PV Cells' Electrical Characteristics

In this technical document we will:

- Explain the basics of the photoelectric effect,
- Demonstrate how to calculate the output of a PV cell,
- Identify the main factors influencing the output of a PV cell,
- Name the basic electrical characteristics of a PV cell,
- Interpret an I-V curve

1. Two main Factors Affecting PV Cells' Power Output

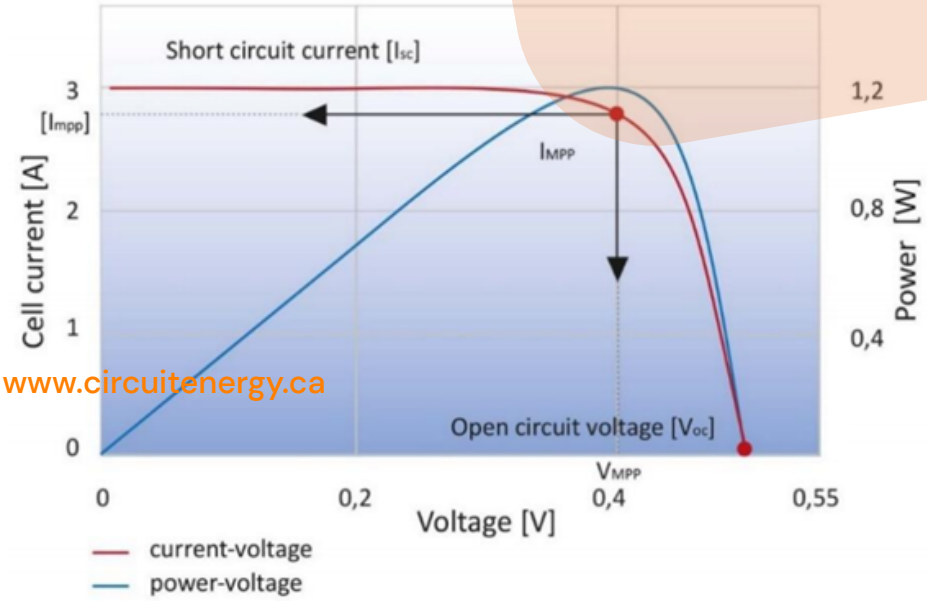
The photoelectric effect is the phenomenon that converts electromagnetic radiation (such as from the photons of solar irradiation) into electricity in certain materials. A PV cell is designed in such a way that the energy from these photons is transferred to the electrons in the cell, causing them to become mobile. When these electrons are all channelled together to run through conductive materials, such as copper cables, they produce useful direct current (DC) electricity.
This mobilization of electrons in a PV cell produces a current and a voltage. The electrical power P for DC systems, measured in Watts [W], is the product of voltage "V" measured in Volts [V] and current "I" measured in Amperes [A]:

Under normal sunlight conditions the PV cell's voltage remains fairly constant. However, the cell's current is very sensitive to **sunlight intensity.** High solar irradiance will produce a high electrical **current** while low solar irradiance will produce a low electrical current. The s**urface area** of the PV cell also affects the electric current output. A cell with a large surface area will produce more electric current than a cell with a small surface area.

Thus, the **two main factors** that affect the output of a PV cell are the **intensity of the sunlight** and the **size of the cells**. Other factors are also important and will be discussed in the following sections.

2. **I-V curve**

The **I-V curve** describes an important electrical characteristic of a PV cell. At any given time, a PV cell is operating with a specific current and voltage which lies along its I-V curve (red curve in the figure). This line shows the current I, which is produced over a range of voltages. ISC represents the short circuit (SC) current, i.e. the value at which the current is at a maximum and the voltage is equal to zero. VOC represents the open circuit (OC) voltage, i.e. the value at which the voltage is at its maximum and the current is equal to zero.
The **power curve** of the PV cell is shown by the blue line. This line shows the electric power produced over a range of voltages. The **maximum power point (MPP),** the point at which the cell produces the maximum power, occurs at the peak of the power curve where the product of voltage and current are greatest. The maximum power is thus:



In the next technical document, we will explain how these factors affect the cells' power output and will go into more details.

Contact us today to discuss how your facility could save you thousands of dollars!