

36.76 $1000 \frac{lb}{hr}$ of fuel with a heating value of $5000 \frac{Btu}{lb}$ is burned in a co-generation plant that produces $600KW$ of electricity. How much energy is available to be harnessed from the waste steam exiting the turbine?

- A. $2 \times 10^6 \frac{Btu}{hr}$
- B. $3 \times 10^6 \frac{Btu}{hr}$
- C. $4 \times 10^6 \frac{Btu}{hr}$
- D. $5 \times 10^6 \frac{Btu}{hr}$

The waste heat is the difference between the energy provided by the fuel and the output power from the plant. Determine the amount of heat provided by the fuel.

$$\dot{Q}_{in} = \dot{m}(HV) = \left(1000 \frac{lb}{hr}\right) \left(5000 \frac{Btu}{lb}\right) = 5 \times 10^6 \frac{Btu}{hr}$$

Convert the power produced by the plant to $\frac{Btu}{hr}$ and subtract from the heat input to determine the waste heat.

$$\begin{aligned}\dot{W}_{out} &= 600KW \left(3412 \frac{Btu}{hr \cdot KW}\right) = 2.05 \times 10^6 \frac{Btu}{hr} \\ \dot{Q}_{waste} &= \left(5 \times 10^6 \frac{Btu}{hr}\right) - \left(2.05 \times 10^6 \frac{Btu}{hr}\right) = 2.95 \times 10^6 \frac{Btu}{hr}\end{aligned}$$

Answer B