

A note on Climate Change (CC)/ Global Warming (GW)

1A.

Climate Change is one of the defining challenges of the 21st century. Another is the removal of world poverty. Connected to both are high population/consumption growth, grave shortages of food (1 billion or 1 in 7 in the world going hungry with food prices having doubled between 2007-13) and an acute shortage of fresh water which is diminishing at an alarming rate. In the words of the Earth Summit, Rio (1992), there is a need for 'economic sustainability, social sustainability and environmental sustainability' all of which are inextricably linked, implying both the need for development (in these areas) that meets the needs of the people on earth without compromising the ability of future generations to meet their own needs. For policy purposes, this definition is further split into two opposing paradigms of sustainability – weak sustainability (WS) and strong sustainability (SS). The main point of divergence is on the treatment of natural capital. Proponents of WS argue that natural capital is substitutable. Hence, investments in man-made and human capital can compensate for decline of natural capital. In contrast, and more correctly, the SS paradigm regards natural capital as non-substitutable. It calls for maintaining the functions of natural capital intact. In our search for prosperity, exploitative growth and success with the accent on short term gains and maximizing short term shareholder value, we are not only destroying the planet's sustainability but causing a further increase in Carbon Dioxide(CO₂) in the atmosphere and the resulting problems associated with Climate Change which in turn affects sustainability in a vicious circle. The really bad news came on the 10th May, 2013 when the CO₂ reading at the research facility at the Mauna Lao Volcano in Fiji surpassed the danger level of 400 parts per million, a concentration past what is regarded as the 'danger' level and not seen on earth for millions of years!

1 B.

The world is indeed getting hotter. The world's mean temperature has risen substantially - by 0.8°C since pre industrial levels c.1750 and this is expected to increase further -by at least the same amount by 2030. Increasing temperatures affect weather by altering oceanic and atmospheric currents, through glacier and ice sheet meltdowns and much else. An obvious and glaring example of the impact of CC is Tuvalu, a low lying island of 11,000 people in the Pacific Ocean will require its population to be transferred within 30 years because of increasing sea levels. There is now a greater number and severity of heat waves, floods, storms, and droughts and farming is becoming even more difficult in areas considered drought stricken. Although there are other factors that affect climate such as solar activity, forest fires, volcanoes etc., scientists are agreed that it is the increase of human induced Green House Gasses (GHG's) in the atmosphere, which is mostly responsible for increased climatic temperatures.

2.

Hence we are now described as being in the age of the Anthropocene (the previous age being the Holocene) implying that it is human action since

around 1750, mainly the increasing and excessive use of fossil fuels in the electricity generation industry and industry generally which is responsible for the increase in GHG's and CC. Deforestation and soil degradation is responsible for one fifth of all emissions of GHG's. Although water vapor too is a GHG, it does not necessarily have any real or direct connection with human activity so when we speak of GHG's we mean - [Carbon dioxide](#) (CO₂), [Methane](#) (CH₄), [Nitrous oxide](#) (N₂O), [Perfluorocarbons](#) (PFCs), [Hydro fluorocarbons](#) (HFCs), and [Sulfur Hexafluoride](#) (SF₆). The measurement of these gases is done in terms of the CO₂ or the CO₂ equivalent of these gasses. For example, one ton of methane released into the atmosphere has the same impact on the climate as 23 tons of CO₂, whereas nitrous oxide is 296 times more potent than CO₂. The real nasty is Sulphur Hexafluoride -- used in the manufacture of electrical systems -- has 22,200 times the global warming potential of carbon dioxide!

3.

The Greenhouse Effect

The atmosphere acts as a blanket around the earth through the action of GHG's which absorb the sun's radiation and without which it would bounce off into space. These gases, at a certain level, play a valuable role in maintaining global temperatures and this had remained fairly constant and consistent (with some ups and downs) in the atmosphere for over 10,000 years. With our interference in this 'carbon cycle' whereby the earth's 'carbon sinks' are releasing a larger proportion of their carbon through our excessive use of fossil fuels, cutting down of forests, impacts of absorption of CO₂ by the oceans and their subsequent acidification etc., the balance is no longer maintained and temperatures are rising steadily.

