

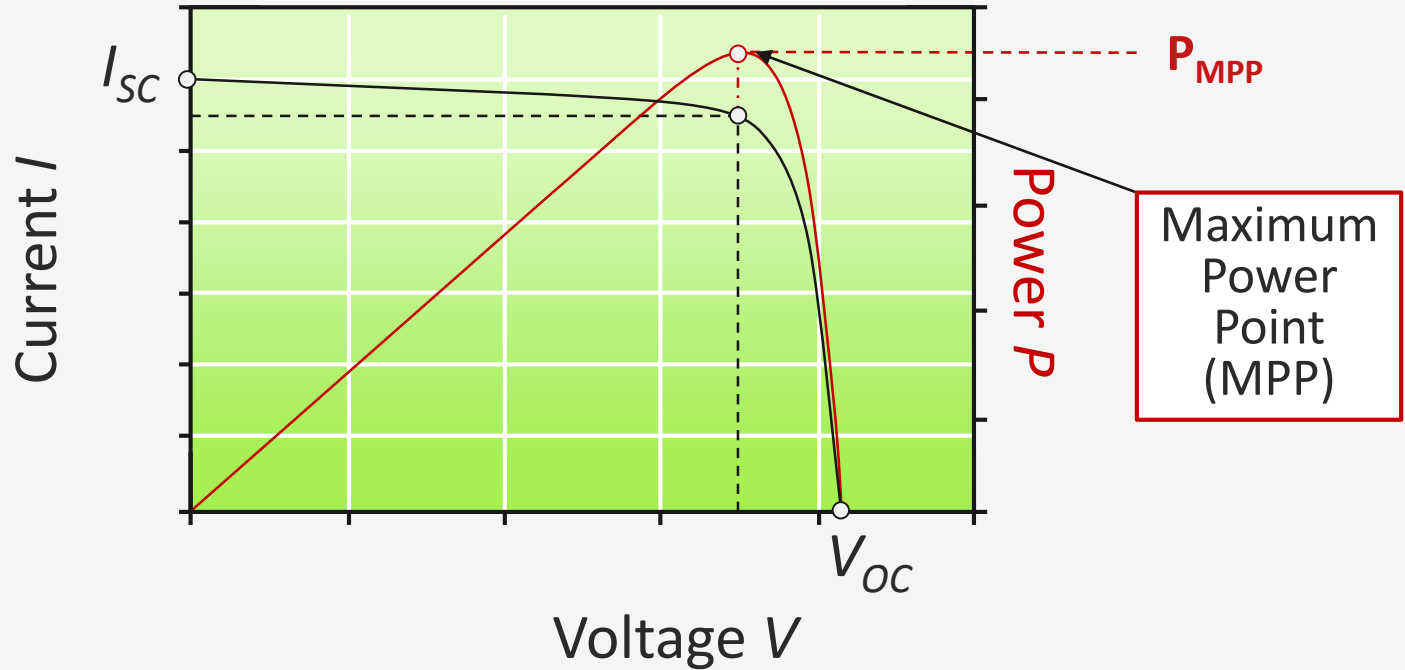
PV Systems - Components and Concepts

Maximum Power Point Tracking (MPPT)

