Http: www.ei.gov kids energy.cfm? page=solar_home-basics

Http://www. ei. gov/kids/energy. cfm? page= solar_home-basics * The sun has produced energy for billions of years. Solar energy is the sun’s rays (solar radiation) that reach the Earth. This energy can be converted into other forms of energy, such as heat and electricity. * In the 1830s, the British astronomer John Herschel famously used a solar thermal collector box (a device that absorbs sunlight to collect heat) to cook food during an expedition to Africa. Today, people use the sun's energy for lots of things. solar energy can be used to: * Heat water – for use in homes, buildings, or swimming pools * Heat spaces – inside homes, greenhouses, and other buildings * Heat fluids – to high temperatures to operate a turbine to generate electricity * Photovoltaic (PV devices) or “ solar cells" change sunlight directly into electricity. Individual PV cells are grouped into panels and arrays of panels that can be used in a wide range of applications ranging from single small cells that charge calculator and watch batteries, to systems that power single homes, to large power plants covering many acres. Solar Thermal/Electric Power Plants generate electricity by concentrating solar energy to heat a fluid and produce steam that is used to power a generator. In 2011, solar thermal-power generating units were the main source of electricity at 13 power plants in the United States * The amount of sunlight that arrives at the Earth's surface is not constant. It varies depending on location, time of day, time of year, and weather conditions. * Because the sun doesn't deliver that much energy to any one place at any one time, a large surface area is required to collect the energy at a useful rate. Solar Energy Is Everywhere the Sun Shines Solar energy is by far the Earth's most available energy source. Solar power is capable of providing many times the total current energy demand. But it is an intermittent energy source,

meaning that it is not available at all times. However, it can be supplemented by thermal energy storage or another energy source, such as natural gas or hydropower. Concentrating solar power technologies use mirrors to reflect and concentrate sunlight onto receivers that collect the solar energy and convert it to heat. This thermal energy can then be used to produce electricity via a steam turbine or heat engine driving a generator. Another solar generating technology uses photovoltaic cells (PV) to convert sunlight directly into electricity. PV cells are made of semiconductors, such as crystalline silicon or various thin-film materials. Photovoltaics can provide tiny amounts of power for watches, large amounts for the electric grid, and everything in between. Low-temperature solar collectors also absorb the sun's heat energy, but instead of making electricity, use the heat directly for hot water or space heating in homes, offices, and other buildings. Covering 4% of the world's desert area with photovoltaics could supply the equivalent of all of the world's electricity. A photovoltaic cell, commonly called a solar cell or PV, is the technology used to convert solar energy directly into electrical power. A photovoltaic cell is a nonmechanical device usually made from silicon alloys. Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum. When photons strike a photovoltaic cell, they may be reflected, pass right through, or be absorbed When the electrons leave their position, holes are formed. When many electrons, each carrying a negative charge, travel toward the front surface of the cell, the resulting imbalance of charge between the cell's front and back surfaces creates a voltage potential like the negative and positive terminals of a battery. When the two surfaces are connected through an external load,

such as an appliance, electricity flows. The photovoltaic cell is the basic building block of a photovoltaic system. Individual cells can vary in size from about 0. 5 inches to about 4 inches across. However, one cell only produces 1 or 2 watts, which isn't enough power for most applications. To increase power output, cells are electrically connected into a packaged weather-tight module. Modules can be further connected to form an array. The performance of a photovoltaic array is dependent upon sunlight. Climate conditions (such as clouds or fog) have a significant effect on the amount of solar energy received by a photovoltaic array and, in turn, its performance. The success of PV in outer space first generated commercial applications for this technology. The simplest photovoltaic systems power many of the small calculators and wrist watches used every day Some advantages of photovoltaic systems are: 1. Conversion from sunlight to electricity is direct, so that bulky mechanical generator systems are unnecessary. 2. PV arrays can be installed quickly and in any size. 3. The environmental impact is minimal, requiring no water for system cooling and generating no by-products. The first practical photovoltaic (PV) cell was developed in 1954 by Bell Telephone researchers examining the sensitivity of a properly prepared silicon wafer to sunlight. . PV cells were next widely used for small consumer electronics like calculators and watches and to provide electricity in remote or " off-grid" locations were there were no electric power lines. U. S. shipments (includes imports, exports, and domestic shipments) of PV cells and panels by U. S. industry in 2010 was the equivalent of about 2, 644 Megawatts, about 200 times greater than the shipments of about 13 Megawatts in 1989. Solar thermal power plants use the sun's rays to heat a fluid to very high temperatures. The fluid is then circulated through pipes so

