GLOSSARY

Air Mass (AM): A dimensionless quantity, the ratio of the actual path length of radiation through the atmosphere, to the vertical path length of radiation through the atmosphere to sea level. For all but very high zenith angles (the angle subtended by the zenith and the line of sight to the sun),

AM = secfz, at sea level

AM 0 indicates that the sunlight has not passed through the atmosphere, about 136 MW/cm2. AM1 indicates that the sunlight has passed through one vertical atmospheric thickness with the attendant light absorption and scattering, about 100 MW/cm2. AM2 refers to sunlight passed through two vertical thicknesses of the atmosphere; that is, it passed through the atmosphere at an angle. Typically 1.5 AM is used.

Alternating Current (AC): Electric current in which the direction of flow is reversed at frequent intervals, typically 120 times per second (60 cycles per second), as used in commercial grid power in the United States. Opposite of direct current (DC).

Ambient Temperature: Temperature of the immediate surrounding environment.

Amorphous: The condition of a solid in which the atoms are not arranged in an orderly pattern; not crystalline.

Ampacity: Current carrying capacity in amperes.

Ampere, Amp (A): A measure of electric current; the flow of electrons. One amp is 1 coulomb passing in one second. One amp is produced by an electric force of 1 volt acting across a resistance of 1 ohm.

Ampere Hour (Ah): A measure of current. One ampere flowing for one hour equals one ampere hour. Batteries are usually rated in ampere hour capacity.

Array: A mechanically-integrated assembly of modules and panels, together with support structure and foundation, tracking, thermal control, and other components, if used, to form a DC power-producing unit. (See also PHOTOVOLTAIC ARRAY.)

Azimuth Angle: For a surface such as a roof: the angular deviation of the projection on a horizontal plane of the normal to the roof surface, from the local meridian (due south). Due south is zero azimuth, west of south is considered positive, and east of south is considered negative.

Balance of System (BOS): Parts of a photovoltaic system other than the array: switches, controls, meters, power conditioning equipment, supporting structure for the array, and storage components, if any. The cost of land is sometimes included when comparing total system costs with the cost of other energy sources.

Battery, Storage: A secondary battery; rechargeable electric storage unit that operates on the principle of changing electrical energy into chemical energy by means of a reversible chemical reaction. The lead-acid automobile battery is the most familiar type.

Battery Capacity: Expressed in ampere-hours, the total amount of electricity that can be drawn from a fully charged battery until it is discharged to a specific voltage.

Battery Capacity Available: The total ampere-hours that can be drawn from a battery under specific operating conditions of discharge rate, temperature, initial state of charge, age and cutoff voltage.

Battery Capacity Energy: The total watt-hours (kilowatt-hours) that can be drawn from a fully charged battery. This varies with temperature, rate, age and cutoff voltage.

Battery Capacity Installed: The total ampere-hours that can be drawn from a new battery when discharged to the specified maximum depth of discharge.

Battery Capacity Rated: The manufacturer's conservative estimate of ampere-hours that can be drawn from a new battery under specific conditions.

Battery Cell: The simplest operating unit in a storage battery; one or more positive electrodes, an electrolyte that permits ionic conduction, one or more negative electrodes, and separators enclosed in a single container.

Battery Cycle Life: The number of cycles to a specified depth of discharge a battery can undergo before efficiency is affected.

Battery Life: The period when a battery is operating above specific efficiency levels. Measured in either cycles or years, depending on intended use.

Blocking Diode: A semiconductor device, allowing current to flow in only one direction, used in photovoltaic systems to permit the flow of electricity from the photovoltaic array to a battery, but preventing a reverse flow of energy from the batteries to the photovoltaic system, which could damage the system.

British Thermal Unit (BTU): Amount of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit: 2.93 x 10-4 kWh; 1054.8 J (joules)

Bypass Diode: A diode that is connected, reverse bias, across the PV module. Used in high voltage systems to bypass a shaded or malfunctioning module.

Cathodic Protection and Pipelines: A method of preventing oxidation (rusting) of exposed or buried metal structures such as bridges, by imposing between the structure and the ground a small electrical voltage that opposes the flow of electrons, and is greater than the voltage that is present during oxidation.