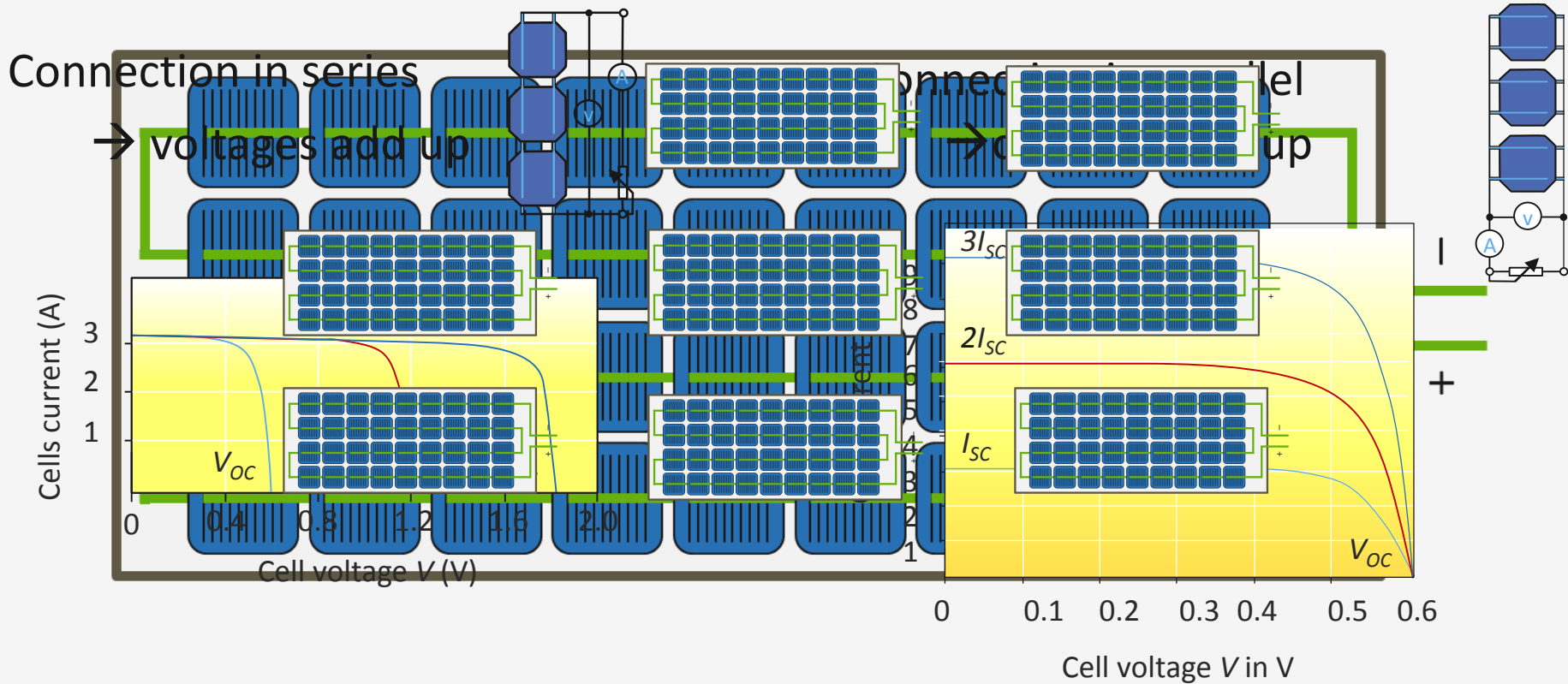
Week 7.3

Arno Smets

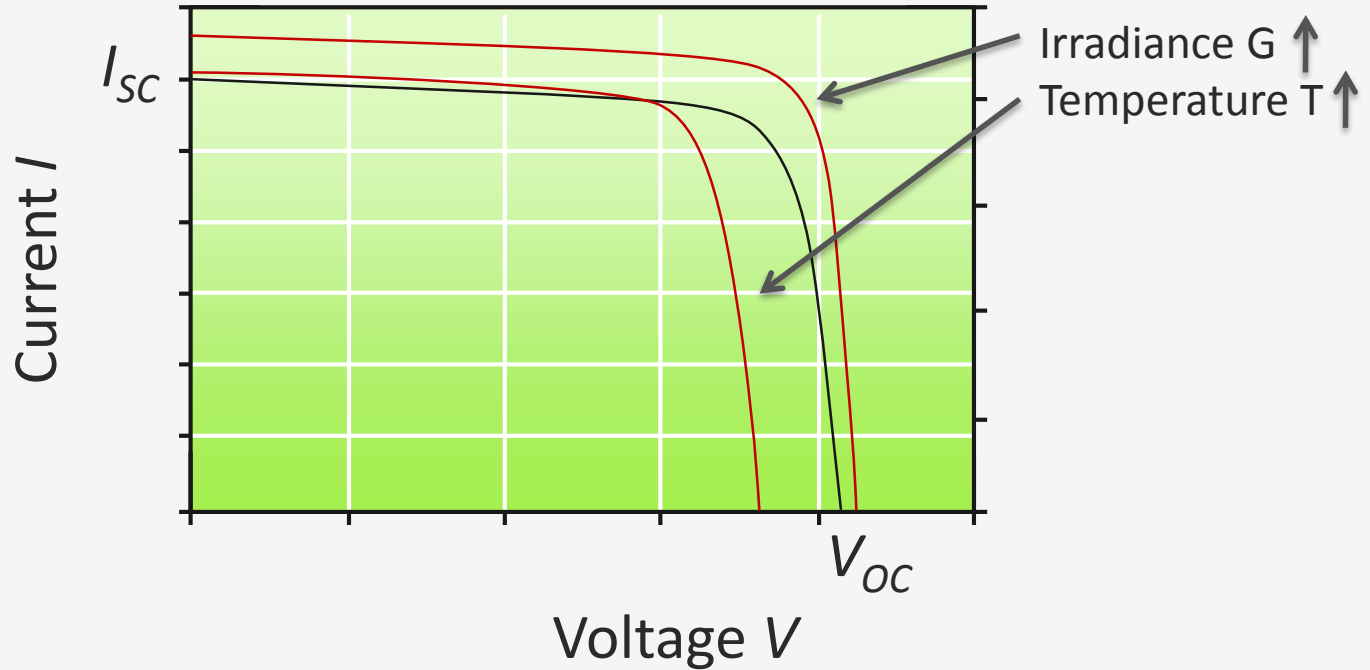
Generic I-V curve of a solar cell



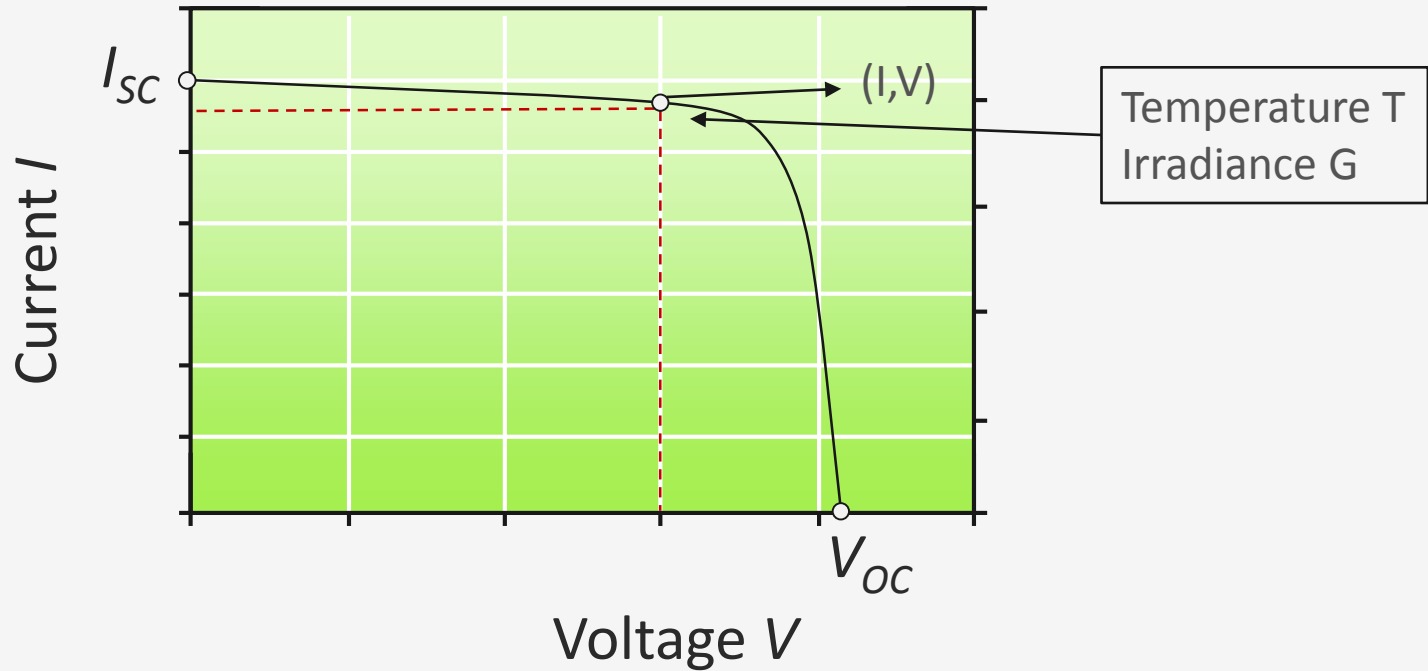
PV cell, module and array



Generic I-V curve of a PV module

