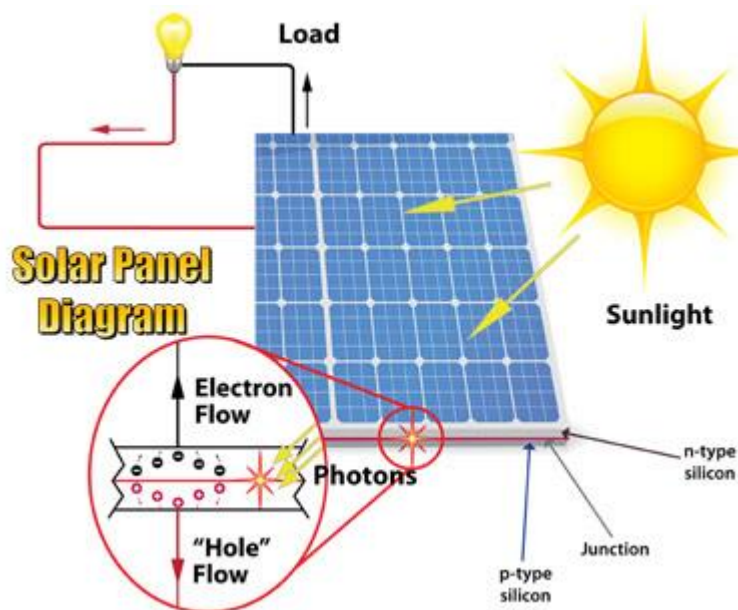
Heat and light radiated from the sun.





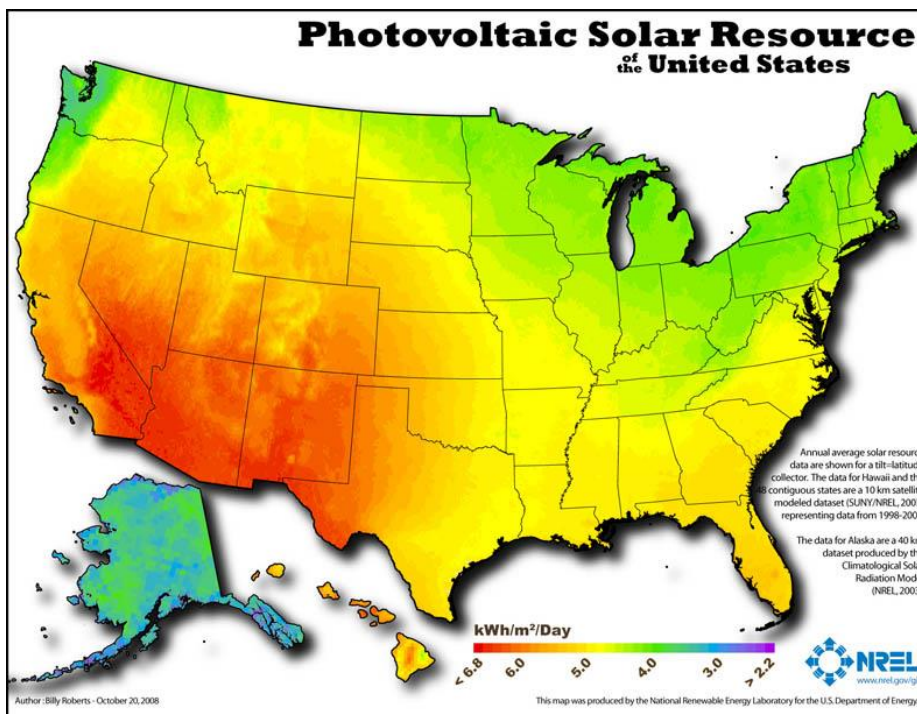
Solar Panel

Devices that collect energy from the sun (solar energy). This is usually solar photovoltaic (PV) modules that use solar cells to convert light from the sun into electricity, or solar thermal (heat) collectors that use the sun's energy to heat water or another fluid such as oil or antifreeze.



