1. a)

   The density of water is nearly $\rho_{water} = 1\frac{kg}{l}$ so the mass is $m = 300kg$.

   $$Q = c_{water} \times m \times \Delta T = 4.187 \times 300 \times 55\ MJ \approx 69\ MJ$$

   b)

   $$P = \frac{Q}{t} \Rightarrow t = \frac{Q}{P} = \frac{69MJ}{4kW} \approx 4h\ 48min$$

   c)

   $$t = \frac{69MJ}{1000\frac{W}{m^2} \times 1m^2} = 69\frac{MJ}{1000\frac{J}{s}} = 19h\ 12min$$

2. $T_1 = 67°C, T_2 = 44°C, T_3 = 41°C, T_4 = 71°C$

   a)

   $$Q = c_{pg} \times m_{pg} \times (T_1 - T_2) = 5980W$$

   b)

   $$P_{sun} = 800\frac{W}{m^2} \times 10m^2 = 8kW$$

   $$Q = 3\frac{kJ}{kgK} \times 1.04\frac{kg}{dm^3} \times \frac{300}{3600}\frac{dm^3}{s} \times 30K = 7.8kW$$

   The efficiency is then calculated by the corresponding quotient:

   $$\eta_{pg} = \frac{7.8}{8} = 97.5\%, \eta_{water} = \frac{5.98}{8} = 74.75\%$$

   c) The amount of heat power which is lost is:

   $$\Delta P = 7800W - 5980W = 1820W$$