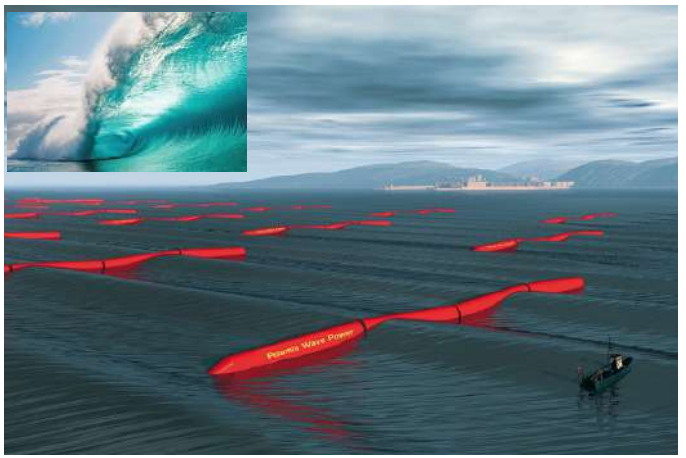
ENVC 24 : Energy and Environment

Part-3 : Non-conventional Energy Resources

Kanyakumari Windmills, India



Pelamis Wave Energy Converter, Scotland

Krafla Geo-thermal Enerrgy, Iceland

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Earth & Atmosphere

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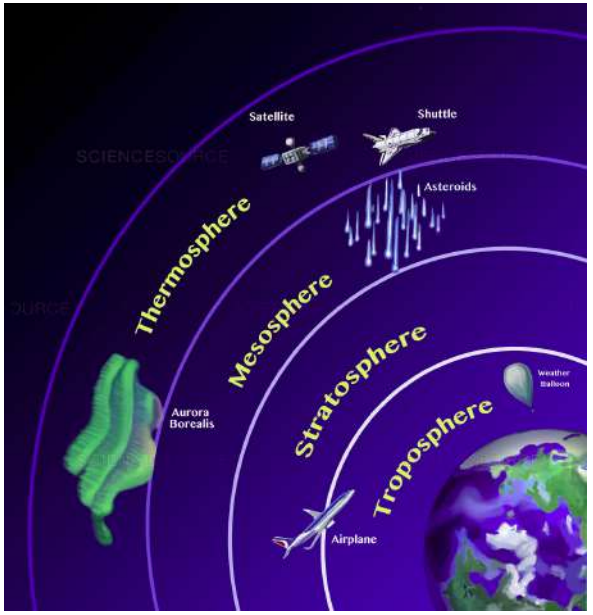

Troposphere → $0 - 12\ km$
Stratosphere * → $12 - 50\ km$
Mesosphere → $50 - 80\ km$
Thermosphere → $80 - 700\ km$
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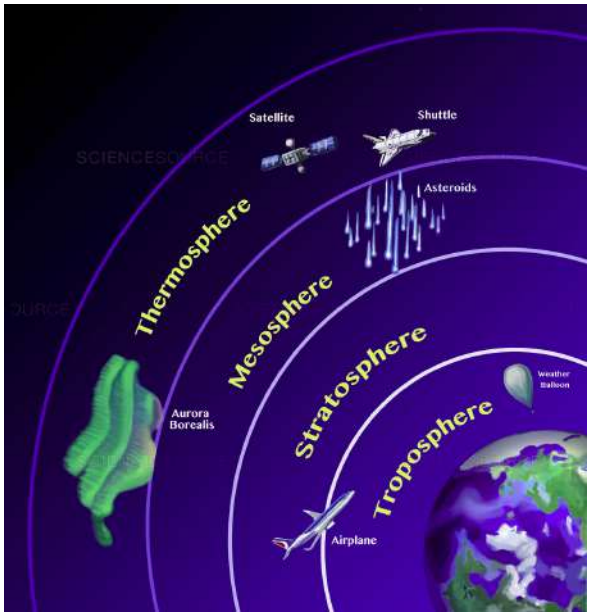

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Earth Radius(R) → $6371\ Km$

Earth+Troposphere Radius(R') → $6383\ Km$

Earth Volume → $\frac{4}{3}\pi R^3 \sim 1.083\ x\ 10^{21}\ m^3$

Troposphere Volume → $\frac{4}{3}\pi R'^3 - \frac{4}{3}\pi R^3$
$= 6.133\ x\ 10^{18}\ m^3$

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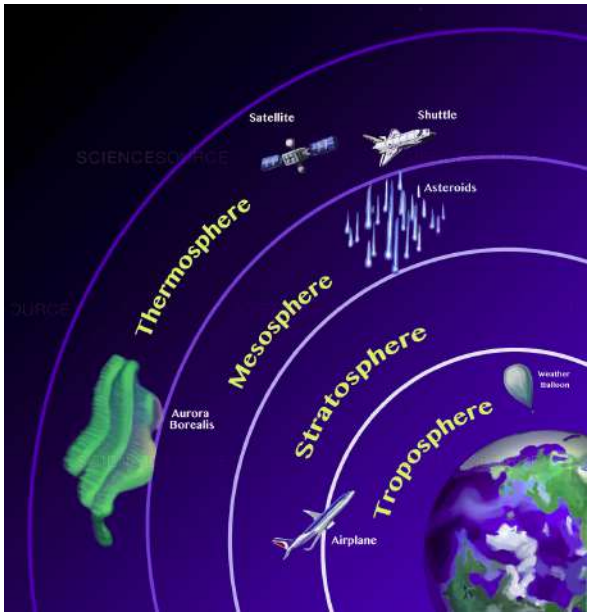

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Atmosphere

- As Volume of Troposphere is $6.133\,x\,10^{18}\,m^3$, then 0.04% of CO_2 accounts for $2.453\,x\,10^{15}\,m^3$. To moderate on Greenhouse gas, estimate have to add on this number!!

  1 mole of CO_2 corresponds to 22.4 litre or $22.4\,x\,10^{-3}\,m^3$ at S.T.P.(1atm P, 0°C T).

$$\frac{0.04}{100}\,x\,6.133\,x\,10^{18} = 2.453\,x\,10^{15}\,m^3.$$

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- World energy usage/year ➔ 500 ExaJoules. So, heat of formation of CO_2 is $\triangle H = -394\,kJ/mol$ and therefore CO_2 emission amounts to an energy release/year ~

$$\frac{5\,x\,10^{20}\,x\,22.4\,x\,10^{-3}}{3.94\,x\,10^{5}} = 2.843\,x\,10^{13}\,m^3 \text{ of } CO_2/yr\,.$$

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- Time required to double the amount of CO_2 in the atmosphere at the present usage is $\frac{2.453\,x\,10^{15}}{2.843\,x\,10^{13}} = 86\,years!!$ Big reasons to worry, as if we increase more, this time of doubling will be reduced and Greenhouse gas effects (global warming, snowstorms, ice-age?) can initiate towards a severe climate change. So energy usage by humans can significantly alter the composition of atmosphere within a very short period of time!

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