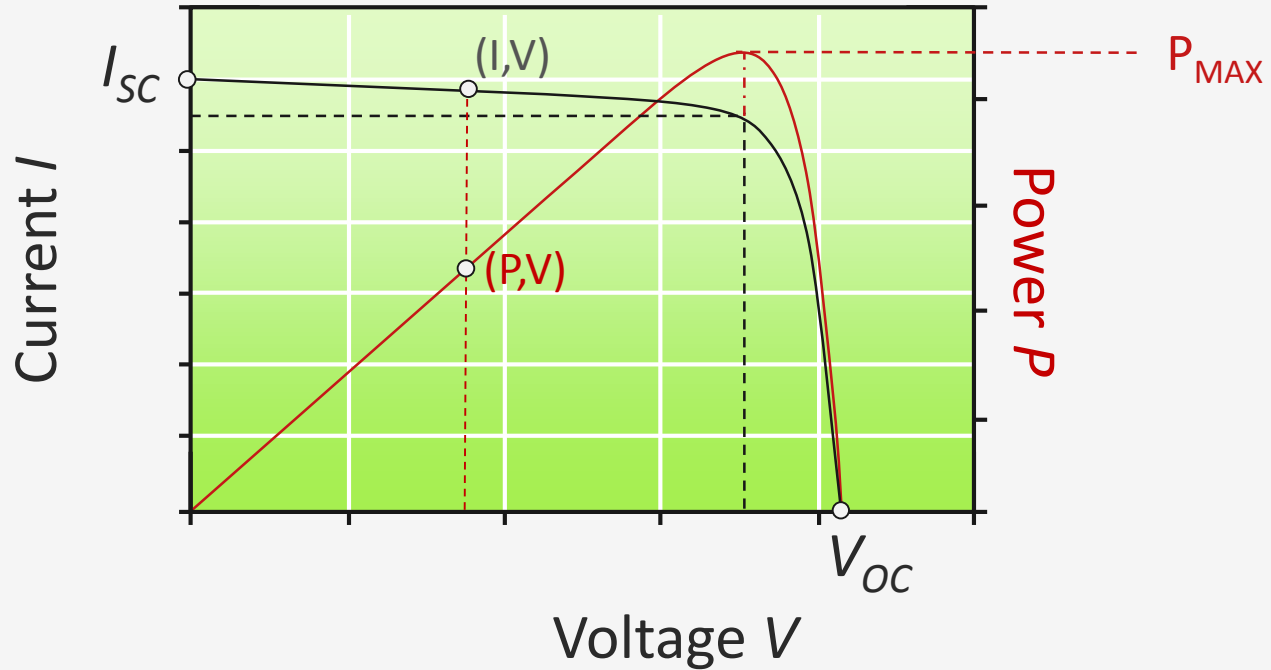


PV module – operating point

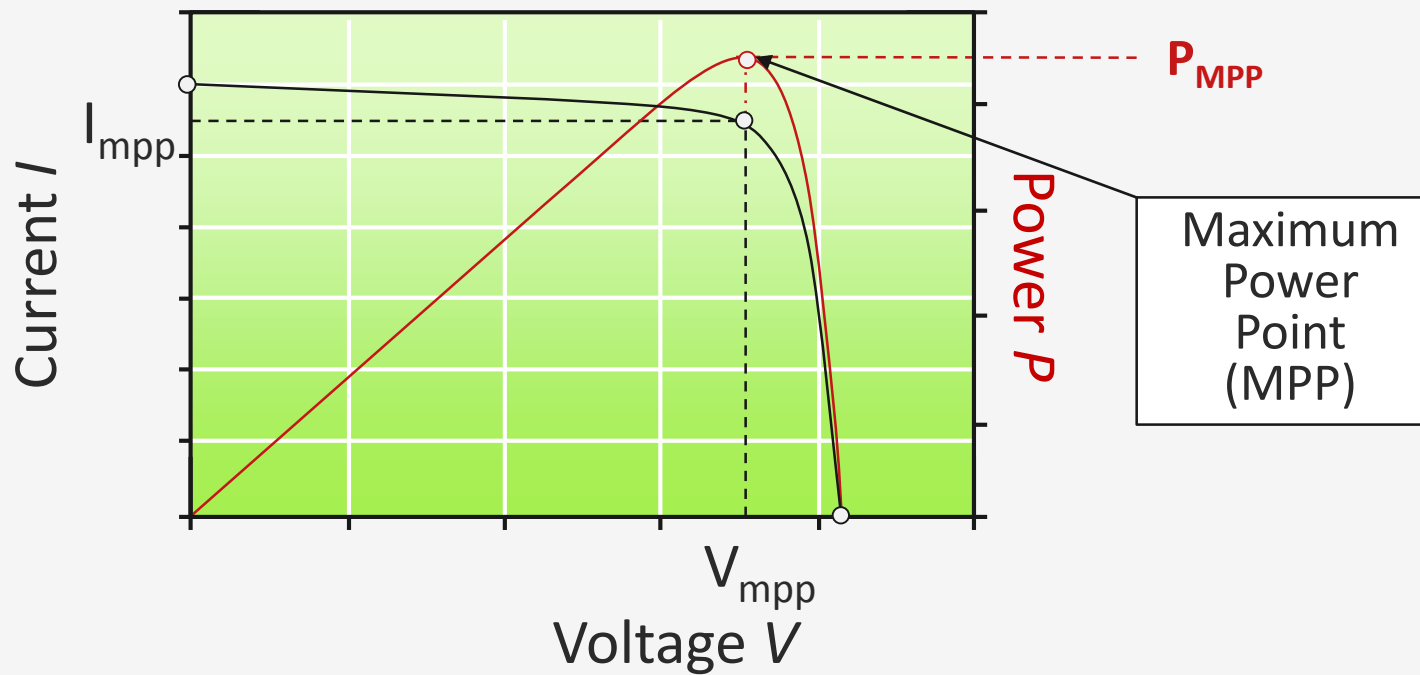


PV module – PV curve

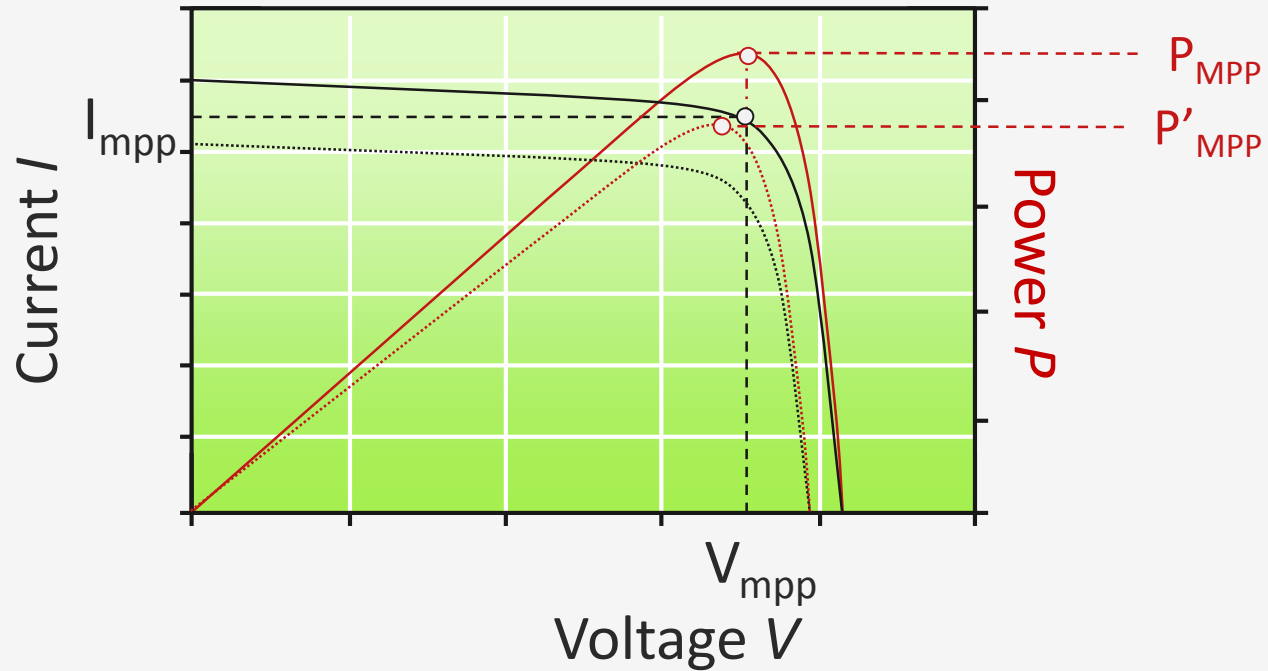
$$P = V \times I$$



PV curve - MPPT

