Lecture 13 Alternate Fuels March 3, 2020

Topics covered
- Review of energy demand –the exponential growth factor
- Alternate Fuels
- Conversion from fossil fuels

Keypoints:
- Alternate Fuels: Biodiesel and ethanol
  Ethanol: 27.3 kJ/gram, 0.79g/cc E 21.6 kJ/mL
  Gasoline: 48.1 kJ/gram, 0.70g/cc E 33.7 kJ/mL
  The energy density (kJ/mL) for ethanol is 36% lower than that for gasoline.
- Emergence of Biodiesel as alternate to gasoline Pro and Cons of biodiesel

Hydrogen –the clean fuel
- (production, storage & utilization)

Solve
1. If world consumption of energy is to increase at an annual rate of 2.0%, how long it would take to double and sixteen times?

2. Natural gas is mostly methane, but it also contains some ethane and propane. If the Enthalpies of combustion of methane, ethane and propane are −890, −1560, and −2220 kJ mol⁻¹, respectively. Calculate the amount of heat released per mole of carbon dioxide produced for the three gases.

\[ \text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} \]
\[ 2\text{C}_2\text{H}_6 + 7/2\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O} \]
\[ \text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O} \]

Using the enthalpy values, determine the energy generated per gram of fuel.

3. Calculate the volume (in liters) of CO₂ produced at 1 atm and 300K from the complete combustion of 1 L gasoline. Consider the chemical formula for gasoline as C₈H₁₈ and its density 0.702 g/mL.