

Carbon emission impact on Energy Sector

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Abstract

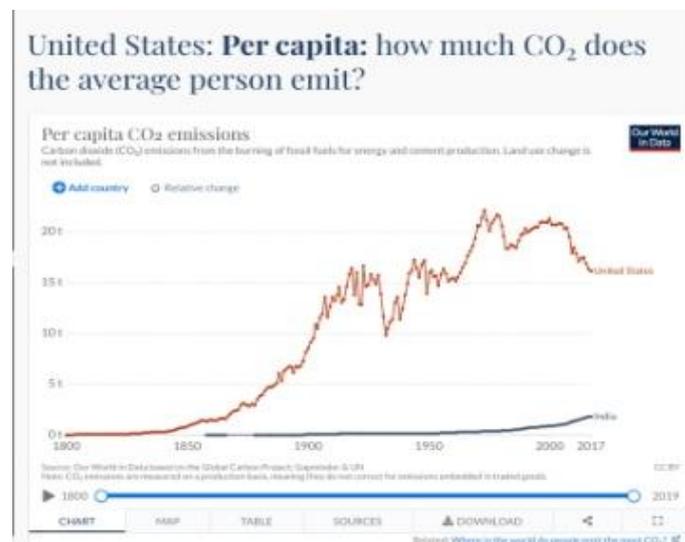
Anthropogenic Climate change since industrial revolution is an accepted reality. In the last 100 years Earths' temperature has go up by 0.7⁰C. A 3⁰C rise in Earth's temperature will make the planet unlivable. Soaring Carbon dioxide emissions remain the major contributor for GHG and it takes around 30 years to remove 50% of increased CO₂ from the atmosphere. Primary source of CO₂ emission is due to burning of fossil fuels for Global Energy requirements. The 1988 UN general assembly resolution and 'Paris Agreement' within United Nations Framework Convention on Climate Change in 2016 has given clear cut aim to humanity of holding increase of global average temperature below 2⁰C above pre-industrial levels to save our planet.

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I. Hunger for greenhouse gas emissions

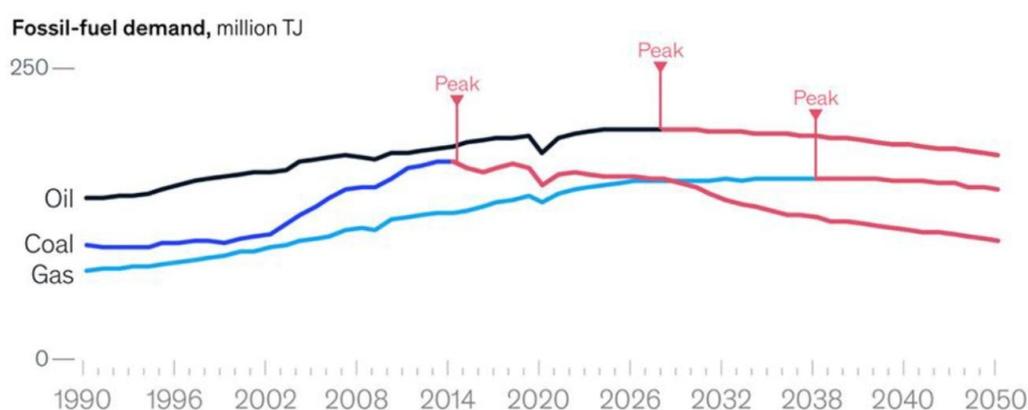
(a) Human comforts require energy. Carbon footprint in USA is 16 tons¹ per person as compared to 0.6 tons¹ per person in India. It is impractical to ask developed countries like USA to reduce their standard of living or for developing/poor countries like India to stop improving their quality of life.



(b) Growth in human population from 1.6 billion in 1900 to over 7 billion in 2020 has been a major contributor to climate change. Population is expected to stabilize to around 10.9 billion by 2100². Growing populations require energy and they are prime contributors towards increase in green house gases.

(c) Kyoto Protocol, 1997 require industrial nations to reduce emissions by 5.2% from 1990 level whereas developing countries are exempt³. Human civilization is not fighting climate change together and the burden has been predominantly left to the industrialized nations.

Kyoto protocol targets have pushed developed countries for change. The developed world has targeted Electricity and transportation as two sectors where next generation technologies will reduce GHG. The next decade will be transformational and fossil fuel consumption is likely to reach peak demand in 2027 as per latest study by Mckinsey & Company.



Three technological marvels unfolding at a frightening pace to reduce GHG emissions

Solar Power

Solar power will increasingly replace fossil fuel (primarily coal) based electricity generation. Solar power uses photovoltaic (PV) cell to convert solar energy into Direct Current. Concentrated Solar Power (CSP) converts solar energy into heat to drive a steam turbine but CSP has been limited to a few countries only. PV cell is a Si based semi-conductor solar cell. PV efficiency has gone up from 14% to 30% with c-Si (crystalline Silicon) based PV cells⁴. Solar electricity per unit cost has crashed in last 5 years. In India, on 22 Nov 2020 unit solar tariff reached a low of Rs 2 per unit in the bid conducted by Solar Energy Corporation of India Ltd (SECI). In an optimistic assessment, it is expected that solar/renewable power generation will overtake fossil fuel in electricity generation by 2030 and fossil fuel emissions will cease by 2070, a scenario which would still make 'Paris Agreement' climate goals difficult to achieve.

EVs for Personal Mobility

Global oil consumption is 100 million barrels per day. CO₂ concentration above 450 parts per million is considered catastrophic for our planet. EVs have the capacity to reduced global oil consumption by as much as 2 million barrels a day in next few years. Worldwide, car manufacturers have stopped making new ICE and are investing in newer generation Electrical Vehicles. The future of EVs depend on newer battery technologies like carbon nanotube electrode, cobalt free lithium battery (cobalt is very expensive), Lithium-Sulphur batteries etc. In 2020, the explosive sale of EVs along with covid-19 pandemic has resulted in lowest drilled oil wells globally in last 20 years, a staggering fall of 23% from 2019 levels.

Fuel Cell

Hydrogen based fuel cell generate electricity by reacting hydrogen with oxygen and produces water vapour as exhaust. Hydrogen can be stored like petrol in a car and hydrogen is abundantly available. Japan has gone with fuel cell technology and 'Mirai' hydrogen powered zero emission hybrid (electricity plus battery) engine from Toyota is considered the first economically viable hydrogen engine that can replace gas combustion ICE and Lithium battery based EVs. A hydrogen based eco system is technologically feasible and even in India a Hydrogen Fuel Cell (HFC) prototype vehicle has been developed by CSIR and KPIT. The prototype has undergone successful trials.

Lockdowns during Covid-19 have demonstrated nature's ability to reclaim destroyed systems as global greenhouse emissions saw a drastic fall during the pandemic lockdown. Dhauladhar mountain range of Himachal was visible from Jalandhar, a cool 200 kms away, for the first time in 30 years. Banning of Chlorofluorocarbon (CFC) for refrigeration has helped Ozone layer heal at a rate of 1% to 3% since 2000. Humanity can prevent impeding climate emergency by listening to science, innovating and moving to climate friendly way of life.

References

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