

A power plant, generating 400 MW of electric power, has an efficiency of 30%. What is the rate (in MW) at which heat energy is exhausted to the river that is used to cool the plant?

Given:

Power generated by the power plant: $P_w = 400 \text{ MW}$
Efficiency of the power plant: $e = 30\% = 0.30$

To determine:

Rate of heat exhaustion to the cold reservoir: P_c

Since energy generated per second is 400 MW, work done $W = 400 \text{ MJ}$.

Use formula:

$$e = W / Q_h \text{ ----- (1)}$$

Rearranging (1) and substituting for e & W :

$$Q_h = 400 / 0.30 = 1,333 \text{ MJ}$$

Known:

$$W = Q_h - Q_c \text{ ----- (2)}$$

Rearranging (2) and substituting for W & Q_h in (2):

$$Q_c = Q_h - W = 1,333 - 400 = 933 \text{ MJ}$$

The rate at which heat is exhausted in to the river that cools the plant is:

$$P_c = 933 \text{ MW}$$