Qu. 7 (cont.)

$$\text{Combustion efficiency} = \frac{\text{Actual temperature rise}}{\text{Ideal temp rise}}$$

where ideal temp rise given by:-

$$\dot{m}_{fuel} \times LCV = (\dot{m}_{fuel} + \dot{m}_{air})\, C_{pc}\, \Delta T_{ideal}$$

$$\text{or} \quad LCV = (1 + AFR)\, C_{pc}\, \Delta T_{ideal}$$

$$0.98 = \frac{1070 - 510.5}{\Delta T_{ideal}} \qquad \text{where } \Delta T_{ideal} = 570.9\,K$$

$$\therefore \quad 43 \times 10^6 = (1 + AFR)\, 1126 \times 570.9$$

$$\therefore \underline{AFR = 65.89} \qquad \text{ie. } \underline{\sim 66.0}$$

$$SFC = \frac{\text{Fuel flow}}{\text{Power out-put}} = \frac{\dot{m}_{fuel}}{\dot{W}}$$

$$= \frac{\frac{\dot{m}_{air}}{AFR}}{\dot{W}} \qquad \left(NB: AFR = \frac{\dot{m}_{air}}{\dot{m}_{fuel}}\right)$$

$$= \frac{\frac{1}{AFR}}{\eta}$$

$$= \frac{\frac{1}{65.89}}{160.6} \; kJ/kg$$

$$= 94.5 \times 10^{-6} \; kg/kJ$$

$$\text{or} \quad \underline{0.340 \; kg/kWh}$$