1. Module temperature

a) A module datasheet states the following module parameters:

I_{sc} = 3 A
V_{oc} = 20.4 V
P_{max} = 45.9 W
NOCT = 43ºC

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 = 34ºC.

b) A PV module is found to operate at 60ºC, T_a = 30ºC G = 980W/m^2. Determine the NOCT of the module.

c) Determine de variation with temperature (between -25ºC and +75ºC) of the power of a module with 36 Si cells in series each with I_m = 5.85A and V_m = 0.5V at 25ºC.

2. Energy accumulation

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.]

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3. Homework

(To be solved individually; 'handed' in by email to solar@fc.ul.pt by 24/11/07.)

Design a stand alone system for your hometown. Make up the modules' inclination (depends on the available roof), discuss the relevance of using tracking. Use real data for the equipment considered, i.e. modules, charge regulator, inverter, batteries (include datasheets). Consider the load described in the table below.

Equipment	Power	Usage
5 lights	20 W	3 h/day
3 lights	60 W	2 h/day
Fridge	150 W	10 h/day
Freezer	150 W	10 h/day
Iron	1000 W	1 h/day
TV	60 W	4 h/day
Washing machine	2.2 cycle	Twice week
Dish washer	1.9 kWh/cycle	Once a day