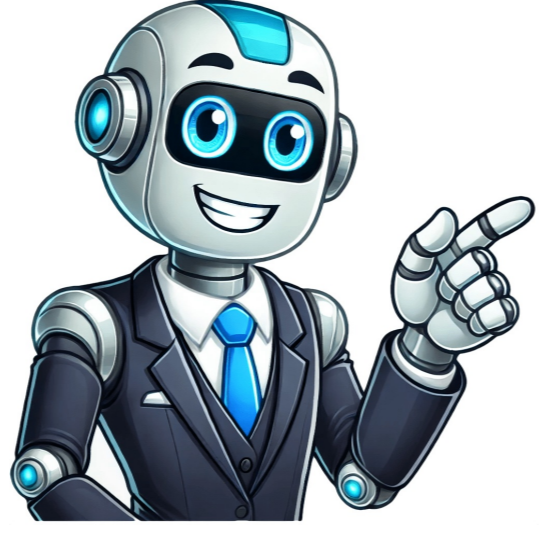


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Solar radiation is an important meteorological variable that determines the amount of "heat" that we will receive from the sun on the earth's surface. Unfortunately, this amount of solar radiation is being altered by climate change and the retention of greenhouse gases.Solar radiation is electromagnetic radiation capable of heating the surface of the ground and objects (including ours) without hardly heating the air.Due to the characteristics of the Earth's atmosphere, solar radiation undergoes specific alterations to pass through it and reach the surface.How much solar radiation is absorbed by the atmosphere?The average intensity of solar energy reaching the top of the atmosphere facing the Sun is about 1,366 watts per square meter (solar constant). This amount of solar irradiance is related to the thresholds of the atmosphere and the plane perpendicular to the incoming solar rays.The atmosphere, in turn, filters the Sun's rays to a certain extent, as does every body, causing:A reflection and a back-scattering of the rays, due to the albedo, to the clouds and atmospheric gases themselves.An absorption that causes an increase in temperature due to emitting radiation in any direction according to Wien's law. However, this absorption is modest in the visible light band, making it transparent to direct solar radiation>About half of the solar radiation that reaches passing through the atmosphere is absorbed by the ground and objects, the other half is reflected back into space, creating a feedback loop that maintains the Earth's temperature at a level that is suitable for life.The atmosphere absorbs infrared radiation thanks to water vapor and CO2. The filtering action of the bands in the ultraviolet wavelengths, mostly lethal, is essential for the development of life.What is the greenhouse effect?The greenhouse effect is a natural and beneficial phenomenon for the Earth system.Certain gases present in the atmosphere retain part of the thermal radiation emitted by the earth's surface after being heated by the sun plus the Earth radiation, keeping the planet's energy budget stable. The radiation budget is crucial to have the temperature at an adequate level for the development of life.However, mass action has increased these gases in the atmosphere mainly carbon dioxide and methanecausing them to retain more outgoing radiation, increasing the planetary temperature. It is what we know as global warming.What is diffuse solar radiation?Diffuse radiation is also called indirect radiation. It depends on the atmospheric conditions.Diffuse radiation represents the portion of solar radiation that has hit at least one particle of atmospheric gases by changing the angle of incidence. Nevertheless, it reaches the ground because it is directed towards it. That's because in de polar regions.Increases relative to total in cloudy skies. In particular, the Rayleigh scattering of the blue component of solar radiation is responsible for the blue color of the sky. Some of the diffuse radiation is back into space.What is incident solar radiation?Incident solar radiation is the amount of solar energy that has encountered any obstacle to which it has delivered all or part of its energy. The energy that does not reach the earth's surface is said to be extinct and is made up of radiation re-emitted, reflected, and backscattered into space.According to Lambert's law, the amount of radiation that hits the unit area is proportional to the incidence angle cosine.The maximum amount of incident solar irradiation is obtained with perpendicular incidence. Since the angle increases, both the surface is affected by the same amount of radiation and the thickness of the atmosphere through which it passes increases, thus creating the daily, annual, and latitudinal variation in solar irradiation.What is the reflection coefficient of solar radiation?The part of incident solar radiation reflected from the earth's surface back into space is called solar radiation reflection coefficient (c). Values of c are generally between 0 and 1 or are expressed as a percentage. It is given by the relationship between the radiant energy reflected from a surface concerning the incident energy. The Earth has an average value of 40% (c = 0.4). At the albedo altitude of the Earth, we add the radiations reflected by atmospheric particles into space.What is absorbed solar radiation?After deducting all the losses due to reflection and backscattering from the atmosphere and the Earth's surface, the remaining incident solar radiation is absorbed by the Earth's surface. It thus varies proportionally to its warming depending on the latitude and the type of surface.Author: Oriol Planas - Technical Industrial EngineerPublication Date: July 8, 2021Last Revision: July 8, 2021Power from the sun is effectively infinite. Its also clean and free. Solar panels turn that sunlight into electricity.How home solar panels and a whole solar system generates electricity we can use can be a little difficult to follow. Fortunately, you dont need to understand how solar panels work to get them installed and start saving money. Heres the step-by-step process of how solar energy works.See how much you can save by going solar with PalmettoWhat Is Solar Energy?Solar energy is the solar radiation emitted from the sun. Earth receives enough of that renewable energy on a daily basis to provide electricity to every user of electricity on the planet. Thats one powerful energy source!Humans have devised several ways to capture solar energy, the most common being the use of photovoltaic (PV) solar panels that convert the sun's rays into usable