Solar Resource

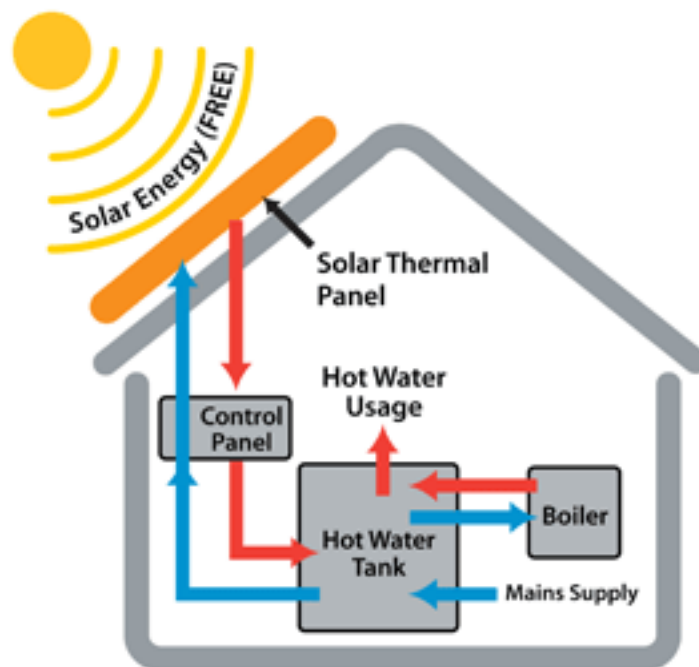
The amount of solar insolation a site receives, usually measured in kWh/m²/day, which is equivalent to the number of peak sun hours.





Solar Thermal

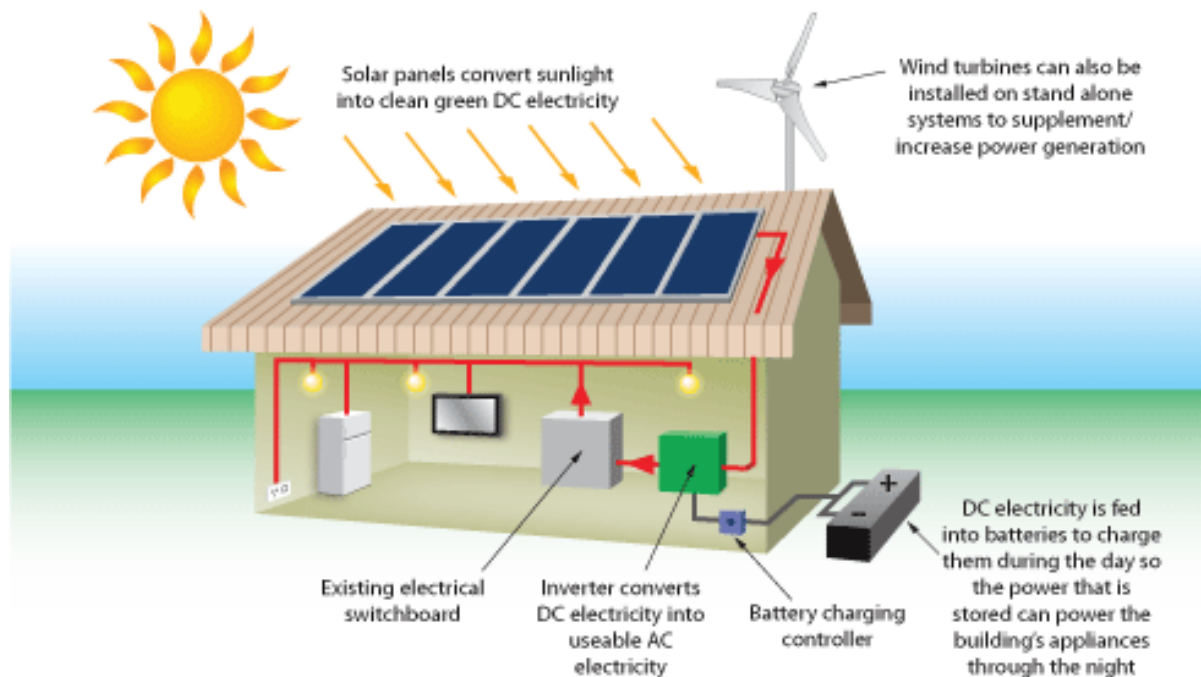
The process of concentrating sunlight to create high temperatures that are needed to heat fluids, like water (solar hot water) or to vaporize fluid to drive a turbine for electric power generation.





