

Tutorial problems (23750) for “Solar Energy” lecture (23745), WS 2014/2015

Michael Oldenburg & Bryce Richards

Tutorial Questions #7:

1. Heat Capacity

The heat capacity is the quantity which states how much energy is needed to heat up one gram of a material by one Kelvin.

- a) Calculate the energy which is needed to increase the temperature from 15°C to 70°C of 300 l water $\left(c = 4.187 \frac{\text{J}}{\text{g}\cdot\text{K}}\right)$.
- b) A solar system with a nominal power of 4 kW_p is used to heat the amount of water in a). What should the PSH be to provide the temperature increase?
- c) Assuming that the amount of 300 l is covering a surface of 1 m^2 and exposed to the sunlight. What time is needed to heat it up (AM1.5)?

2. Solar thermal system

Propylene glycol $\left(\rho = 1.04 \frac{\text{g}}{\text{cm}^3}, c = 3 \frac{\text{J}}{\text{g}\cdot\text{K}}\right)$ is used in a solar thermal system as heat carrier. The flux velocity is $300 \frac{\text{l}}{\text{h}}$. During one cycle it got heat up from 41°C to 71°C and is cooled down by a water reservoir from 67°C to 44°C .

- a) What is the amount of heat transferred from the propylene glycol to water?
- b) Assume an irradiation power of $0.8 \frac{\text{kW}}{\text{m}^2}$ and a surface of 10 m^2 . How much of the solar energy is used for the heating process?
- c) How much energy get lost between the collector and the heat exchanger?