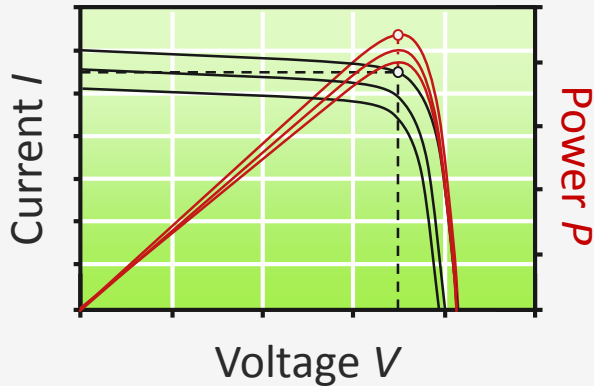


PV module – Need for MPPT



MPPT Techniques

**MPP
Tracking**



Indirect

Fixed Voltage
Method

Fractional Open
Circuit Voltage
Method

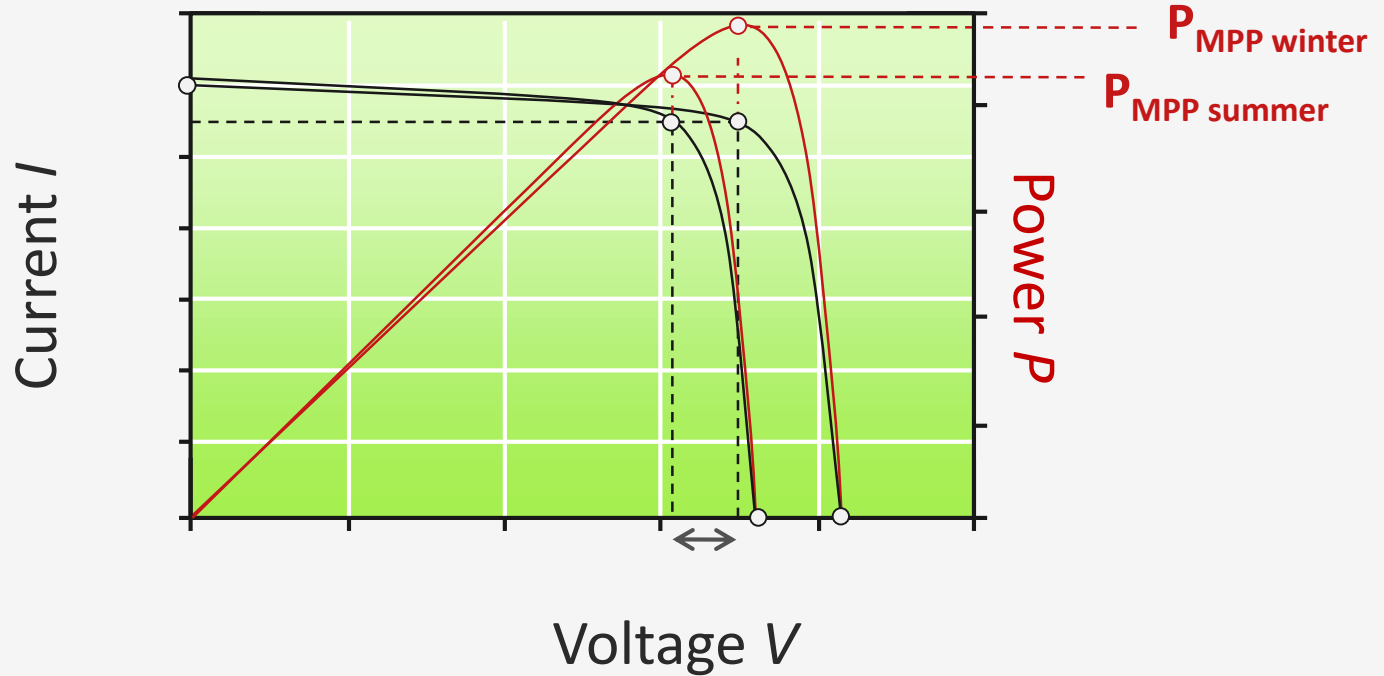
Perturb and