Stand-Alone System

An autonomous or hybrid photovoltaic system not connected to a grid. May or may not have storage, but most stand-alone systems require batteries or some other form of storage.





Storage

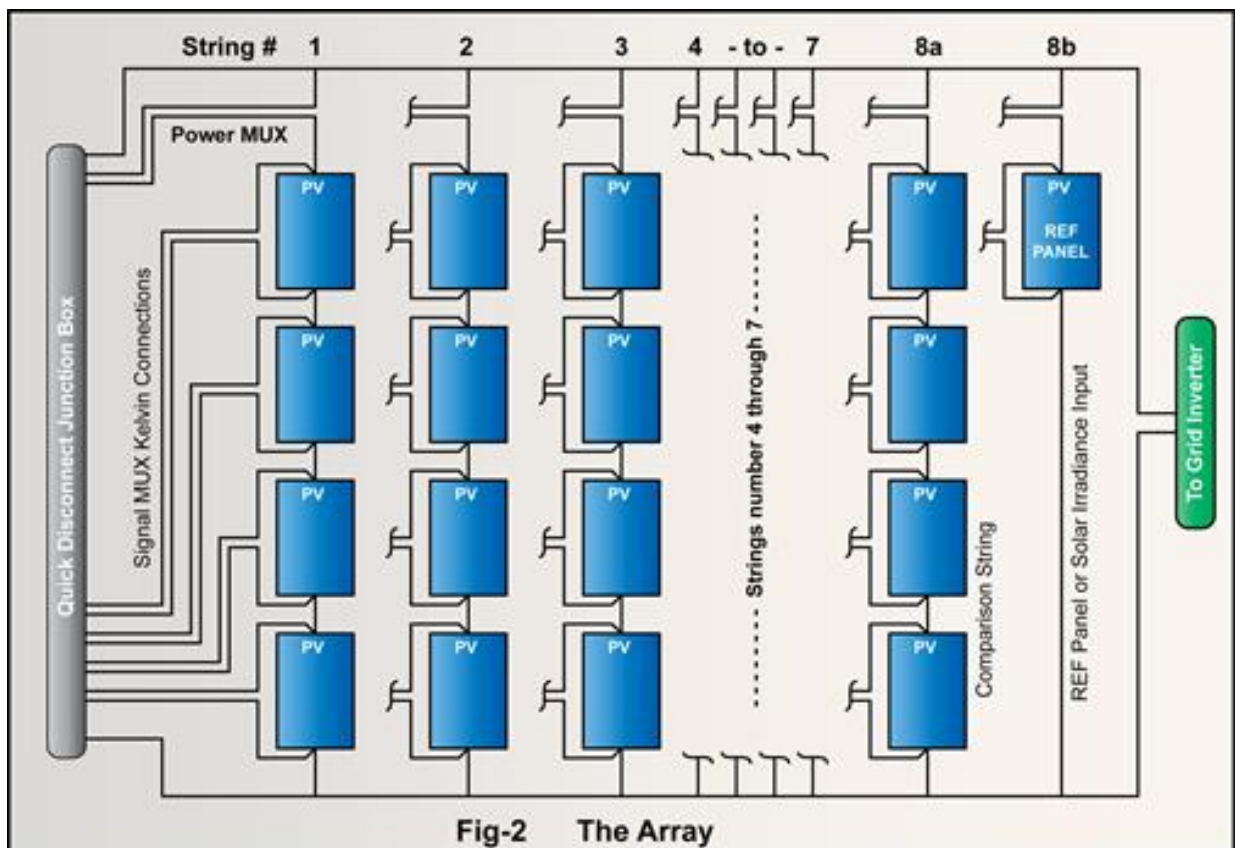
Storage refers to saving surplus electricity produced by a photovoltaic (PV) system. Generally, batteries are used as storage devices.





