Example
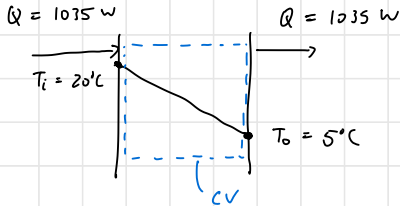
Temperatures at the inner and outer surfaces of a brick wall are 20°C and 5°C, respectively. The rate of heat transfer through the wall is 1035 W.

What is the total rate of entropy generation in the wall?

$$\Delta u = \Sigma Q - \Sigma W$$
$$= Q_{in} - Q_{out}$$

$Q = 1035\ W$

$T_i = 20°C$

$Q = 1035\ W$

$T_o = 5°C$

CV

$$\frac{dS}{dt} = \dot{S}_{in} - \dot{S}_{out} + \dot{S}_{gen}$$

$$\frac{dS}{dt} = \Sigma \frac{\dot{Q}_k}{T_k} + \dot{S}_{gen}$$

steady-state

$$0 = \frac{1035\ [W]}{293\ [K]} - \frac{1035\ [W]}{278\ [K]} + \dot{S}_{gen}$$

$$\dot{S}_{gen} = 0.191\ [W/K]$$

Entropy generation ≥ 0 ∴ Process is valid

> 0 ∴ Process has irreversibility

Heat transfer through
a finite temp. difference