Observe
Method

Direct

Incremental
Conduction
Method

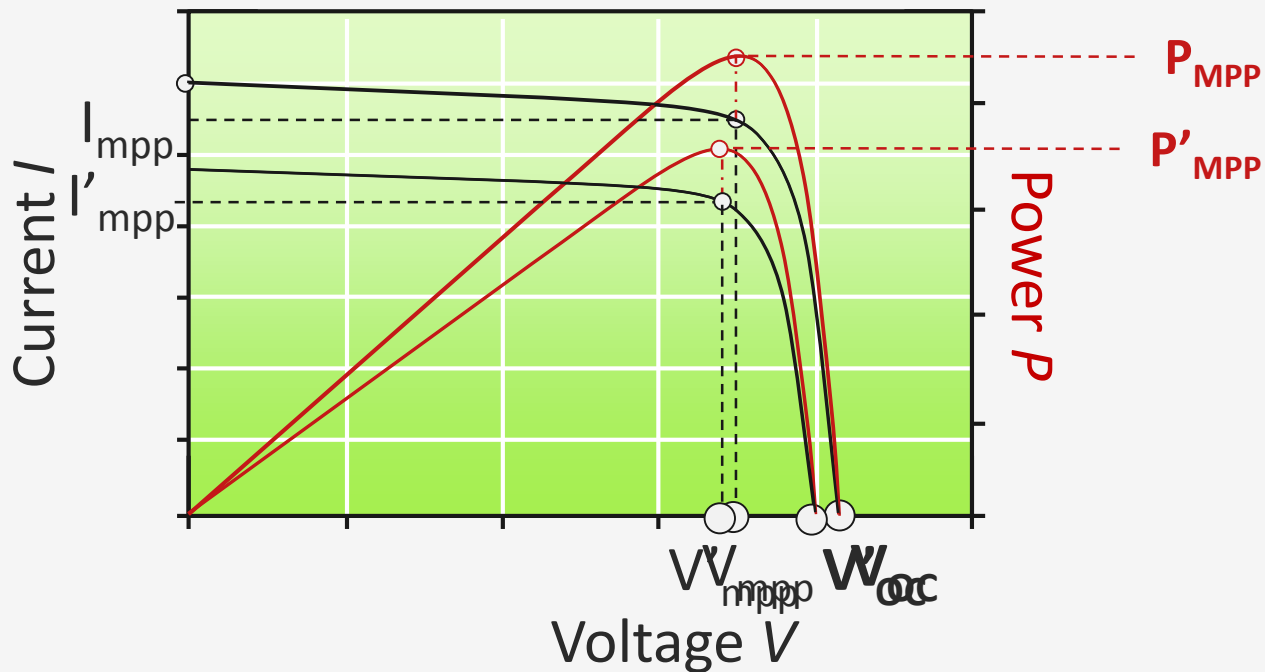
MPPT – Fixed Voltage Method

Constant irradiance

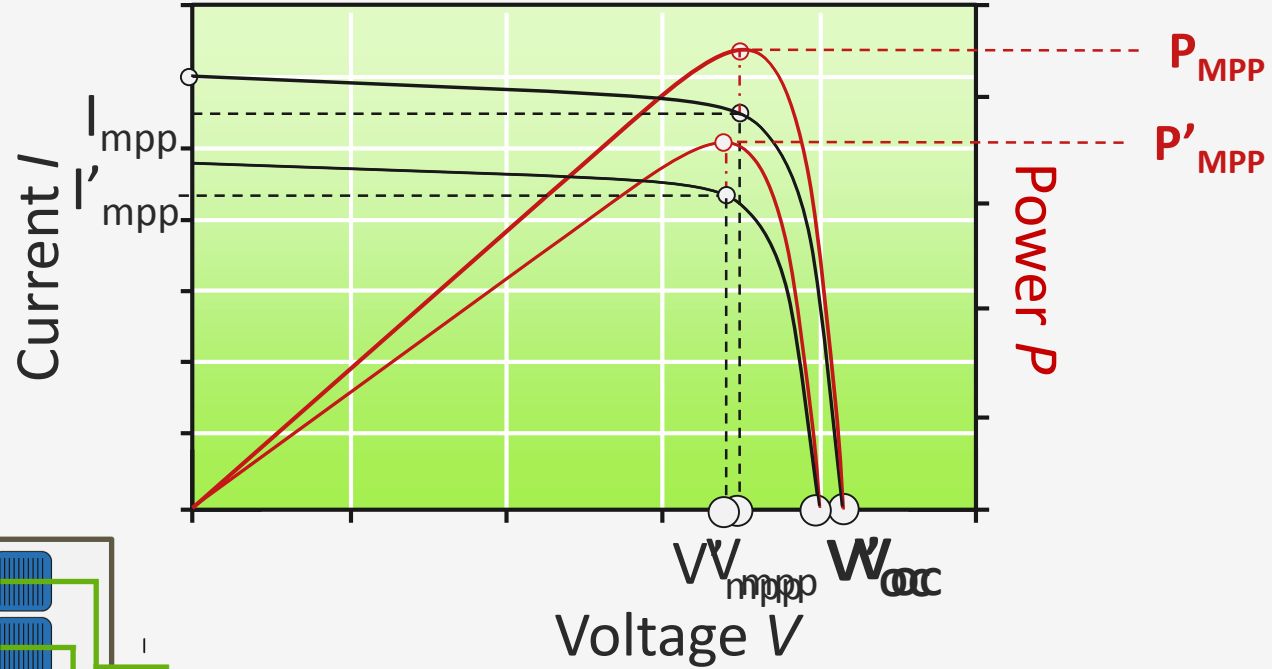
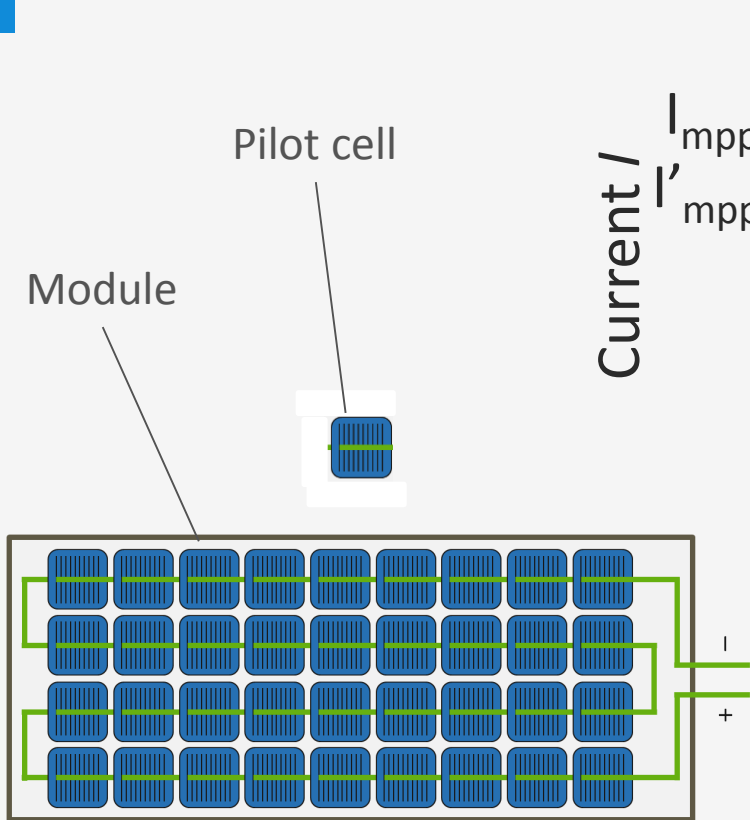


