1. Microgeneration

Considering a yearly fulfilment of the 10MW cap of the Portuguese micro generation law:

1. How much would a 3.68kW PV system produce in Portugal? [average insolation: 1.5kWh/Wp/year]
2. Determine the income from a PV system with maximum allowed power, installed in 2009 [lifetime: 30 years].
3. Compare with the evolution of the cost of electricity from the grid [12c€/kWh in 2009; 6% annual increment].
4. Assuming typical installation costs [6€/Wp], determine the payback time.

2. PV car

Internal combustion engines are not very efficient in producing electricity for car gadgets such as lights, radio, etc.

1. What is the cost of 1kWh produced from gasoline? [assume: 10kWh/litre; 25% mechanical efficiency; 70% electric efficiency]
2. Compare this value with the cost of 1kWh from PV. [assume: 7€/Wp; 7 years lifetime; in Portugal, i.e. 1.5kWh/Wp/year]
3. Assuming that a car requires 300W of electric power, calculate the average savings per 100km. [assume: 20,000km/year, 7 years, average speed 50km/h]
4. Why don't cars come with PV systems on the roof?

3. Land for energy

How much land would Portugal need to supply all its electricity needs with PV? [assume: demand: 50TWh/year; 1.5kWh/Wp/year; 15% efficiency].

Noticing that the land required is proportional to 1/efficiency [draw y(x)=1/x plot!] discuss the relevance of improving efficiency for the mass deployment of PV.

4. Radiation

1. Determine the photon flux, power density and spectral irradiance for AM0, AM1.5D and AM1.5G. [use spreadsheet and excel data file]
2. Use the PVGIS tool to determine the increase in yield using monthly inclination adjustment [reference: fixed system with optimum inclination for location; use insolation data for your hometown]