

Given

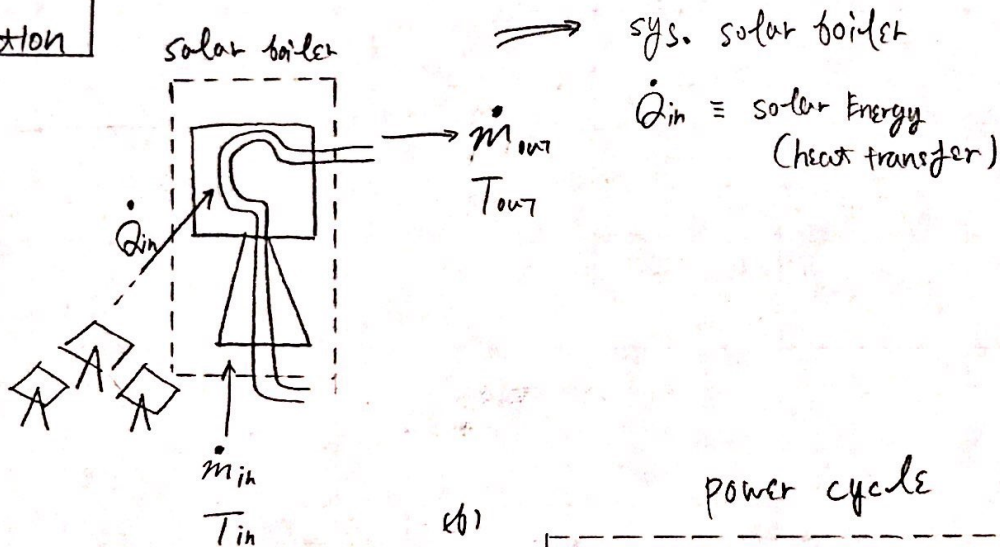
For the power plant shown below, solar radiant energy is the energy source to generate water vapor in the power cycle. During daylight operations, the absorbed radiant energy in the solar boiler generates water vapor that bypasses the storage unit to the turbine to provide net work (net work is the work output by the turbine minus the work into the pump). The water leaving the turbine enters the condenser where there is a heat transfer to condense the water into a liquid. The liquid water is pumped back to the solar boiler to complete the daylight power cycle. When there is insufficient sunlight, the bypass line is closed and the energy stored in the storage unit is the energy source.

Find

- (a) Consider the solar boiler as the system, identify the system and the locations on the system boundary where the system interacts with the surroundings and the directions for all flows.
- (b) Consider the power cycle as the system (include all piping system, boiler, storage unit, turbine, condenser, and pump), identify the system and the locations on the system boundary where the system interacts with the surroundings and the direction for all flows.

Solution

(a)



sys. power cycle

$\dot{Q}_{in} \equiv$ solar energy (heat transfer)

$\dot{Q}_{out} \equiv$ condenser heat release

$\dot{W} \equiv$ turbine work

