

Energia Solar Fotovoltaica

Problem Sheet 3

(Ver. 1: 2017.11.13)

1 Energy storage

1.1 A water well is in a location with a mean daily solar radiation of 4.8 hours of sun. The PV powered pump is able to produce 16m³ /day from a depth of 18m.

- a) Determine the required capacity of the batteries for autonomy of 3 days.
- b) Determine the required installed PV power.

**1.2 How much water would have to be pumped to a tank raised 3 meters from the ground in order to be able to recover 1kWh of electricity?
[Assume 100% conversion efficiency.]**

Energia Solar Fotovoltaica
Problem Sheet 3

(Ver. 1: 2017.11.13)

2 Module temperature

- 2.1 A module datasheet states the following module parameters: $I_{sc} = 3A$; $V_{oc} = 20.4V$; $P_{max} = 45.9W$; $NOCT = 43^{\circ}C$. Determine the parameters (I_{sc} , V_{oc} , FF , P_{max}) of a module formed by 34 solar cells under the following operating conditions: $G = 700W/m^2$; $T_a = 34^{\circ}C$.**
- 2.2 A PV module is found to operate at $60^{\circ}C$ when $T_a = 30^{\circ}C$ and $G = 980W/m^2$. Determine the $NOCT$ of the module.**
- 2.3 Determine the variation with ambient temperature (between $-25^{\circ}C$ and $+75^{\circ}C$) of the power of a module (under standard $1000W/m^2$) with 36 Si cells in series each with $I_m = 5.85A$ and $V_m = 0.5V$ at $25^{\circ}C$ and a $NOCT=45^{\circ}C$.**

Energia Solar Fotovoltaica

Problem Sheet 3

(Ver. 1: 2017.11.13)

3 Sizing a grid connected system

Modules as those described in Table 1 are to be connected to an inverter with the specifications presented in Table 2. The modules' temperature range is -10 to 40°C.

Table 1: Module specification

Voc	30.2 V
Vm	24 V
Isc	8.54 A
Im	7.71 A
T coeff P	-0.485 %/°C
T coeff V	-0.104 V/°C

Table 2: Inverter specification

Max DC power	3200 W
Max DC voltage	600 V
MPP voltage range	268 - 480 V
DC nominal voltage	350 V
Min DC voltage	268 V
Max input DC current	12 A
Max output AC current	15 A

- Determine the module voltage range.
- Determine the minimum number of modules in a string, considering a 2% drop loss in the DC cables and a 10% safety margin for the minimum inverter input voltage.
- Determine the maximum number of modules in a string, considering a 5% safety margin for the maximum inverter input voltage.
- Determine the number of strings by matching the current specifications (neglecting temperature effects).
- Compare the array DC power of the configuration specified in the previous questions to the max DC power of the inverter.