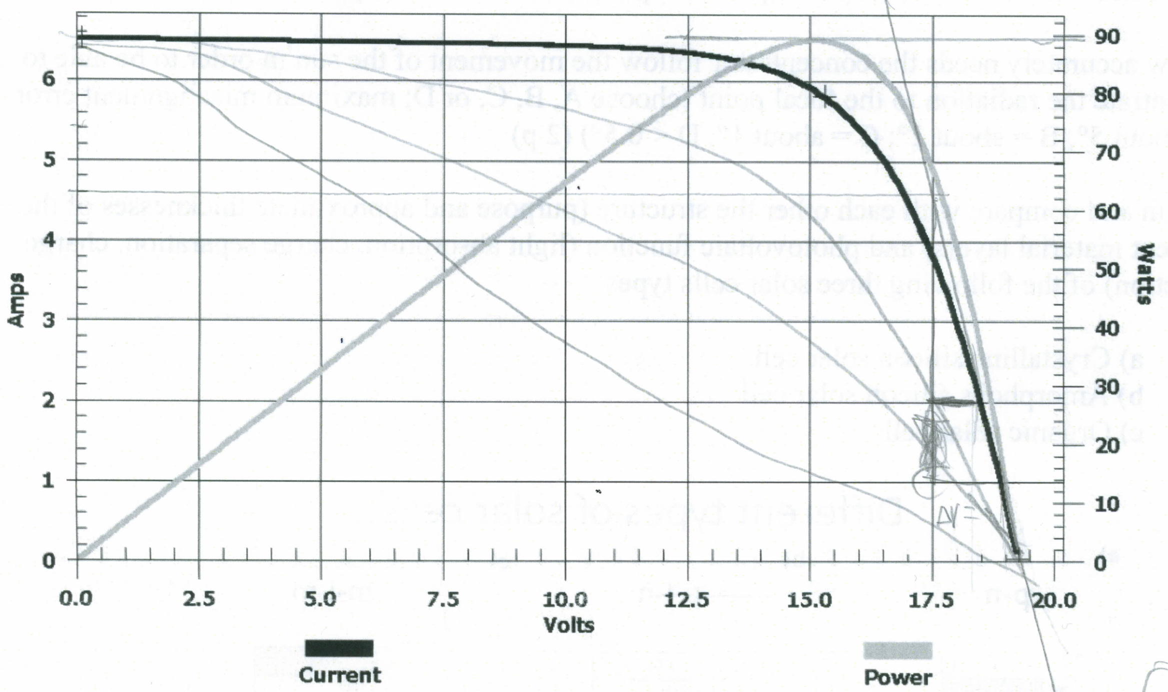
4. The figure below shows the current (I) – voltage (V) curve of a solar module (black curve) and corresponding power curves (power as the function of voltage, gray curve), measured at the standard test conditions (STC, radiation intensity 1000 W/m^2, T = 25 °C, AM1.5G spectrum). The dimensions of the module are 600 × 1000 mm. Estimate the open circuit voltage (V_{OC}), short circuit current (I_{SC}), fill factor (FF), and energy conversion efficiency (η) of the module in the following two cases:

a) Initial case, as in the Figure (3 p)
b) Initial case, but with series resistance (R_S) of the module increased from its initial value by 1 Ω (3 p)



5. Explain shortly following definitions (each 1 p)
a) Trombe-wall
b) Thermosyphon
c) Heat produced by a typical solar heating system in Southern Finland (kWh/m^2 per year)?
d) Hottel–Whillier–Bliss (HWB) equation
e) Fin efficiency of a solar collector
f) Threshold intensity (kynnysintensiteetti)