FLS ENERGY
YOUR SOLAR EXPERTS

Solar Facts, Terminology, and Frequently asked questions:

Alternating Current (AC): The electricity used in households is AC, or Alternating Current. AC electricity changes voltage periodically, typically 60 times a second.

Active Solar: technology that uses electrical or mechanical equipment to convert solar energy into usable light, heat, cause air-movement for ventilation or cooling, or store heat for future use.

Back up energy system: An uninterruptible power supply (UPS), also known as a battery backup, provides emergency power and, depending on the topology, line regulation as well to connected equipment by supplying power from a separate source when utility power is not available

BTU (British thermal unit): a unit of heat equal to the amount of heat required to raise one pound of water one degree Fahrenheit at one atmosphere pressure; equivalent to 251.997 calories.

Collector Efficiency: The ratio of usable heat energy extracted from a collector to the solar energy striking the cover.

DC Current: an electric current that flows in one direction steadily. DC is produced by solar cells.

Drain Back Solar Thermal Syst.: a closed loop solar thermal system in which the fluid in the solar loop drains into tanks when the system is not in use.

Electrical Grid: interconnected network for delivering electricity from suppliers to consumers.

Energy Audit: an inspection, survey and analysis of energy flows for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output(s).

Fixed Tilt Array: a set (array) of solar power collectors that do not pivot to follow the track of the sun in the sky. In the Northern Hemisphere, they are usually mounted with a southern tilt that will maximize the amount of energy that they can receive.

Flat Plate Collector: a solar power collector that absorbs the sun's energy on a flat surface without concentrating or refocusing it.

Grid-Tied System: a solar electric system that sends the energy it produces back to a utility company's electrical grid.

Heat Exchanger: A device designed to transfer heat between two physically separated fluids or mediums of different temperatures.

Interconnection: refers to the technical and practical aspects of connecting the solar generator to the grid. This includes the DC to AC power inverter, disconnect switches, distribution panel, and meter.

Inverter: a device that changes DC power at its input into AC power at its output. Also called a power converter.

Kilowatt (kW): a unit of power equal to 1000 watts

Kilowatt Hour (kWh): a unit of energy equal to the work done by a power of 1000 watts operating for one hour

Megawatt (mW): a unit of power equal to one million watts

Megawatt Hour (mWh): a unit of energy equal to the work done by a power of 1,000,000 watts operating for one hour

Monocrystalline: a crystalline solid in which the crystal lattice of the entire sample is continuous and unbroken to the edges of the sample, with no grain boundaries.

North American Board of Certified Energy Practitioners (NABCEP): an organization that is committed to providing a certification program of quality and integrity for the professionals and consumer/ public it is designed to serve.

National Electrical Code (NEC): a United States standard for the safe installation of electrical wiring and equipment.

Net Metering: A practice used in conjunction with a solar electric system where your electric meter tracks your net power usage, spinning forward when you use electricity from the utility, and spinning backward when your system is generating more electricity than you need.

Passive Solar: technologies are means of using sunlight for useful energy without use of active mechanical systems.

Photovoltaic: refers to a technology which uses a device (usually a solar panel) to produce free electrons when exposed to light, resulting in the production of a DC electric current.

Photovoltaic Cell: An electric cell made from two layers of different materials that can produce an electric current when light shines on the cell.

Pressurized Solar Thermal System: a closed loop solar thermal system in which the fluid in the solar loop is always pressurized and present in all parts of the loop.

Renewable Energy: energy generated from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are naturally replenished.

Renewable Energy Credits (RECs): represent the environmental and economic value of electricity produced from clean, renewable, emission-free energy resources that are safe for our environment and will never be depleted. RECs hold real and quantifiable economic value and act like a form of currency that allows the environmental attributes of renewable energy generation to be separated from the electricity commodity and to be sold as a separate product.

Retrofit: The application of a solar energy technology to an existing building

Silicon (Si): a tetravalent non-metallic element; next to oxygen it is the most abundant element in the earth's crust; occurs in clay, feldspar, granite, quartz and sand; used as a semiconductor in transistors, such as photovoltaic cells.

Solar Array: a grouping of multiple solar panels

Solar Energy: energy from the sun that is converted into thermal or electrical energy

Solar Thermal: a technology for harnessing solar energy for thermal energy (heat).

Thin Film: employ materials such as amorphous silicon (a-Si, still silicon, but in a different form), cadmium telluride (CdTe) and copper indium (gallium) diselenide (CIS or CIGS). These materials have high light absorbency and a much thinner layer of material is required.