Cell: See PHOTOVOLTAIC CELL.

Cell Efficiency: The ratio of output electrical energy to the input solar energy falling on a solar cell times 100. This is usually determined by shining a simulated AM 1 light source of 100-MW/cm^2 intensity over the entire surface of the cell and relating the wattage output to the total input.

Collector: Usually referred to in solar energy as a device that absorbs energy from the sun to convert it into either thermal or electrical energy.

Collector Efficiency: This is determined by the ratio of energy produced by a solar collector to the radiant energy incident on the collector.

Concentrator: A photovoltaic array which includes an optical component such as a lens or focusing mirror to direct incident sunlight onto a solar cell of smaller area.

Controller: The device which controls the flow of electricity from the array to the batteries. Prevents the batteries from being overcharged or over discharged.

Conversion Efficiency (Cell): The ratio of the electric energy produced by a solar cell (under full sun conditions) to the energy from sunlight incident upon the cell.

Counter EMF (CEMF) Cell: A device used to reduce EMF (electromotive force, voltage), typically consisting of a series/parallel diode arrangement.

Current: The rate of flow of an electric charge.

DC/DC Converter: A device used to convert direct current of one voltage into direct current of another voltage.

Deep Discharge: Discharging a battery to 20 percent or less of its full charge.

Deep Discharge Cycles: Cycles in which a battery is nearly completely discharged.

Depth of Discharge (DOD): The number of ampere-hours withdrawn from a fully charged battery, stated as a percentage of rated capacity.

Diffuse Insolation: Sunlight received indirectly as a result of scattering due to clouds, fog, haze, dust, or other substances in the atmosphere.

Direct Current (DC): Electric current in which electrons are flowing in one direction only.

Direct Insolation: Sunlight falling directly upon a collector. Opposite of diffuse insolation.

Discharge Rate: The current removed from a battery, stated as load current divided by a time constant.

DMM: Digital Multimeter

Efficiency: In a photovoltaic solar cell, the electrical power output of the solar cell is expressed as a percentage of the amount of solar energy striking it. More generally, the amount of useful energy produced by a system compared to the amount of energy put into it to make it run.

Fill Factor: For an I-V curve: the ratio of the maximum power to the product of the open-circuit voltage and the short-circuit current. Fill factor is a measure of the "squareness" of the I-V curve shape.

Flat Plate (Module or Array): An arrangement of solar cells in which the cells are exposed directly to normal incident sunlight. Opposite of concentrator.

Full Sun: The power density received at the surface of the earth at noon on a clear day. About 100 MW/cm^2. Lower light intensities may be described as a fraction of a sun. Higher levels encountered in concentration solar cells may be described as multiple suns.

Grid: Network of transmission lines, substations, distribution lines, and transformers used in central power systems.

Hybrid Systems: Generally means combination of two different renewable energy systems such as PV and wind or PV and thermal (not from the same unit).

Insolation: Sunlight, direct or diffuse (not to be confused with insulation). The intensity of sunlight reaching a given area, usually expressed in milliwatts per square centimeter per day. This may express average insolation in referring to solar energy falling on different regions of the country.

Interconnect: A conductor within a module that provides a mechanism for conducting electricity between cells.

Inverter: A device used to change DC current, which is produced by a photovoltaic system, into AC current which is used in most electrical appliances.

Irradiance: The instantaneous incident solar power on a surface, per unit area (typical units are kW/m^2). Note the distinction between irradiance and insolation.

I-V Curve: A graphical presentation of the current versus the voltage from a photovoltaic cell as the load is increased from the short circuit (no load) condition to the open circuit (maximum voltage) condition. The shape of the curve characterizes cell performance.

Kilowatt (kW): 1,000 Watts.

Kilowatt Hour (kWh): 1,000 Watt hours.

Leakage Current: Current which escapes, or leaks, from the PV circuit due to an insulation breakdown between the PV circuit and surrounding metallic members, such as module frames or support structures.

LED: Light Emitting Diode.

Life-Cycle Costing: A method of calculating the total cost or value of an item over its full lifetime, including interest, maintenance costs, fuel costs, replacement costs, etc. This is usually put in terms of present day dollar value.