MPPT – Fractional Open Circuit Voltage

$$V_{mpp} = k \times V_{oc}$$

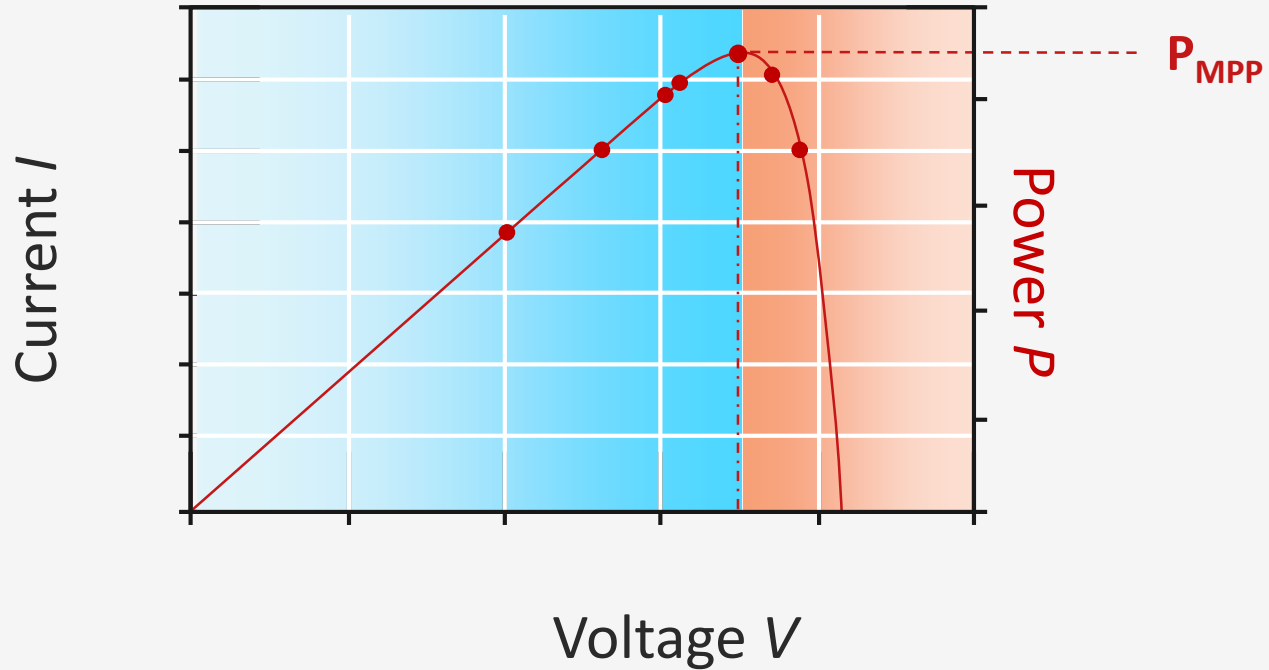


Addition of a pilot PV cell

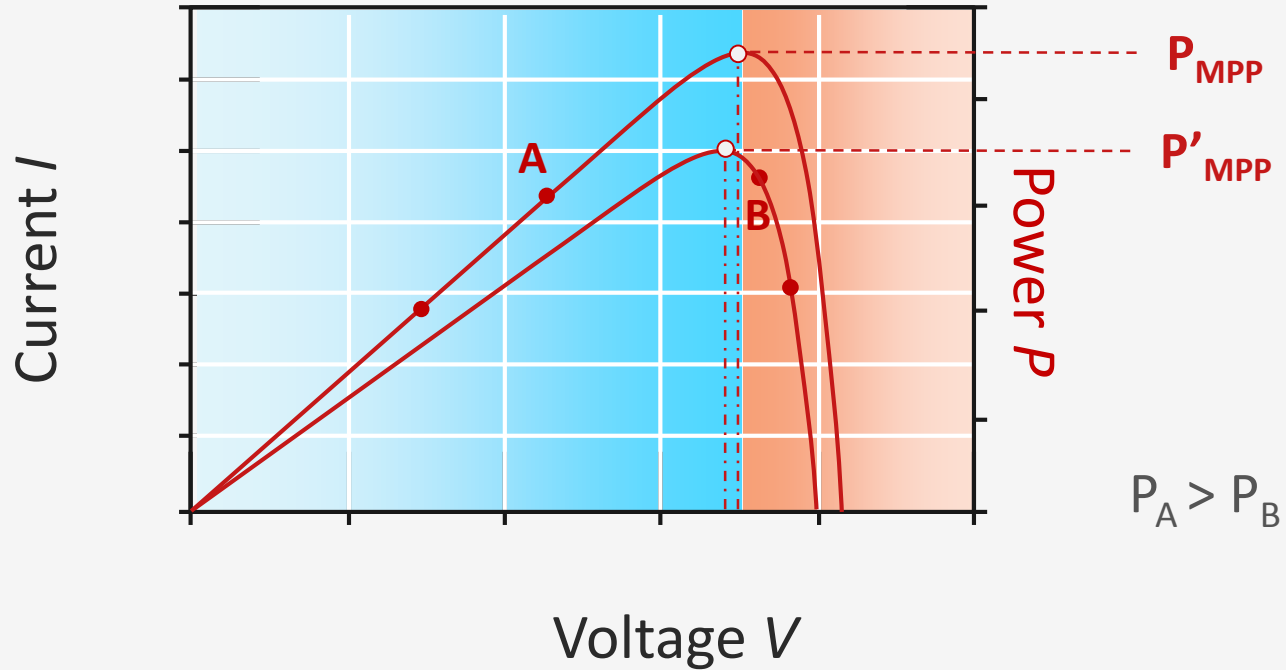


$$V_{mpp} = k \times V_{oc}$$

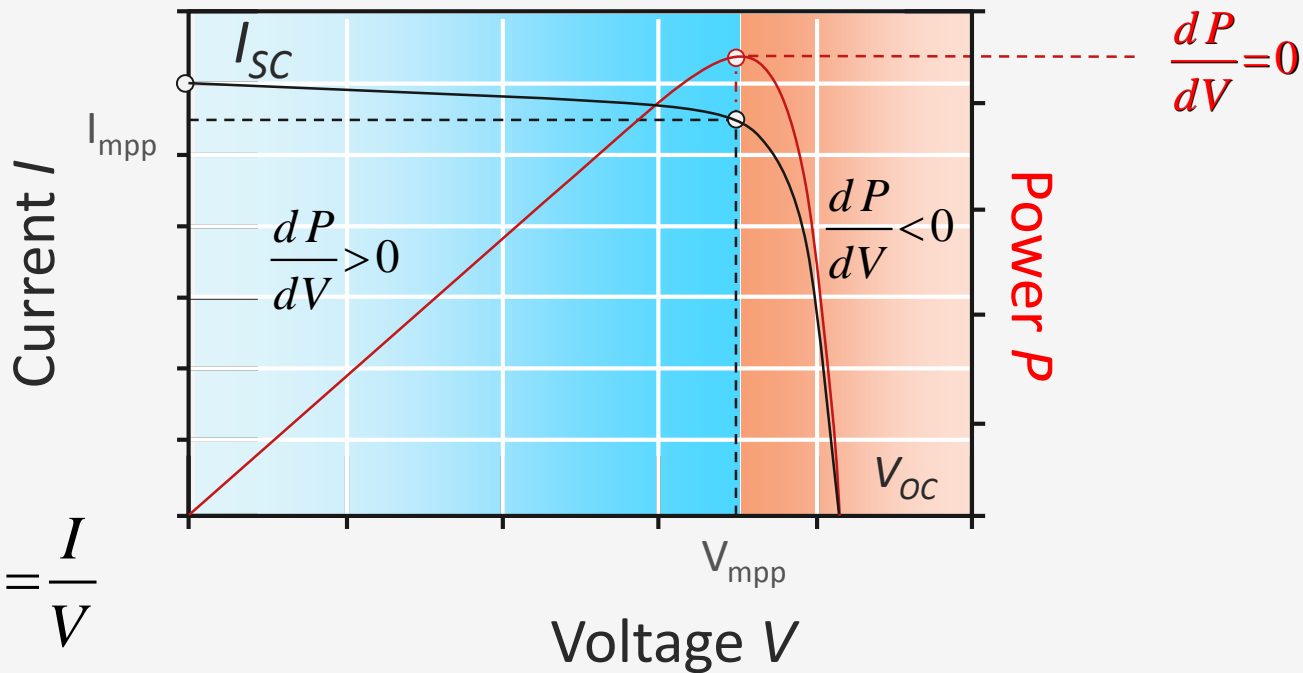
MPPT – Perturb and Observe



MPPT – Perturb and Observe - Drawback



MPPT – Incremental Conductance