Watt: a unit of power equal to 1 joule per second; the power dissipated by a current of 1 ampere flowing across a resistance of 1 ohm

Frequently Asked Questions:

How much solar would it take to run my whole house? It all depends on the energy load of your home. First, look at your energy bill to determine how many kilowatt hours of energy you use each month. Next, using the assumption that a 1 kilowatt solar electric system will produce approximately 120 kilowatts hours of electricity a month, you can estimate the size system to "run" your home. For example if you use 1200 kilowatt hours a month you need a 10 kW system.

How much does solar cost? Domestic solar hot water systems range in cost from $5500 to $9000 installed depending on the number of people in your home (1-5). Solar electricity has a much wider range of costs due to the varying energy loads of homes. Economies of scale also makes a big difference in cost. In other words a 1kW system might be $11 per watt or $11,000 while a 9kW system might cost might be $8.00 per watt or $72,000.

Where do I start? The first step is conservation. Every dollar spent on conservation can save you $7 in Solar Photovoltaic costs. A well insulated house, compact fluorescent lighting and Energy Star appliances are just a few of the steps a homeowner can take in reducing their energy load. If you have a limited budget for renewable energy start by installing a solar hot water system. Next to conservation, there is no more cost effective and environmentally significant step a homeowner can take. After reducing your energy load and installing a solar hot water system, a solar professional can help you size a Photovoltaic system which would best meet yours goals and budget.

Are there any incentives for purchasing renewable energy? State and federal tax incentives can make a substantial difference in the cost of solar for homeowners and businesses. In North Carolina a tax credit of up to $1400 exists for solar hot water, up to $3500 for solar space heating, and up to $10,500 for solar electricity. The Federal tax credit is a straight 30% of the cost of the system. An example would be; a $40,000 PV system would qualify for a $10,500 state tax credit and a $12,000 federal tax credit, for a combined total of more than half the system cost. Commercial installations qualify for a straight 35% NC state tax credit and 30% federal tax credit with additional tax depreciation benefits which make the systems very cost effective. Some states other than North Carolina have tax credits and you can view those credits by going to the Tax Credits section of our website.

Are there new technologies coming out soon that will make solar less expensive? Solar increases in efficiency and decreases in cost have always been incremental. We all hope that there will be a technological breakthrough which will make solar affordable for every homeowner, but those technologies may take some time to come to market. The best bet is to implement cost effective solutions for your home such as Solar Hot Water and if your budget allows an expandable PV system and as new technologies become available they can be added to your system to make you truly energy independent.

How do I pick a solar contractor? Track record. As with any industry, do your homework. The best indicator of the work that will be done for you as a customer is the work that has been done in the past by the solar contractor. Check references, training and certifications. NABCEP (National Association of Board Certified Energy Practitioners) is a nationally recognized certification for solar installers and is a good indicator of the quality of work that your solar contractor will provide.

Will solar energy work on my roof? A solar energy system can be installed on a variety of roof surfaces including metal, composite, shingle, membrane and a variety of others. Solar panels are mounted in a southern orientation to gain the most solar energy production. East and west facing roofs will produce less energy; however, west facing roofs produce more energy during “peak” times when the power can be worth more money and might be advantageous to utility customers with time of use charges. FLS Energy recommends clients with older roofs redo their roofs in conjunction with the solar installation.

How much does a solar energy system weigh? Solar panels and the associated piping or wiring add very little weight to a roofing structure. A solar thermal panel will add only about 4 to 5 pounds per square foot to a roof structure while a solar electric (photovoltaic) panel adds even less. Storage tanks for a solar hot water system can add significant weight to a roof and if the roof structure cannot support the additional load a variety of storage options are available including ground floor locations, enclosed outbuildings or buried storage tanks.

How does solar energy help the environment? Your system will reduce the demand on existing fossil-fuel power plants and help reduce the need to build new facilities. Both solar hot water and electricity systems greatly reduce the CO_2 emissions that individual homes or companies produce. Whether your concern is reducing asthma producing particulates in your local town or reducing CO_2 emissions globally, solar represents one of the cleanest and most abundant forms of energy available.

How does solar electricity work? The sun’s energy in the form of photons release electrons from their bonds in the silicon semiconductors that make up the solar cells. The flow of these electrons makes up the current that will ultimately be utilized in your home or building. The inverter

in a solar electricity system takes the electricity and converts it, which comes from the solar panel in a DC current, into an AC current which can then be used in your home or business.

What is solar thermal? Solar thermal systems (also called solar hot water) heat hot water for domestic hot water use. Solar thermal installations involve the placement of solar collectors on a roof top or suitable location. These panels include an insulated copper piping system. As the heat transfer fluid (food grade antifreeze or glycol) runs through the pipes it is heated by the sun and then is transferred to the domestic water supply through a heat exchanger. Solar hot water is the number one step, next to conservation, a business or homeowner can take to help our country move towards a renewable energy future (according to the NC State Energy Office).