4.

Whilst higher emissions cause harm anyway as poor air quality increases the incidence of respiratory diseases and heat melts glaciers causing rising ocean levels making small islands and coastal areas increasingly vulnerable, the actual impact of the increase in carbon is proportionately greater on account of 'tipping points'. A warmer climate decreases the ability of plants to photosynthesize for example. The process of CC triggers 'positive feedbacks' which further accelerates the process. For example in Greenland where the ice sheet is thinning, the removal of ice has a cascading effect- when sunlight falls on snow and ice most of its energy is reflected back into space but when it falls on water, most of its energy is absorbed which melts more ice and so on.

There is now evidence (BBC News -Siberian Permafrost thaw warming sparked by cave data, 23/02/2013) deduced from stalactites and stalagmites in caves in Siberian which record 500,000 years of changing permafrost conditions, suggesting that a global rise in temperature of 1.5°C would release a trillion tons of CO₂ and methane into the atmosphere due to permafrost thaw. (Permafrost covers 24% of the land area of the northern hemisphere). This would further increase global temperatures by 1.5°C

(Economist 30th March 2013- Pages 73-75)! Long stored methane is already escaping into the atmosphere from the Arctic melt. An increase in temperature further increases water vapor, another GHG and which again results in higher temperatures. This phenomenon of 'feedback mechanism' in the Arctic, it is believed, and elsewhere is capable of flipping the ecosystem from one state to the other after reaching the 'tipping point' causing even greater damage.

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There is another reason why the Greenland/Arctic and other melts are significant. The ice melt has and will further increase sea levels and this together with the destruction of coral reefs is likely to affect more than a billion people living near the coastlines. The other reason is that it will compound the already great shortage of water in the world. About one sixth of humanity relies on water dependent on snowfall and the depletion of these stocks will take a heavy toll. The WHO estimated that by 2004 140,000 deaths were caused by CC. It is estimated that by 2020 between 75-200 Million people will suffer from increased water shortage solely caused by CC. The question really is- have we already reached the 'tipping point' or are we going to do so soon?

6.

Impact on India

This brings me to the other aspect of CC -that it will harm the poorer countries a lot more than the richer ones. Partly of course it is because the poor lack the means to adapt to CC. Rich countries can afford to build sea walls, vaccinate everyone and plant disease resistant crops and install air conditioning which the poor cannot!. There is also a geographical aspect that the most affected parts are going to be in those parts of Africa and Asia which already contain the poorest people on the planets. Asia has areas with the greatest population density. The Agricultural lands of India(and China/South East Asia) are the oldest, most irrigated, most depleted and most extensively cultivated in the world. Whilst nutrients are being added, there are some bio-nutrients which are not possible to replenish and are being slowly depleted so that the land has begun to give diminishing returns. We do not realize the enormity of the food crisis – India has only 2% of the world's land area but one fifth of its people and also one fifth of its cattle population and only 4% of its water. India adds 1.5% every year to our 1.25 billion giving us over 15million more mouths to feed. There are over 700 million Indians living in poverty. What has 'saved' India from being a basket case a long time ago is this lack of purchasing power and the presence of vegetarianism- 70% of the total, and this more out of compulsion than choice! With economic development and higher incomes more meat will be consumed and for every kilo of meat at least 5 kilos of cereal is required putting an even greater load on food availability. We can already see this trend in the big cities- Mumbai has reached the same consumption levels as any big city in the west! Add to

this the devastation caused by CC. As an example it is estimated that out of the combined populations of the deltas of the Rivers Ganges and Brahmaputra (total 111 million in India and Bangladesh) that approx 3.43 m will be displaced by 2050 (total world figure-over 9 million likely to be displaced from their homes across the world), and a further 4.7 million exposed to flooding during storm surges. So India shows us an example of a truly explosive situation in both food and water shortages. Coupled with this is the massive immigration from the villages to the cities in the next two decades which along with the needs of industrialization based upon increased consumption levels and therefore relying heavily on manufacturing will require a doubling of infrastructure and so more emissions of GHS's taking our expected per capita carbon footprint from 2 tons to 3.5tons! India will need to take drastic action and require out-of-the-box solutions.