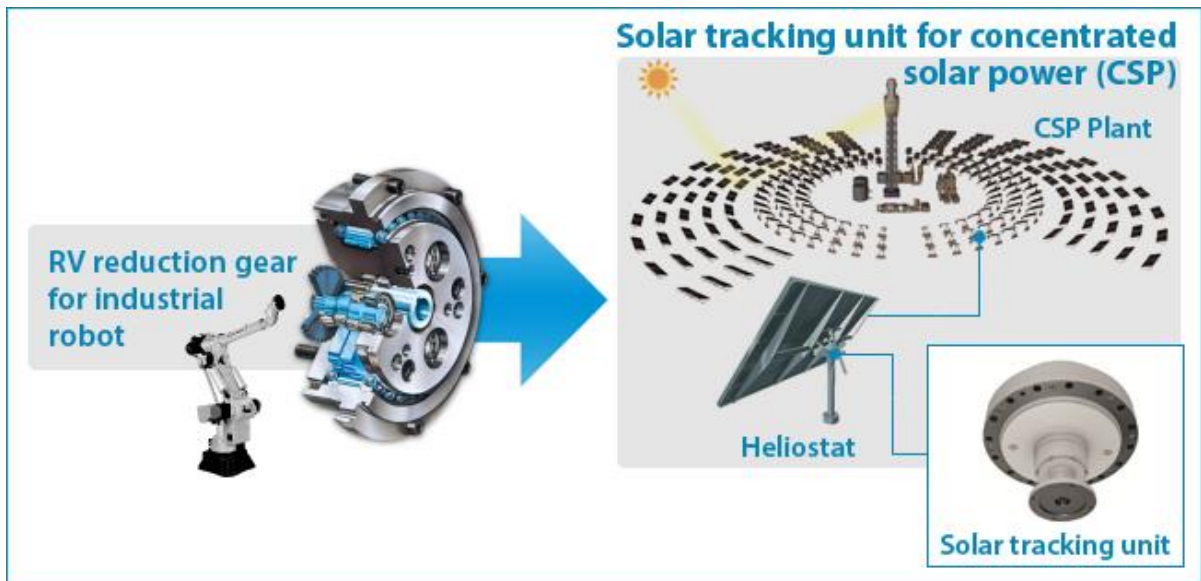
String

A number of photovoltaic modules or panels interconnected electrically in series to produce the operating voltage required by the load.



