$$\dot{E}_{in} - \dot{E}_{out} = \Delta\dot{E}_{system}$$

$$\dot{E}_{in} = \dot{E}_{out}$$

$$\dot{m}h_{in} + \tfrac{1}{2}\dot{m}v_1^2 + \dot{m}gz_1 = \dot{m}h_{out} + \tfrac{1}{2}\dot{m}v_2^2 + \dot{m}gz_1 + \dot{W}_{out} + \dot{Q}_{out}$$

$$\tfrac{1}{2}\dot{m}v_1^2 = \tfrac{1}{2}\dot{m}v_2^2 + \dot{W}_{out}$$

$$\dot{W}_{out} = \tfrac{1}{2}\dot{m}(v_1^2 - v_2^2)$$

$$\dot{m} = \rho v A$$

let $v = \tfrac{1}{2}(v_1 + v_2)$

$$\dot{m} = \tfrac{1}{2}\rho A(v_1 + v_2)$$

$$\dot{W}_{out} = \tfrac{1}{4}\rho A(v_1 + v_2)(v_1^2 - v_2^2)$$

$$\dot{W}_{out}^{max} = \dot{E}_{in} = \tfrac{1}{2}\rho A v_1^3$$

$$C_p = \dot{W}_{out} / \dot{W}_{out}^{max} = \tfrac{1}{2}\left[1 - \left(\frac{v_2}{v_1}\right)^2\right]\left[1 + \left(\frac{v_2}{v_1}\right)\right]$$

$$y = \tfrac{1}{2}(1 - x^2)(1 + x)$$