EXAMPLE: Isentropic efficiency of a turbine

A turbine with an adiabatic efficiency of $\eta_T = 0.9$ operates between 8 MPa and 100 kPa with an inlet temperature of 700°C. The mass flow rate of steam through the turbine is 1.25 kg/s and the environment is at $T_0 = 300$ K and $P_0 = 100$ kPa.

a) Sketch the process on a *T-s* diagram.
b) Calculate:
    1) the power out of the turbine,
    2) the rate of irreversibility in the turbine, and
    3) the lost power from the turbine.
c) Calculate the quantity

$$\varepsilon = \frac{\dot{W}_{out}}{\dot{W}_{out} + \dot{W}_{lost}}$$

How does this compare to η_T? Explain.