Tracking Equipment

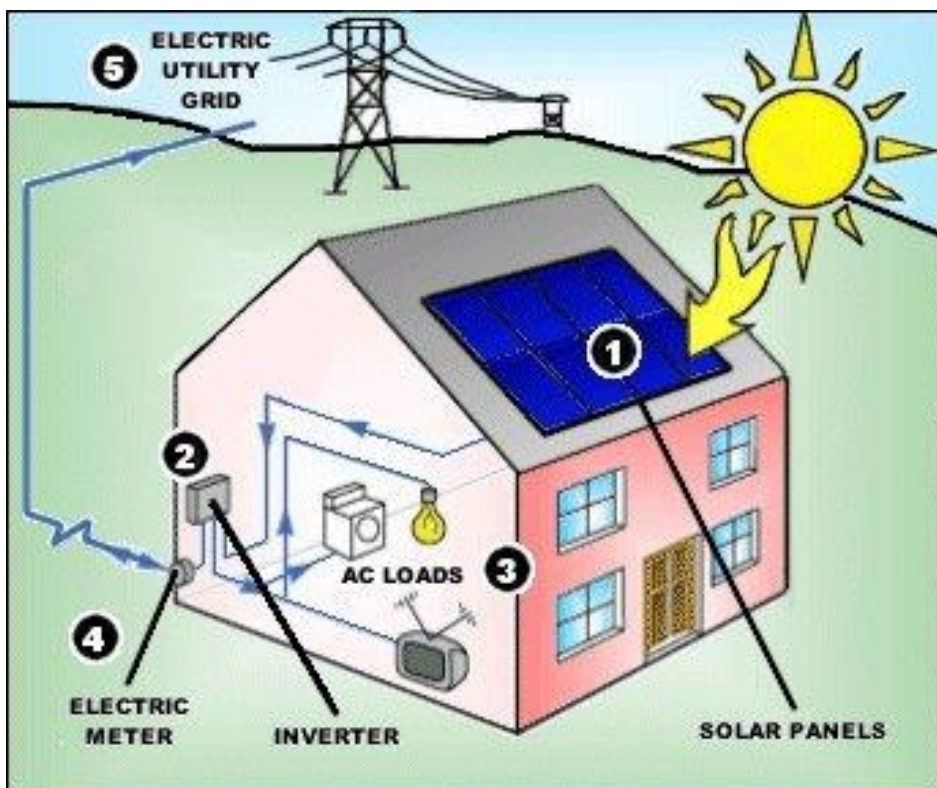
Structure that houses PV modules and that can automatically follow the sun across the sky throughout the day to maximize output.





Utility Grid

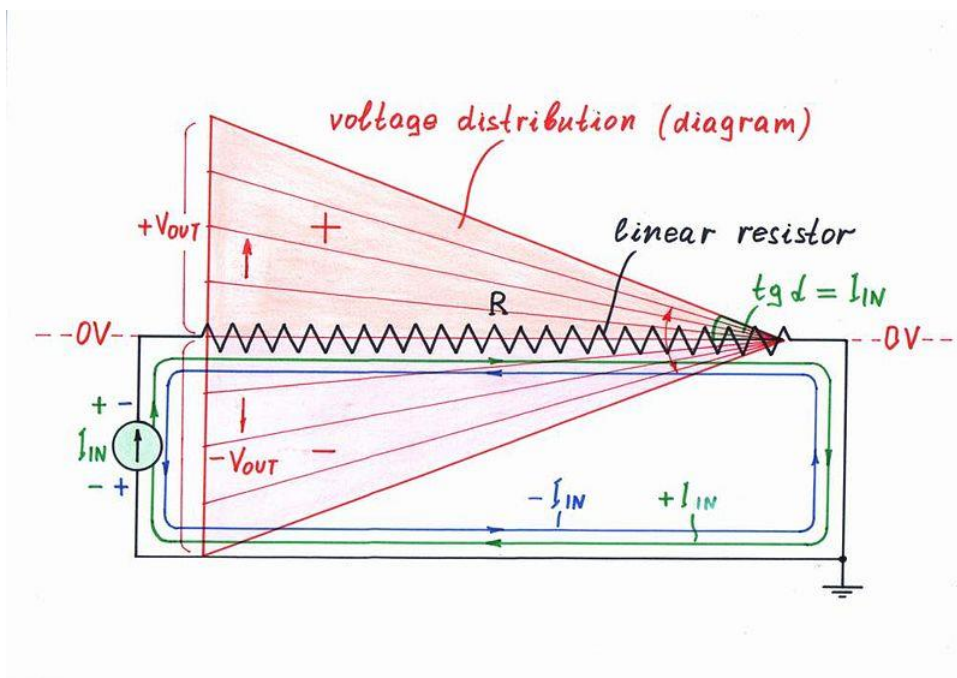
The interconnection of electricity generation plants through the transmission and distribution lines to customers. The grid also refers to the interconnection of utilities through the electric transmission and distribution systems.