Load: Electric power being consumed at any given moment. In an electrical circuit, any device or appliance that is using power. See PEAK LOAD.

Load Profiles: The amount of energy used by a building or piece of equipment, viewed over time, i.e. an electric oven's load profile may show 1/2 kW hours use in the morning, with no use until early evening when it would peak at 1.5 kW hours and again drop down to 0.

Load Resistance: The amount of resistance presented by an electric load to the flow of electrical current.

Low Voltage Disconnect (LVD): Low Voltage Load Disconnect Circuit which disconnects the load at a preset point.

Maximum Power Point: Refers to the operating point on an I-V curve where the product of the current and voltage (power) is maximized. Accordingly, the terms "maximum power current" and "maximum power voltage" are also encountered.

Maximum Power Tracking: A mode of operation for a power conditioner, whereby it continuously controls the PV source voltage in order to operate the PV source at (or very near) its maximum power point.

Megawatt (MW): 1,000,000 Watts; 1,000 kilowatts.

Milliampere (mA): One thousandth of an ampere.

mm: millimetres.

mV: millivolts.

Module: A number of solar cells connected together electrically and sealed inside a weatherproof package with a clear face. Sometimes called a "solar panel".

MOV: Metal Oxide Varistor - transient/lightning protector.

NEC: National Electrical Code, which contains safety guidelines for all types of electrical installations, including "Solar Photovoltaic Systems" in Article 690.

Nominal Operating Cell Temperature (NOCT): The equilibrium cell junction temperature corresponding to nominal module service operating conditions in a reference environment of 80 MW/cm^2 irradiance, 20°C ambient air temperature, 1 m/s wind, 1.5 AM and electrically open circuits.

OHM: A measure of resistance to the flow of an electric current.

Open Circuit Voltage (Voc): The voltage across a photovoltaic cell in sunlight when no current is flowing; the maximum possible voltage.

Panel (Flat Plate): A collection of modules fastened together, assembled and wired, intended to provide a field-installable unit.

Panel Assembly: A collection of modules fastened together, assembled and wired, intended to provide a field-installable unit.

Parallel Connection: A method of interconnecting two or more electricity- producing devices, or power-using devices, such that the voltage produced, or required, is not increased, but the current is additive. Opposite of series connection.

Peak Load, Peak Demand: The maximum load, or usage, of electrical power occurring in a given period of time, typically a day.

Peak Watt or Watt Peak (Wp): The amount of power a photovoltaic device will produce at solar noon on a clear day (insolation at 1000 Watts per square meter) when the cell is faced directly towards the sun.

Photovoltaic: Pertaining to the direct conversion of light into electricity.

Photovoltaic Array: An interconnected system of photovoltaic modules that functions as a single electricity-producing unit. The modules are assembled as a discrete structure, with common support or mounting structure.

Photovoltaic Cell: A device that converts light directly into electricity by direct absorption followed by separation of positive and negative photocarriers. A solar photovoltaic cell, or solar cell, is designed for use in sunlight. All photovoltaic cells produce direct current (DC).

Photovoltaic Module: See MODULE.

Photovoltaic System: A complete set of components for converting sunlight into electricity by the photovoltaic process, including array and balance-of-system components.

Polycrystalline Silicon; Polysilicon: Silicon which has solidified at such a rate that many small crystals (crystallites) were formed. The atoms within a single crystal are symmetrically arrayed, whereas in crystallites they are jumbled together.

Power Conditioner: The electrical equipment used to convert power from a photovoltaic array into a form suitable for subsequent use, as in supplying a household. Loosely, a collective term for inverter, transformer, voltage regulator, meters, switches, and controls.

PV: Abbreviation for photovoltaics.

PV Output Circuit: As used by the National Electrical Code, the PV output circuit is the DC input to the inverter, either two- or three-wire DC, which results from the electrical combination of the PV source circuits.

Pyranometer: An instrument for measuring solar radiation received from the whole hemisphere including the direct and diffuse component. The sensing element is a thermopile that produces millivolts in proportion to radiation.

Rectifier: A device that converts AC electricity to DC electricity.