it can transfer its heat to water to produce steam. The steam, in turn, is converted into mechanical energy in a turbine and into electricity by a conventional generator coupled to the turbine. So solar thermal power generation works essentially the same as generation from fossil fuels except that instead of using steam produced from the combustion of fossil fuels, the steam is produced by the heat collected from sunlight. A parabolic trough collector has a long parabolic-shaped reflector that focuses the sun's rays on a receiver pipe located at the focus of the parabola. The collector tilts with the sun as the sun moves from east to west during the day to ensure that the sun is continuously focused on the receiver. The plant is usually designed to operate at full power using solar energy alone, given sufficient solar energy. However, all parabolic trough power plants can use fossil fuel combustion to supplement the solar output during periods of low solar energy, such as on cloudy days. A solar dish/engine system uses concentrating solar collectors that track the sun, so they always point straight at the sun and concentrate the solar energy at the focal point of the dish. A solar dish's concentration ratio is much higher than a solar trough's, typically over 2, 000, with a working fluid temperature over 1380°F. The engine in a solar dish/engine system converts heat to mechanical power by compressing the working fluid when it is cold, heating the compressed working fluid, and then expanding the fluid through a turbine or with a piston to produce work. A solar power tower, or central receiver, generates electricity from sunlight by focusing concentrated solar energy on a tower-mounted heat exchanger (receiver). This system uses hundreds to thousands of flat, sun-tracking mirrors called heliostats to reflect and concentrate the sun's energy onto a central receiver tower. Power towers

must be large to be economical. This is a promising technology for large-scale grid-connected power plants. Power towers are in the early stages of development compared with parabolic trough technology. * a 5-Megawatt, two-tower project, built in the Mojave Desert in southern California in 2009 * a 390-Megawatt, three-tower project being built in the Mojave Desert * a 110-Megawatt project located in Nevada * * * Solar thermal (heat) energy is often used for heating water used in homes and swimming pools and for heating the insides of buildings (" space heating"). Solar space heating systems can be classified as passive or active. Passive space heating is what happens to your car on a hot summer day No mechanical equipment is needed for passive solar heating. Active heating systems require a collector to absorb and collect solar radiation. Fans or pumps are used to circulate the heated air or heat absorbing fluid. Active systems often include some type of energy storage system. Nonconcentrating collectors – The collector area (the area that intercepts the solar radiation) is the same as the absorber area (the area absorbing the radiation). Flat-plate collectors are the most common type of nonconcentrating collector and are used when temperatures below about 200°F are sufficient. They are often used for heating buildings. There are many flat-plate collector designs but generally all consist of: * A flat-plate absorber that intercepts and absorbs the solar energy * A transparent cover(s) that allows solar energy to pass through but reduces heat loss from the absorber * A heat-transport fluid (air or water) flowing through tubes to remove heat from the absorber, and a heat insulating backing Concentrating collectors – The area intercepting the solar radiation is greater, sometimes hundreds of times greater, than the absorber area. Using solar energy produces no air or water pollution and no

greenhouse gases, but does have some indirect impacts on the environment. For example, there are some toxic materials and chemicals, and various solvents and alcohols that are used in the manufacturing process of photovoltaic cells (PV), which convert sunlight into electricity. Small amounts of these waste materials are produced. large solar thermal power plants can harm desert ecosystems if not properly managed. Concentrating solar systems may require water for regular cleaning of the concentrators and receivers and for cooling the turbine-generator. Using water from underground wells may affect the ecosystem in some arid locations. http://www. makeitsolar. com/solar-energy-information/ Solar energy has been used by humans for thousands of years. The discovery of photovoltaics happened in 1839 when the French physicist Edmond Becquerel first showed photovoltaic activity. . In 1921 Einstein received the Nobel Prize for his theories on the photoelectric effect. Solar cells of practical use have been available since the mid 1950’s when AT&T Labs first developed 6% efficient silicon solar cells. The first long-term practical application of PV cells was in satellite systems. In 1958 the Vanguard I, was launched into space Photovoltaic silicon solar cells provided the electrical power to the satellite until 1964 when the system was shut down. . The sun provides endless nonpolluting energy to the satellite power systems and demand for solar cells has risen as a result of the telecommunications revolution and need for satellites. The energy crisis and oil embargos of the 1970’s made many nations aware of their dependency on controlled non-renewable energy sources and this fueled exploration of alternative energy sources. An economic breakthrough occurred in the 1970's when Dr. Elliot Berman was able to design a less expensive solar cell bringing the price