What if there are clouds or no sun? All solar energy systems and their energy outputs are based upon long term weather data for the area in which the system is being installed. The solar hot water or electricity system is installed independently of the buildings normal water heating or electrical systems. When the sun is not shining the buildings backup water heating and electrical systems operate at normal levels. When the sun is shining, solar replaces the fossil fuel produced power with a clean and renewable source of energy. The amount of energy replaced depends upon the size of the solar energy system installed.

How do I know how much hot water or electricity I use? Electricity use is a very simple number to determine by looking at your utility bills and figuring out the number of kilowatt hours consumed per month. Solar hot water use can be a little more complicated to determine. For a household, the first 2 people in a home each use approximately 20 gallons of hot water per day and each additional person uses 15 gallons. Commercial and industrial use can be determined through a combination of determining factors such as a percentage of overall water usage, industry standards (hotels have a per person estimate), flow rates (metering of domestic hot water usage), or original design estimates of hot water usage. In most cases, actual hot water usage will be determined through a combination of data sources and system size will be designed to meet 60% to 80% of that usage.

How is solar energy stored? Solar hot water is stored in tanks which range in size from a normal residential hot water tank (40 gallons) to industrial tanks which can be as much as 2000 gallons. Storage of hot water is one of the most important considerations when installing a solar hot water system. If you do not have enough storage then the BTU's produced by the solar hot water system will be wasted. The storage for a hot water system is calculated based upon the number and size of the solar hot water panels.
Solar electricity can be either stored in batteries or sent back into the power grid. Batteries can be a great solution when a power grid is not available or a facility is isolated. The size and number of batteries needed is determined by the size of the system, the amount of power produced and the days of power needed before the solar electric panels need to recharge the batteries. Unless a client has a strong desire to be disconnected from the power grid, FLS Energy recommends a grid tied system due to the additional cost and maintenance of a battery back-up system.

What is the difference between solar hot water and solar electricity? Solar electric panels and solar hot water panels are two separate technologies and independent systems. Solar electricity can be used to operate the small pumps needed to operate a solar hot water system, but the panels themselves either produce hot water or electricity, not both. Solar hot water is produced by circulating a fluid through the solar collector panels and then transferring the heat absorbed in the fluid into the domestic hot water system. Solar electricity is made by converting sunshine into an electric current which is converted into AC electricity and used in your home or business.

Which is more cost effective, solar hot water or solar electricity? Solar hot water is the most cost effective solar energy solution available (NC State Energy Office). Using the available tax credits (individual state tax credits vary), Renewable Energy Credits, and energy offsetting, a solar hot water system can pay for itself in 3 – 7 years and a solar electricity system can pay for itself in 5 – 15 years (commercial systems fall in the lower part of the range due to additional tax and depreciation benefits available).

Do I have to change the way I live after I install solar hot water? No. Every solar hot water system FLS Energy installs has a backup to ensure that there is always hot water available. However, changing your habits, such as doing the laundry at noon on a sunny day, will enable the system to optimize performance and limit the amount of backup hot water that has to be produced.

What is the proper orientation of a solar panel? Solar collectors should be mounted on an un-shaded section of a south facing roof. The panels can face up to 45 degrees east or west without a significant loss in energy production. If aesthetics are a concern on a sloping roof, mounting the panels parallel to the roof plane is recommended. Usually a pitch of greater than 4 inches in 12 is sufficient to ensure year round solar production. On flat roofs, the panels can be tilted to an angle roughly equal to the latitude of the area where the system is being installed (NC is at a latitude of 35 degrees). This angle ensures year round production while compensating for the lower level of the sun in the winter months.

How much maintenance does a solar energy system require? Solar electric systems are for the most part, maintenance free. We do recommend a yearly check to ensure the system is operating properly and depending on the area, a periodic cleaning of the panels can be beneficial. A solar electric system should still be producing 80% of the panel's rated power after 25 years and can last 40 to 50 years.
Solar hot water systems have an expected lifespan of 25 or more years. Just as a plumbing system in a home or business may need periodic maintenance, solar hot water systems may need to have some electronics, pumps, or storage tanks repaired or replaced over time.

Should I wait for more efficient solar technologies? Solar hot water is an extremely efficient and cost effective solution for both homeowners and businesses. With incentives, a commercial hot water system can pay for itself in as little as 3 years and last for 30. The technology is proven and reliable. Advances in efficiency for solar electricity have been incremental and though a technological leap is possible, the most likely scenario will be continued incremental advancements. With the combination of incentives through state and federal agencies, renewable energy credits, and depreciation there has never been a better time to purchase a solar electricity system. Also, a solar electric system can be expanded over time and as advancements are made new solar panels can be added to increase the overall efficiency of the total system.