electricity. Solar panels aren't making or creating the energy, they are just converting it from sunlight to electricity.With that information in mind, here's how solar energy works step by step:Step 1: Solar Panels Capture Solar EnergySolar panels convert solar energy from sunlight into electrical energy. The most common solar panels are made from one of three semiconductors: monocrystalline silicon, polycrystalline silicon, or thin-film solar cells.When sunlight hits the thin layer of semiconductor material, it triggers the release of electrons from silicon atoms. The negatively charged electrons are attracted to the positively charged side of the cell. This photovoltaic effect results in free-flowing electrons within the solar panel. The moving electrons create an electric current which is harnessed by the wiring connected to the solar panels to produce electricity.Solar power systems are carbon-free in their energy production. The lifetime emissions of solar panels, which includes emissions from the manufacturing of panels, is about 12 times less than lifetime emissions from a natural gas plant and about 20 times less than from a coal plant. The more sunlight that reaches the solar panels, the more energy they generate, which means they generate more or less electricity at different times of day and year.A solar installation company should walk you through and help you understand factors ranging from specifics about your property, such as shading and your family's typical power usage, to your climate and geographical location.Solar panels can be tilted to capture the most sunlight at the optimal angle for the best efficiency. Usually, that angle matches your latitude. In the lower 48, that spans from 24.5 degrees in Key West, Florida to 49.2 degrees in Angle Inlet, Minnesota. See how much you can save by going solar with PalmettoStep 2: Solar Inverters Convert DC to ACNext up in our quest to answer How does solar energy work? is a lesson about inverters. Solar panels produce electricity in the form of direct current (DC), which means the electricity flows in only one direction. However, your home appliances use alternating current (AC) electricity, which means the electricity flows in both directions.This means the solar electricity from your panels needs to be converted from DC to AC to make it usable in your home. To convert DC power to AC power, you need an inverter.Its a simple job, but an essential one if you want to use solar energy. Without the inverter, your system would create electricity, but it wouldn't be able to power anything.The type of inverter you use depends upon the size and configuration of your home solar energy system. A simpler system typically uses a string inverter, a single box in a central location near your circuit breaker. More intricate systems use microinverters in which each panel has its own individual inverter. Other inverter options include power optimizers and hybrid inverters, which are more expensive but offer more control over the system and can be used to create a microgrid system that can be used to power your home or even a small business. Step 3: Electrical Panel Distributes ElectricityYour electrical panel distributes electricity throughout your home, whether that's your dishwasher, refrigerator, or energy-efficient heat pump. The circuit breakers in the electrical panel can also cut the current to an electrical circuit in case a fault or surge occurs, to prevent an overload in electrical lines that can cause damage.While your solar panels generate electricity, they typically aren't connected directly to your appliances or other electronic devices. In terms of understanding how solar panels work, they provide electricity to the electrical panel, and your electrical panel separates the power into individual circuits that run to everything in the house.Lastly, electrical panels are also a key component of consumption monitoring. There are devices that can be attached to either the main panel or each individual circuit, allowing you to view more details about your specific energy consumption, which can help you optimize your energy usage over time.See how much you can save by going solar with PalmettoStep 4: Electric Meter Records Consumption and ProductionYour electric meter (sometimes called the utility meter) is the device your utility company uses to measure your electricity consumption. Its how they know what to bill you each month. A traditional electric meter has analog dials that spin as current flows through it, which is why the utility company has someone check your meter in person once a month. Even then, that meter reading is just a summary of your electricity consumption for the month.When you go solar, you consume electricity from your solar panels, which lowers the amount of electricity you consume from the grid. As a result, your electric meter records a lot less consumption, and you save money by not paying for electricity from the utility company. Most homes with solar have a smart meter installed, which records the exact consumption of electricity for your house. Smart meters send real-time usage data to the utility company, which bills you accordingly. Step 5: Solar Energy Powers Your HomeOnce you've installed your solar panels and your electrical panel is connected to the electricity grid (most are), then net metering allows you to get credits from your local utility company for any surplus electricity generation.Your smart electric meter will record energy production in addition to consumption, and when you generate more energy than you need for your home, you can export that power to the grid and earn credits to reduce future electric bills.Step 5: Batteries Store Excess