down from $100 per watt to $20 per watt. The Sun is a big ball of heat and light resulting from nuclear fusion at its core. The nuclear reaction releases energy that travels outward to the surface of the Sun. . A solar panel is used to collect heat. The heat is transferred to pipes inside the solar panel and water is heated as it passes through the pipes. The hot water, heated by the Sun, can then be used for showers, cleaning, or heating your home. When we say something is solar powered, we mean that the energy it uses for power came directly from solar energy or sunlight energy. The sun provides Earth with 2 major forms of energy, heat and light. By slanting windows in a house and facing them to the south you can control the heat energy that enters the house There are vehicles that run on solar power. Some have PV panels as a direct power source that convert light energy into electricity to power their motors. Since those cars will not run when the sun is not available it is more practical to have a car powered by batteries that can be recharged with solar energy. Solar panels collect heat energy from the sun. We call this heat solar thermal energy. A simple example of a solar panel is a closed box with a top made of a transparent material such as glass or plastic. The sun shines through the glass and heats up the inside of the box. This is the same type of heating that happens to the inside of a car when it sits in the sun. In some cases the inside of the box is painted black so that it absorbs more heat. The heat that is collected inside the box can then be used for several purposes. The most common uses for solar panels is to heat air or water. A system that uses solar thermal energy to heat air is not complex. A transparent top is attached to a box. The box has an inlet pipe for cool air. The cool air can be pushed into the box using a fan. The cool air moves through the inlet pipe into the box. Inside the box the air is

warmed by the heat energy from the sun rays. Solar cells are devices which convert solar light energy directly into electricity and function by the photovoltaic effect. Photo- means light and -voltaic means electrical current or electricity (light-electricity). Solar cells can even be used to charge rechargeable batteries so that electricity can be stored for later use when the sun is not available. Solar cells provide DC electricity similar to batteries however, batteries differ because they operate through a process known as an electrochemical reaction. When you hook up a motor to the battery, also known as a load, the reaction begins and electrons flow as shown in the picture: " Battery Circuit". Direct current (DC electricity) is different from the alternating current (AC electricity) that is used to power the TV, refrigerator, and other appliances in your home however, DC can be converted to AC when needed. Sunlight contains packets of energy called photons that can be converted directly into electrical energy. You can’t see the photons but they hit the cell and produce free electrons that move through the wires and cause an electrical current . A greater amount of light available means a greater amount of photons are hitting your solar cell and the more power you get from it. www. solarenergy. com Many, if not most people, when they hear the term 'solar energy' or 'solar power', will think of 'PV' or Photo-Voltaic panels — those shiny things on house roofs that make electricity. The origins of mankind's use of the sun's energy go back to the beginnings of our development as a species, but for the purposes of this site we will concentrate on technological developments of the last few decades, and more specifically what's available today! Without a doubt, fossil fuels have a limited quantity, whether we're talking a few decades or a few hundred years, the inevitable dead-end of burning oil, coal & gas is there

Like the computer industry during the 80’s and 90’s, the solar industry is going through huge and rapid change and development on a worldwide basis. Today’s solar installations are very efficient and have a long life expectancy. Solar hot water, solar HVAC, solar electric - all these and more can be implemented in military bases around the world. Sunworks Solar have been in solar since 1973 and are an experienced military and commercial installer. Solar Heating, Ventilation and Air Conditioning systems are a relatively recent development, with a vacuum tube solar collector to super-heat the liquid refrigerant, thus taking the workload off the compressor and cranking the air conditioning unit up to an astonishing 32 SEER when the sun is shining Sunbeam is a brand previously owned by Chrysler, and now offer a line of electric cars & vans — ideal for use on base with up to 100 miles range. Although using the sun's energy is an idea that has been around since mankind evolved, it can be argued that the solar industry as we know it today grew out of a demand for energy alternatives after the oil embargo of the early 1970's. Book * The needs for people only account for . 1% of the suns total power * Enough sunlight reaches Earth each minute to meet the world energy demand for a year * When photons strike a solar cell some photons are reflected off the solar panel, some pass through the solar panel and some are absorbed, only the absorbed energy is turned into electricity * When a cell absorbs enough sunlight, the photons release electrons. The electrons move to the surfaces of the cell. The negative electrons on the cell create an in balance between the front and back surfaces. When the two surfaces of the cell are connected by an external piece of electricity flows. This phenomenon, called the photovoltaic effect is what makes solar electric

power. Jones, Susan. The Library of Future Energy: Solar Power of the Future. New York, The Rosen Publishing Group, Inc