MPPT – Incremental Conductance

$$\frac{dP}{dV} = \frac{d(I \times V)}{dV}$$

$$\frac{\Delta I}{\Delta V} = -\frac{I}{V}$$

At MPP

$$\frac{dP}{dV} = I + \frac{V \times dI}{dV}$$

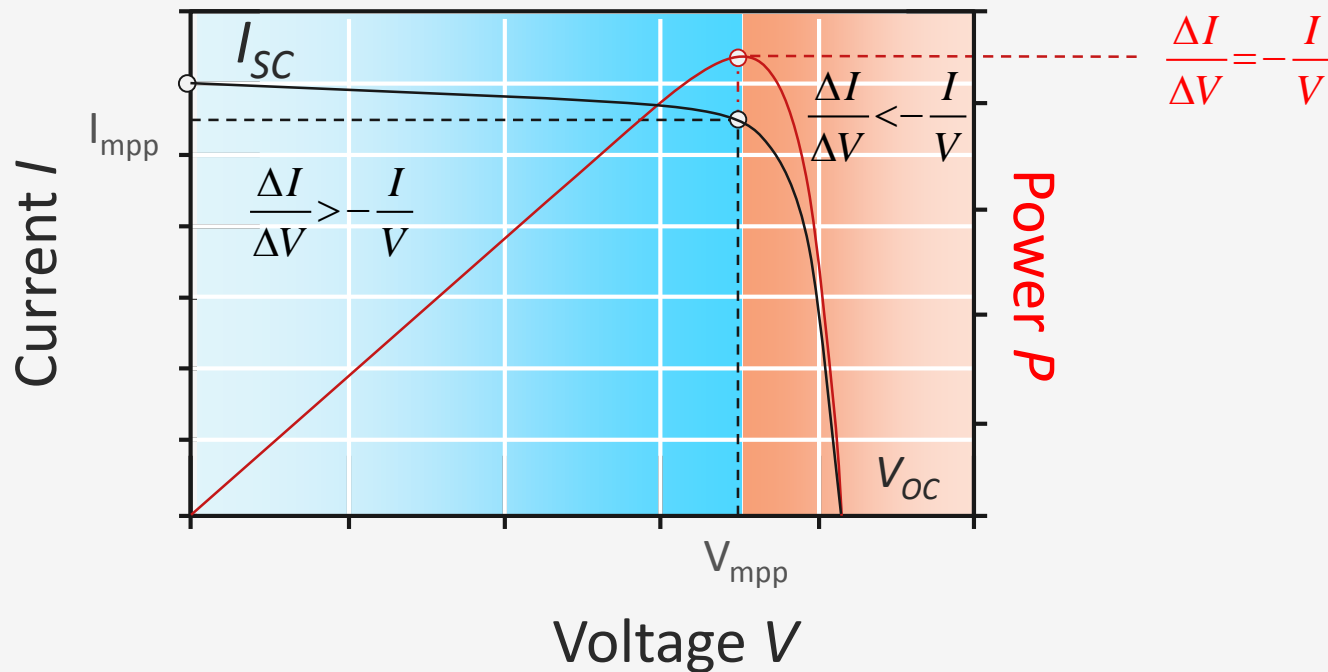
$$\frac{\Delta I}{\Delta V} > -\frac{I}{V}$$

To the left of MPP

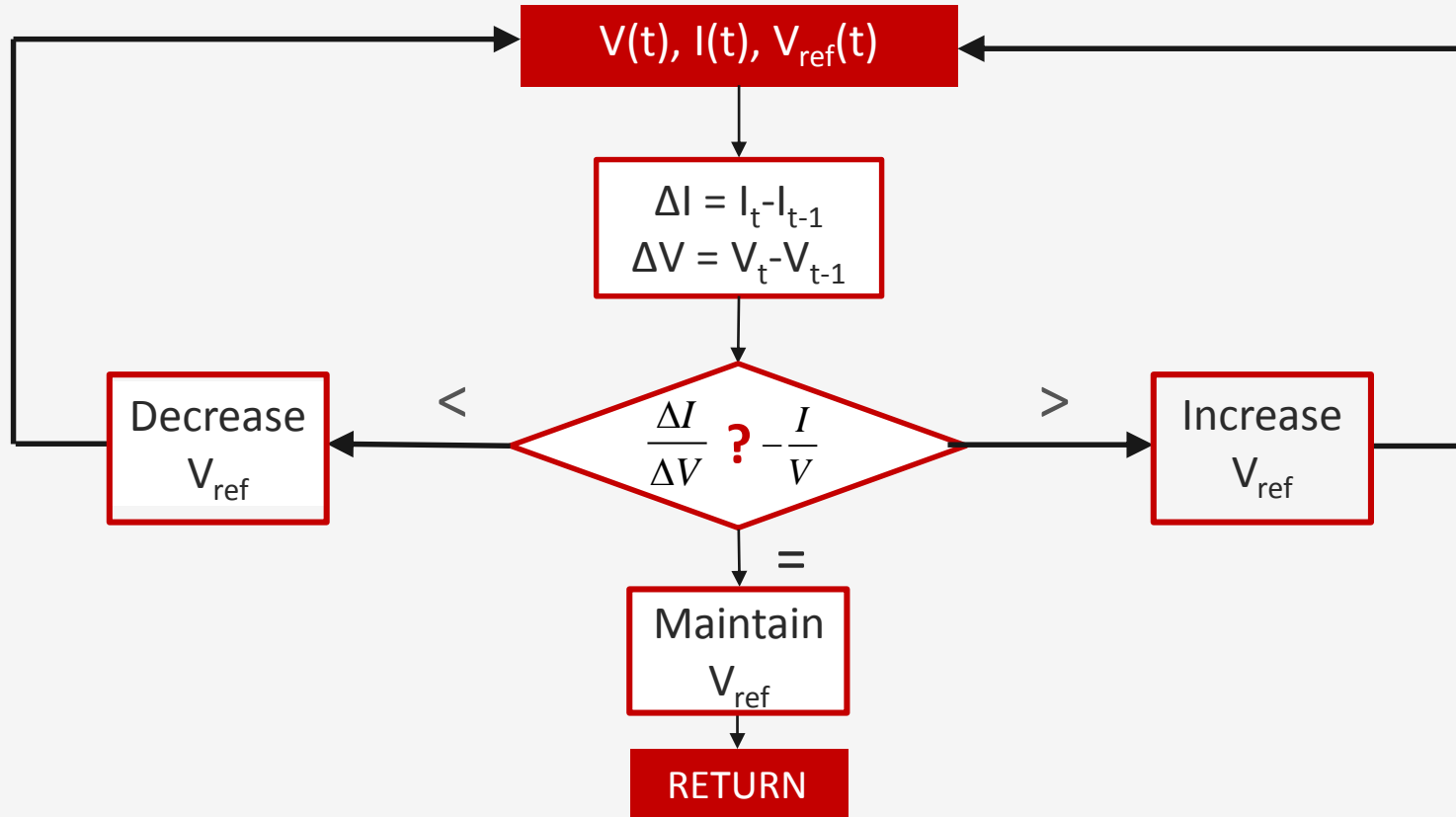
$$\frac{\Delta I}{\Delta V} < -\frac{I}{V}$$

