Grade: _____ Name: LRR

FSC 401

Quiz #1

Read the following statements carefully and indicate whether they are true (T) or false (F).
Note: For partial credit (if an answer is incorrect), summarize the procedure you used to obtain the answer and show the relevant calculations.

F (25%) If the energy consumption of a country, whose GDP is $100 billion, consists of 80 million tons of coal (12,000 BTU/lb), 20 million barrels of oil (5.6e6 BTU/bbl) and 5 trillion cubic feet of natural gas (960 BTU/scf), its energy intensity does not exceed 20,000 BTU/$GDP.

Coal: 1.92×10^{15} BTU/yr
Oil: 1.12×10^{14} "
NG: 4.8×10^{15} "

$\Rightarrow EI = \frac{6.83\times10^{15}\ \text{BTU}}{100\times10^{9}\ \$\text{GDP}} = 68{,}320\ \frac{\text{BTU}}{\$\text{GDP}}$

T (25%) If the annual growth rate of natural gas use (currently at 1.5e12 scf) is 5.7%, it will take more than 10 years for the consumption to reach 3.0e12 scf.

$t_D = \frac{\ell n 2}{0.057} \simeq 12.2\ \text{yrs}$

F (25%) If the efficiency of a 650-MW power plant (CUF=90%) is 40% and it uses natural gas (23,500 BTU/lb), its annual output of CO_2 does not exceed 1.0e6 metric tons.

$$\frac{44\ \text{mt CO}_2}{12\ \text{mt C}}\ \frac{12\ \text{mt C}}{16\ \text{mt NG}}\ \frac{1\ \text{mt NG}}{2200\ \text{lb}}\ \frac{1\ \text{lb}}{23{,}500\ \text{BTU(ch)}}\ \frac{3412\ \text{BTU(ch)}}{1\ \text{kWh(ch)}}\ \frac{1\ \text{kWh(ch)}}{(0.40\ \text{kW})(1\text{h})\text{(el)}}$$

$$650\times10^{3}\ \text{kW(el)}\ \frac{24\text{h}}{1\text{d}}\ \frac{365\times0.9\ \text{d}}{1\text{yr}} \simeq 2.3\times10^{6}\ \text{mt CO}_2/\text{yr}$$

T (25%) If 1 kWh of electricity costs 12 cents and a household uses four 1500-W hair dryers during 10 minutes every day, the monthly electric bill attributed to these devices does not exceed $15.

$$6.00\ \text{kW(el)}\times10\ \frac{\text{min}}{\text{d}}\ \frac{30\ \text{d}}{1\ \text{month}}\ \frac{1\text{h}}{60\ \text{min}}\ \frac{\$0.12}{1\ \text{kWh(el)}} = \frac{\$3.60}{\text{month}}$$

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