Volt (V)

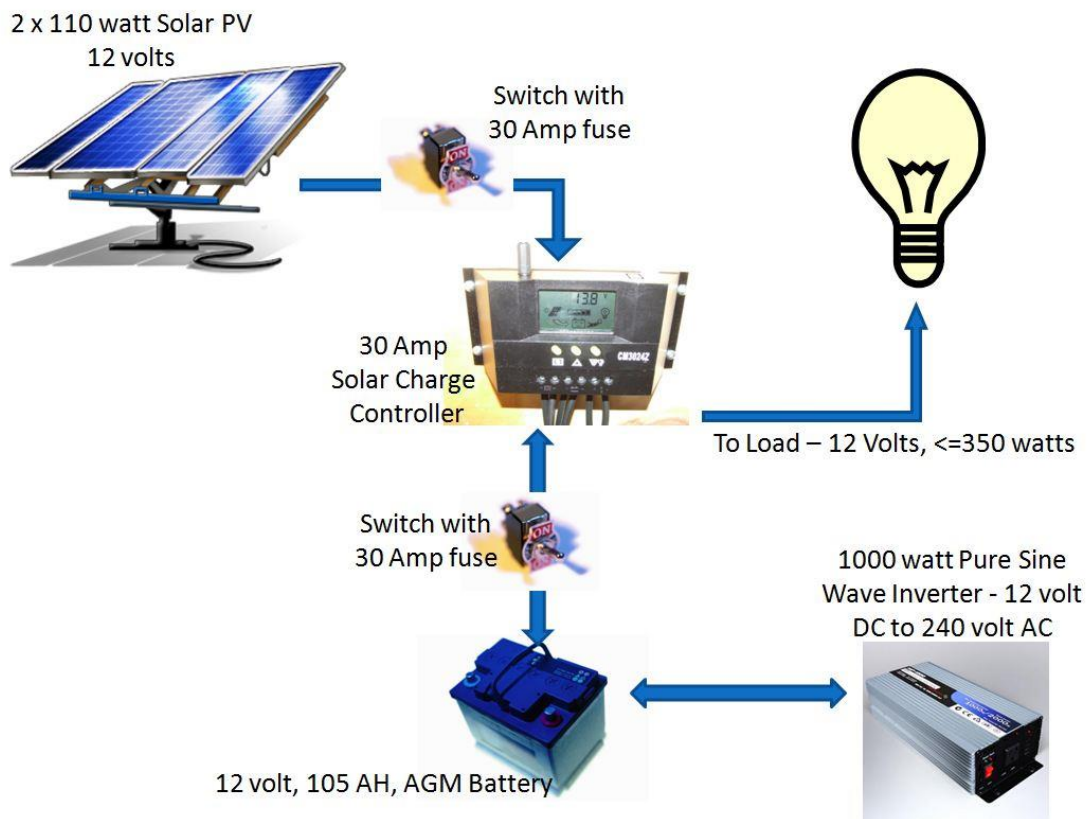
The amount of force required to drive a steady current of one ampere through a resistance of one ohm. Electrical systems of most homes and offices use 120 volts. (volts - watts/amps) (volts = amperes x resistance)





Watt (W)

Electric measurement of power at one point in time, as capacity or demand. For example, light bulbs are classified by wattage. (1,000 watts = 1 kilowatt).





You Finished!

Quick Question...

If all the energy of the sun shining on the Earth's land mass could be harnessed, it would be enough to meet the world's power needs how many times over?

- A. 6 times
- B. 60 times
- C. 600 times
- D. 6000 times



Correct Answer

6000 Times

The sunshine on the Earth's land is estimated to be 120,000 terawatts (trillion watts), or about 6,000 times the world's estimated 20-terawatt electricity demand by 2020.



Clean Footprint is a Solar Development and Finance Company who is passionate about creating a Clean Energy Economy.

“Our goal is to partner with Project Developers across the US keeping the jobs in their home town.”

- **John Kluwin**
Clean Footprint
Managing Partner



Do you have a Solar Project that needs Development or Financing?

Clean Footprint is passionate about its mission to create a “Clean Energy Economy” and YOUR efforts make this possible. Thank you!

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