To the right of MPP

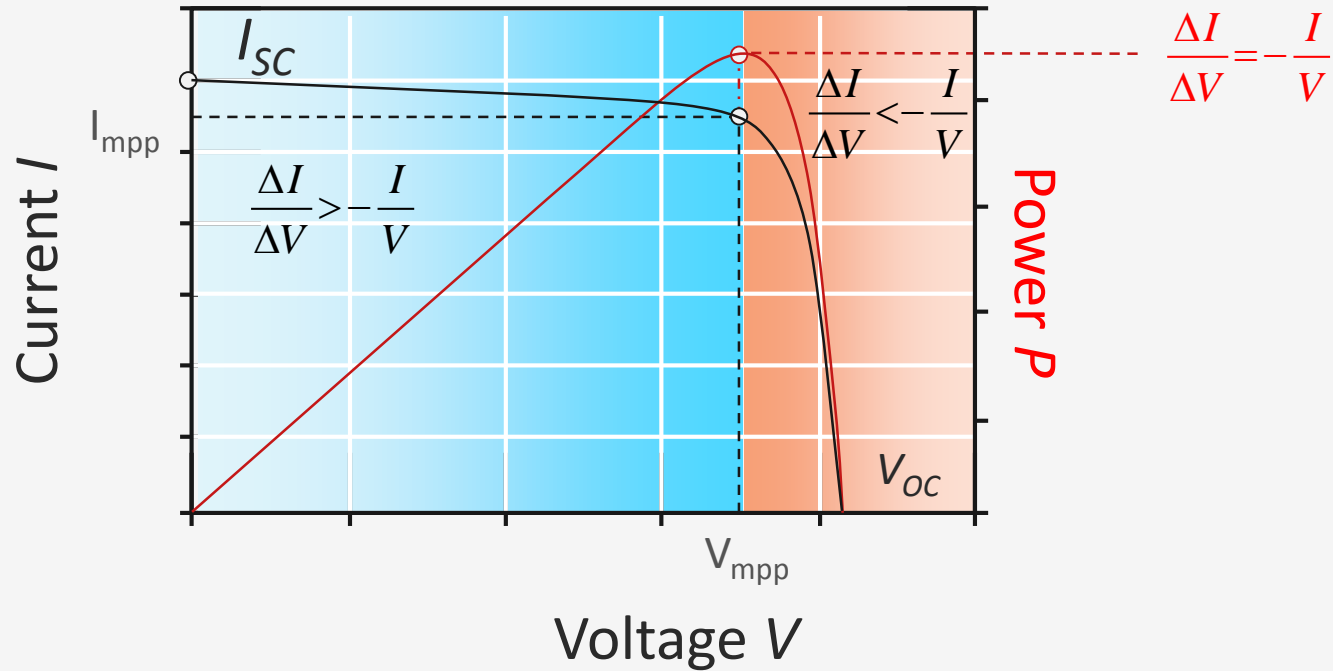
MPPT – Incremental Conductance



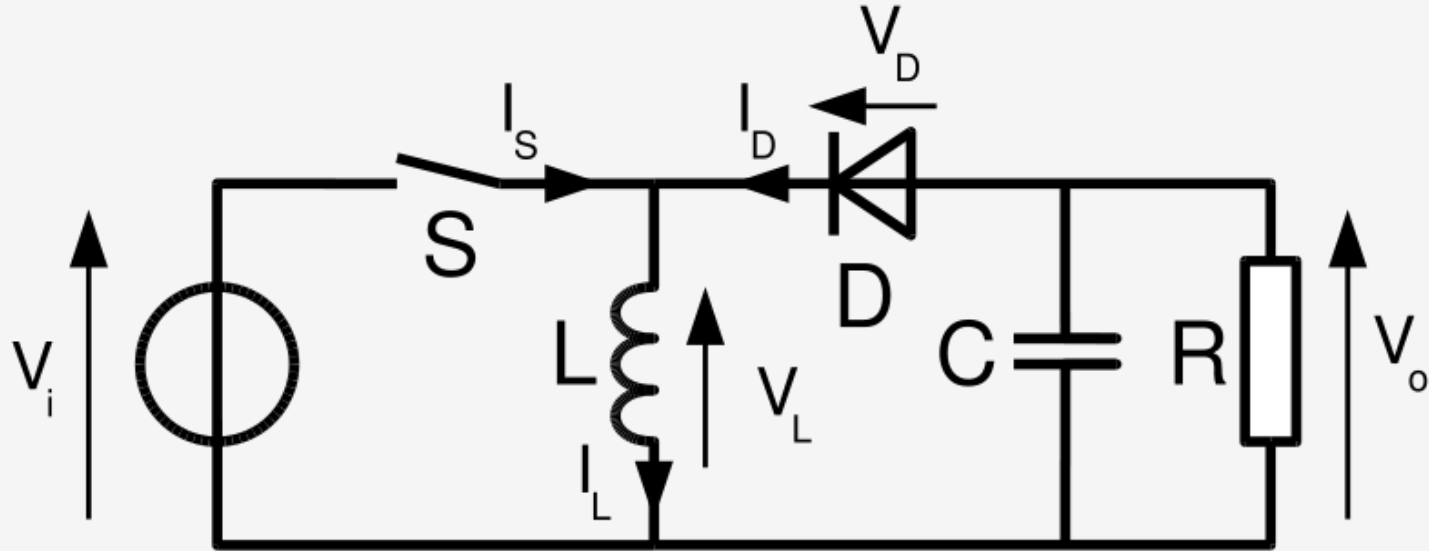
Incremental Conductance Algorithm



MPPT – Incremental Conductance



MPPT – Hardware Implementation



BUCK BOOST DC-DC CONVERTER

MPPT – Products

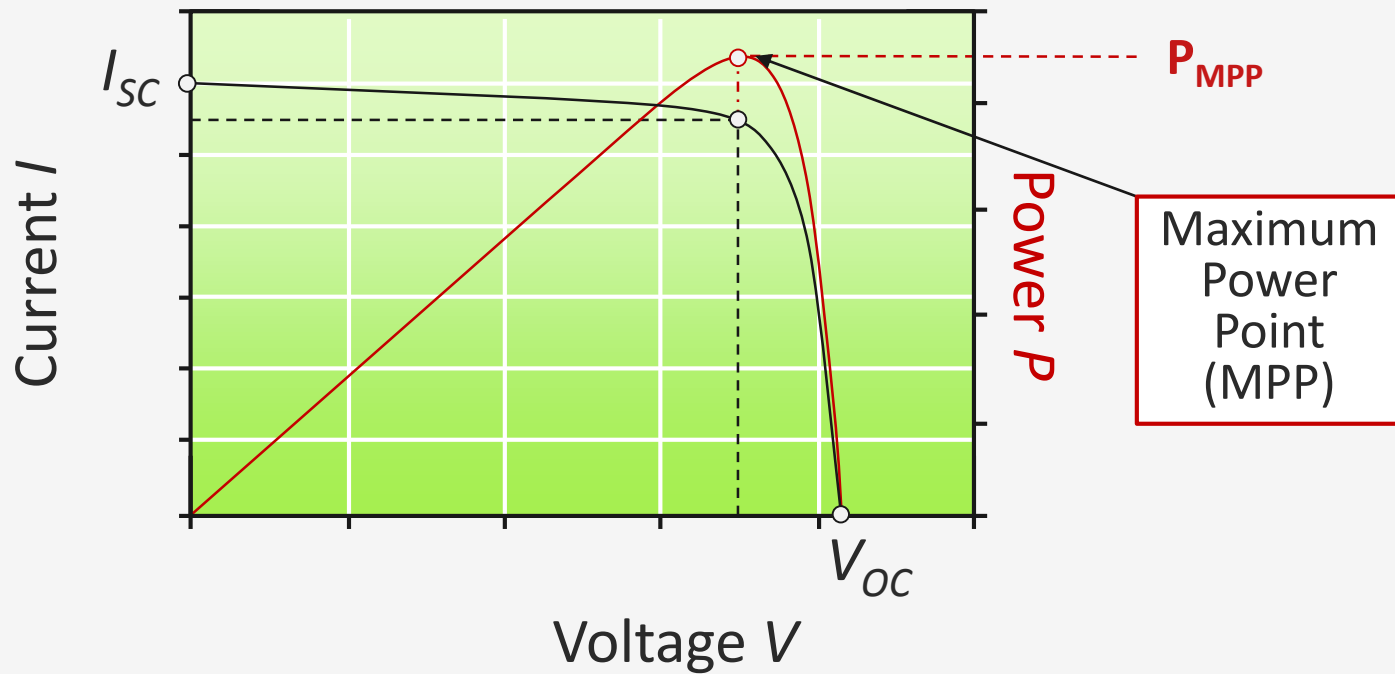


Steca Solarix MPPT Charge Controller



Steca Grid 500 MPPT Inverter

MPPT – Summary



Thank you for your attention!