7. Given what most scientists have to say with conviction about the impact of CO₂ on CC, it is surprising that there should be much debate at all about issues relating to CC. But there are contrarian voices. For example there are those who say that atmospheric heating is a relatively temporary phase and that climate will revert to its original acceptable level. Further that any heating that has taken place according to them is more likely to have been caused by factors not connected with human activity such as sun spots etc. There is an on going controversy about the extent of action- the Stern Review advocates very strong action for dealing with the problem of CC on the basis of the gravity of the situation whereas William Nordhaus suggests that the problem is not unmanageable and a modest response is required with strong action being delayed for decades.

There is a feeling among some echoed in the recent Economist(30 March, 2013- "Global warming slows down") that CC is exaggerated. They point to the recent mismatch between rising green house gases of which 100 billion tons were added between 2000-10- 25% of all CO₂ put into planet since 1750 but the temperatures did not in fact rise! This is likely to be because of lags and/or deep ocean atmospheric heat absorption. The results of the Research Council of Norway from the University of Oslo predicts that doubling CO₂ emissions would increase temp between 1.2-2.9°C with the most likely figure being 1.9°C. Even this is quite alarming and compares unfavorably with what is the consensus among mainstream scientists whose views are represented by IPCC (The Inter Governmental Panel on CC) which warns that CO₂ emissions will ensure a rise in rise in temperatures and that " ..the equilibrium sensitivity [temperature rise after allowing all feedback mechanisms to work but without incl. changes to vegetation and ice sheets] is likely to be in the range of 2°-4.5°C with the best estimate of about 3°C and is very unlikely to be less than 1.5°C ".

8. The dangers of CC are clearly visible. One report predicts a million yearly deaths due to CC from 2030 onwards. Another study suggests that CC diminishes 5-20% of the world's economic production. Population is increasing and will reach 9 billion by 2050. This will further exacerbate CC and CC will in turn adversely affect the population. Partly because of CC,

world agriculture production is anyway slated to fall by between 15-50% by 2080 from current levels and agriculture commodity prices, already increasing spectacularly, will hit the roof.

As CC does harm, one could say that it is the moral responsibility of each individual to reduce carbon emissions. The annual emissions of a single person living in a rich country (average 800 tons in a lifetime) shortens about 6 months of healthy human life in total. (WHO -Page74 'Climate Matters'). A return air trip London/NY for example emits more than a ton of CO₂. Emissions can be reduced through a string of measures-insulating our houses, using solar panels, using hybrid cars and more public transport, reducing air travel, turning off lights in a room, planting more trees etc and, finally, buying offsets for all the CO₂ we cannot help but generate.

9. Whilst individual action will help, the problem of CC can only really be dealt with successfully by governments because it is only governments that have the power to get large numbers of people to change their behavior through subsidies, taxes, incentives etc. Clearly encouraging new and innovative low carbon technologies / renewable energy, subsidizing clean coal technology, legislating/using tenders for insisting on Corporate Social Responsibility, using and levying carbon taxes etc are what is required on a war footing. The EU Emissions Trading Scheme started in 2005 envisages a cap/limit on total amounts of GHG's that can be emitted by industrial units, power plants etc. covering 50% of total CO₂ emissions and 40% of all GHG's. The cap is steadily reduced over time so that by 2020 the emissions from sectors covered by the EU ETS will be 21% lower than in 2005 in spite of the GDP increases! In Britain govt. departments compete on how to reduce electricity and have come out with innovative ways to encourage individual householders to do so.

10.