Regulator: A device that prevents overcharging of batteries.

Remote Site: Not connected to a utility grid. See STAND-ALONE.

Resistance: The opposition of a substance to the free flow of electrons or electricity through it.

Retrofitting: Placing energy producing devices on an existing building structure to provide part or all of the energy required by that structure.

Self-Discharge Rate: The rate at which a battery will discharge on standing; affected by temperature and battery design.

Series Connection: A method of interconnecting devices that generate or use electricity so that the voltage, but not the current, is additive one to the other. Opposite of parallel connection.

Series Diode: See BLOCKING DIODE.

Series Resistance: Resistance intrinsic to the PV cells which causes the I-V curve to exhibit a large negative slope near the open-circuit voltage-axis intercept.

Series String: Modules are connected in series to form a series string. Series strings are also known as "source circuits" in the National Electrical Code. A series string may consist of one or more modules wired in series, and no parallel module connection.

Short Circuit Current (Isc) or S/C Current: The current flowing freely from a photovoltaic cell through an external circuit which has no load or resistance; the maximum current possible.

Shunt Resistance: Resistance intrinsic to the PV cells which causes the I-V curve to exhibit a small negative slope near the short-circuit current-axis intercept.

Single Crystal: The perfect state of a solid in which all of the atoms are arranged in an ordered fashion.

Solar Cell: See PHOTOVOLTAIC CELL.

Solar Constant: The strength of sunlight; 1,353 watts per square meter in space, and about 1,000 watts per square meter at sea level.

Solar Energy: Energy from the sun, usually used for heating or light, specifically, the photon energy originating from the sun's radiation in the wavelength region from 0.3 to 2.7 micrometers.

Source Circuit: As used by the National Electrical Code, PV source circuits refer to the conductors between modules and from modules to the common connection point of the DC system.

Stand-Alone: An isolated photovoltaic system not connected to a grid; may or may not have storage, but most stand-alone applications require battery or other form of storage. See REMOTE SITE.

State of Charge (SOC): A battery's available capacity, stated as percentage of rated capacity.

Standard Test Conditions (STC): Irradiance of 1000 W/m^2, ambient cell temperature of 25°C and an air mass of 1.5.

Subarray: One or more source circuits.

Sulfation: A condition which afflicts unused and discharged batteries; large crystals of lead sulfate grow on the plate, instead of the usual tiny crystals, making the battery extremely difficult to recharge.

Sun Hour or Solar Time: The hours of the day as determined by the apparent position of the sun (which is rarely the same as local standard time) in any one place. Solar noon is that instant on any day when the sun reaches its maximum altitude for that day.

Surge Arrestor: Devices used to protect conductors and circuit elements from the deleterious effects of high-energy electrical surges, such as may be caused by nearby lightning strikes.

System Voltage: The nominal voltage of the PV array, controller and battery bank, as defined by the voltage of the system load.

Temperature, Ambient Air: The temperature of the air immediately surrounding the object being tested.

Terminal Voltage: The electric potential between any two terminals, i.e. the voltage between the positive and negative terminal of a battery.

Tracking System, 2-Axis: A mount capable of pivoting both daily and seasonally to follow the sun.

Tracking System, 1-Axis: A mount pointing in one axis only, reoriented seasonally by hand and used with linear concentrators or flat plates.

Volt, Voltage (V): A measure of the force of "push" given the electrons in an electric circuit; a measure of electric potential. One volt produces one amp of current when acting against a resistance of one ohm.

Voltage Regulator: An electrical device used to keep voltage at pre-specified levels.

Voltmeter: An instrument used to measure the amount of voltage of an electrical device.

Watt, Wattage (W): A measure of electric power, or amount of work done in a unit of time. One amp of current flowing at a potential of one volt produces one watt of power.

Watt Hour (Wh, Whr): A quantity of electrical energy (electricity). One watt hour is consumed when one watt of power is used for a period of one hour. 1/746 horsepower. A power of 1 J, or 107 erg/sec.: 9.4827 x10^{-4} BTU/sec; 1.341 x 10^{-3} hp.

Watt Peak (Wp): Same as peak watt.