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: $P_W = 400$ MW

Efficiency of the power plant: $e = 30\% = 0.30$

Determine:

Rate of heat exhaustion to the cold reservoir: P_C

Since energy generated per second is 400 MW, work done W = 400 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:
$P_C = 933$ MW