But what are the other international initiatives to reduce CO₂ emissions? A treaty known as the UNFCCC (Framework Convention on Climate Change) was adopted in 1992 with the aim to bring emissions under control by international agreement. The UNFCCC meeting in Copenhagen 2009 showed the difficulty of getting any agreement. The most important question is- how should burdens be fairly distributed among countries? Many countries on the basis of the Kyoto Protocol have agreed on cap and trade as a way of tackling CC. This envisages an emissions cap for each country i.e. a quota of GHG's allowed to be emitted; What should the cap be is the most hotly debated topic in all the politics of CC. One can understand why- as the cap forces people of a particular country to reduce their emissions and this implies a decrease of standard of living. The emission permits can be used for GHG or sold and we are talking about billions of dollars so we are really arguing about a distribution of wealth around the world!

11.

There are many questions of equity, morality, philosophy and economics and politics that have to be addressed/taken into account. I give below some of

them not in any order-

a. What is basically to be distributed is a natural resource- the ability of the atmosphere to absorb GHG- so we are really talking about finite space in the atmosphere into which GHG is to be dumped. Before this time, this space was available free but now there its ownership has to be distributed. How is this to be done? Should it be that the total space be divided equally or the space that is left after the dumping that has already taken place? The answer to us maybe obvious that perhaps more space should be kept for those coming out of poverty but it is not obvious to all.

b. The other question how much should governments be spending on renewable energy. Should Govt be spending on controlling CC, say, by spending on hybrid cars rather than putting money into treating tuberculosis, controlling malaria, providing clean drinking water etc which tackle poverty directly?

c. Even Economic Cost Benefit Analysis of alternative energy is immensely complicated and uncertain. What are the benefits of reducing emissions depends upon how much harm they do when they are in the atmosphere. That in turn will depend upon how much they cause the temperature to rise and on a detailed consequence of a higher temperature all around the globe- on the sea levels, on farming, on water supplies, on health, on flooding, on the population etc – indeed on all things that affect our lives. So we have to predict the effect in detail and work out how good the benefit is in detail. For this we have to set a value on each benefit. Predicting effects is difficult because the effects are on the entire earth- atmosphere, oceans + continents and all living things. Once the effects are predicted, setting a value on them is difficult.- requiring the work of economists and philosophers e.g. lives will be lost through CC (heat waves, famines, disease); slowing CC will benefit people. How do you put a value on saving lives? How do we put a cost on the cost of disposal of waste which remains dangerous for thousand years! Economists can give calculations but the real costs in turn depend upon values which arise from moral principles which make a great difference we put upon say human life!

d. Another problem is that because the harm done by CC is insidious i.e. its progress is so slow that we scarcely notice it and its biggest harms will not necessarily be noticeable for many decades. Also Climate Science is in its infancy so that it is difficult to predict the effects of GHG emissions accurately specially as it involves taking into account the entire surface of the earth and many other variables. It is therefore easy to undermine sensible arguments and possible redressive govt action arguing that this could be left for a later date. (See The Economist too in its leader-30th March, 2013).

e. You then have the political problems and hurdles associated with alternative sources of energy for example even when they are good for tackling CC? In GB proposed wind farms were rejected because they would specially Italy and Germany have decided to wind up their nuclear energy

programme. The loss of nuclear energy particularly in environmentally conscious Germany is a serious setback to solving CC .

f. Finally we have to consider whether this generation should be sacrificing for future generations and its impact on resource allocation for CC? The Economist Pigou was certain. 'It is the clear duty of govt. which is the trustee for unborn generations as well as present citizens', he said, ' to watch over and defend the exhaustible natural resources of the country from rash and reckless spoilation.' Others maintain that future generations should be given no weight in planning other than what the present generation accords them in its preferences (Maglin). This too

Conclusion-

John Broom says in 'Climate matters'- "One firm prediction about CC is that it will kill millions of people" says John Broom in 'Climate Matters' and indeed action clearly needs to be taken on a war footing so that we act now and begin to manage the planet as if our life depends upon it.

We certainly ought to immediately start concentrating on strategies for greater carbon absorption, adaptation to higher sea levels and changing weather patterns, investment in agricultural resilience, research into fossil-free-ways of generating and storing energy, strategizing for a higher growth in food production, conserving our resources particularly water and land, and aiming for a more sustainable future . Planting of trees is one such step in this direction.