

INVESTIGATING THE PERFORMANCE OF PHOTOVOLTAIC CELLS

Keywords and Glossary Terms

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CURRENT (I)

Flow of electric charge. 1 amp = 1 coulomb per second.

EFFICIENCY

Ratio of output power to input power of a device. Easy to remember as 'what you want' divided by 'what you pay for'.

ELECTRICAL ENERGY

Energy is required to push charges/electrons (current) through the various components of a circuit. This is generally provided by a power supply that sets up an electric potential (energy) difference between its terminals.

INCIDENT POWER

The rate at which energy strikes the surface of, for example, a photovoltaic cell or module.

INVERSE SQUARE LAW

If something, e.g. light or sound radiates uniformly into space from a point source, then, at a distance d from the source, the power flux will be given by $P/4\pi d^2$, where P is the total power emitted by the source. The flux decreases as the inverse square of the distance from the source.

LINEAR REGRESSION

A mathematical technique for finding the equation of a straight line that best fits a set of data, and evaluating the fit.

LOAD RESISTANCE

A device or appliance in the external part of an electric circuit that uses (dissipates) electrical energy.

MULTIMETER

An instrument to measure various electrical properties, usually potential difference across a component in volts, current through part of a circuit, in amps, and resistance of components in ohms.

OHM'S LAW

For devices made of certain materials it is found that the ratio of the voltage across the device to the current through it is a constant i.e. does not vary as the current is varied, until electrical breakdown, or melting occurs. Such materials are said to be ohmic, and obey Ohm's Law $V = IR$

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OPEN CIRCUIT VOLTAGE

The maximum voltage produced by a device corresponding to infinite load resistance, or zero current.

PHOTONS

When energy is transferred from light or other forms of electromagnetic radiation to matter, it does so in fixed amounts called photons. The energy of a photon is related to the frequency of the electromagnetic radiation by Planck's Constant, h : $E_{\text{photon}} = hf$.

PHOTOVOLTAIC (PV) CELL

Device that converts light energy (photons) to electrical energy. Traditional, first generation photovoltaics consist essentially of a junction between two types of doped silicon semiconductor material, similar to a transistor diode.

PHOTOVOLTAIC MODULE

Several photovoltaic cells connected in series and/or parallel to increase the output voltage and/or current.

POWER (P)

The rate at which energy is released, transmitted or converted to another form; the rate of doing work. 1 Watt = 1 Joule per second.

POWER DISSIPATED IN RESISTOR

The rate at which electrical energy is required to push through a resistor. $P = VI$. In a normal resistor, the electrical energy is generally transformed to heat.

RESISTANCE (R)

An impedance to the flow of charge (current) in a circuit.

SHORT CIRCUIT CURRENT (I_{sc})

The maximum current that can be produced by a device: corresponds to the hypothetical situation of use in a circuit with zero resistance, therefore zero voltage.

SOLAR CONSTANT (S)

The rate of incidence of solar energy on Earth is described by the Solar Constant, S , equal to the power per unit area incident on an imaginary surface perpendicular to the sun's rays at the top of the atmosphere. $S = 1366 \text{ W/m}^2$.

VOLTAGE (V)

The (potential) energy difference that pushes charge (electrons) through a circuit. 1 Volt corresponds to energy of 1 Joule per Coulomb.