EnergyInstalling solar battery storage can unlock greater long-term benefits of going solar. If your solar panels generate more solar energy than you can use, you can store that extra electricity in a solar battery. That way, you have electricity available to you when the sun goes down or in its rainy day instead of drawing from the electricity grid.Depending on the type, solar batteries can either store excess DC electricity that's produced by your solar panels, or they can be charged by AC electricity that's already been converted by your inverter.Many states and power companies now have incentives for residential customers who send excess power from their solar batteries to the overall electric grid. These programs, called virtual power plants, help spread out when renewable energy can be used on the grid. At times of surplus solar, wind, or other renewable energy production, the excess is stored. When its later added to the grid, those sharing their batteries power with the grid are compensated.Solar battery storage is growing and is expected to continue growing exponentially. The National Renewable Energy Laboratory estimates energy storage will multiply by at least five times from 2020 to 2050.Source: National Renewable Energy LaboratoryWill Solar Energy Work for Your Home?Solar energy at its core is clean, renewable, and sustainable. It's a great option for anyone looking to reduce their carbon footprint and save money on their utility bills. However, there are some factors to consider before deciding if solar is the right choice for your home. Lets explore some of the key considerations: Location: Solar panels need sunlight to generate electricity. Areas with high solar irradiance (more than 4 hours of direct sunlight per day) are ideal. Climate: Solar panels work best in warm, sunny climates. Areas with frequent cloudy days or high humidity may see reduced efficiency. Space: You need enough space to install the solar panels. This could be a rooftop, a ground-mounted array, or a solar carport. Budget: While solar panels can save money in the long run, the initial installation cost can be significant. Incentives: Many governments offer tax credits and rebates to encourage solar adoption. Maintenance: Solar panels require minimal maintenance, but they do need to be cleaned regularly to ensure optimal performance. Environmental Impact: While solar panels are generally considered eco-friendly, the manufacturing process can have some environmental impacts. Recycling programs are being developed to address this. Energy Needs: Consider your household's energy consumption and how solar panels can meet those needs. Backup Power: If you're concerned about power outages, you may want to consider a backup battery system. Conclusion: Solar energy is a promising and sustainable energy source. By understanding the key considerations, you can make an informed decision about whether solar is the right choice for your home. Frequent Asked QuestionsHow do solar panels work?Solar panels convert solar radiation into electricity through a process called the photovoltaic effect. This process involves the use of semiconductor materials that absorb photons from sunlight and convert them into electrical energy. The process is based on the principle of the photoelectric effect, where photons strike the surface of a semiconductor material, causing electrons to be ejected from the material. These electrons then flow through a circuit, creating an electric current. The amount of electricity generated depends on the intensity of the sunlight and the area of the solar panel exposed to it. How long do solar panels last?Solar panels typically last for 25 to 30 years. The lifespan of a solar panel depends on several factors, including the quality of the materials used, the amount of sunlight it receives, and the maintenance it receives. Most solar panels are designed to last for at least 25 years, and many can last for 30 years or more. The warranty for most solar panels is 25 years, which typically covers the materials and workmanship. How much do solar panels cost?The cost of solar panels has decreased significantly in recent years, making them more accessible to a wider range of homeowners. The cost of a solar panel system depends on several factors, including the size of the system, the type of panels used, and the location of the system. On average, the cost of a solar panel system is around \$15,000 to \$25,000. However, the cost can vary significantly depending on the specific needs of the homeowner. Are solar panels worth the investment?Solar panels can be a worthwhile investment for many homeowners. They can help reduce energy costs, increase the value of your home, and provide a sustainable source of energy. The initial investment in solar panels is typically paid back within a few years, and the system can continue to generate electricity for 25 years or more. Additionally, many governments offer tax credits and rebates to encourage solar adoption, which can further reduce the cost of a solar panel system. How do I know if solar panels are right for my home?There are several factors to consider when deciding if solar panels are right for your home. First, you need to ensure that your home receives enough sunlight throughout the day. Second, you need to have enough space to install the solar panels. Third, you need to consider the cost of the system and whether you can afford the initial investment. Finally, you should consider your energy needs and whether solar panels can meet those needs. If you're considering solar panels, it's a good idea to consult with a professional solar installer who can help you evaluate your home's suitability for solar energy.

