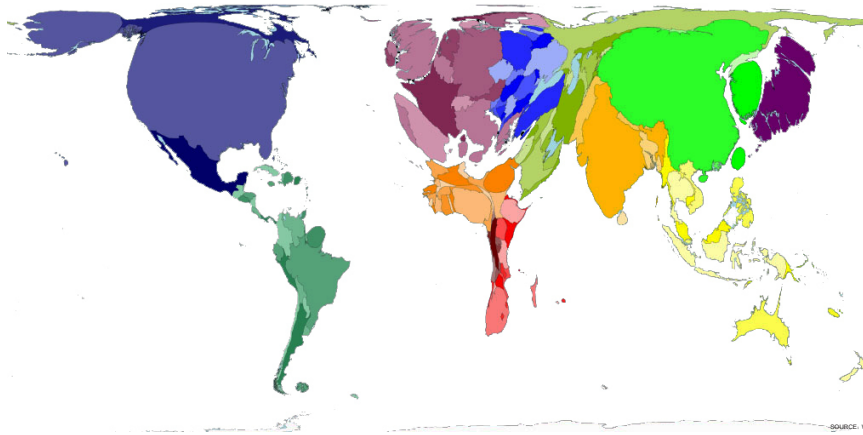
A Subaltern View of Climate Change

Earth provides enough to satisfy every woman's needs but not any man's greed.



Hazards Centre
A UNIT OF SANCHAL FOUNDATION
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EDITED BY: **DUNU ROY**

COVER PAGE & LAYOUT: **JOEL MICHAEL, MD. NAEEM, MEENA**

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ROSA LUXEMBURG STIFTUNG
SOUTH ASIA

A. THE CARBON DIOXIDE CYCLE

Climate change, as is well known by now, is a result of the release of greenhouse gases (GHG) into the atmosphere, which act as a kind of a blanket around the earth and do not allow the heat to escape, so that the planet begins to warm up. Most of these gases have been released because of human activity in the last two-and-a-half centuries. These gases largely come from the burning of the coal and oil that were formed in the Carboniferous (producing/containing carbon) period in the earth's geological history (part of the Paleozoic or "ancient life" era which, in turn, is part of the present Phanerozoic or "visible life" eon – Fig.1)[1] out of the massive growth in vegetation in the wet and humid tropics of that time. This period extended for roughly 60 million years (from 359 million to 299 million years ago) when the Gondwana supercontinent (of which India is a part) was drifting from the south to the north, and the dying plants were slowly buried under layers of silt, eventually forming coal under extreme pressures and temperatures[2]. Oil also formed under similar conditions from billions of marine organisms. Since it is unlikely that this will happen again soon, coal and oil are referred to as 'non-renewable' sources.

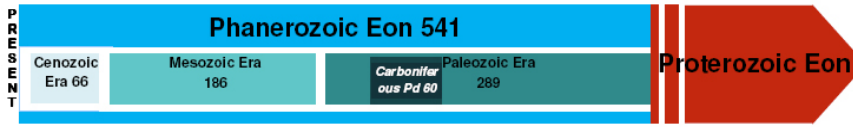


Fig.1: Geological Eras of the Earth in million years in the present Eon

Source: https://en.wikipedia.org/wiki/Paleozoic

The growth of these forests required the transfer of carbon from the air into the trees, hence they removed enormous amounts of Carbon Dioxide (CO_2) from the atmosphere (Fig.2), leading to a release of Oxygen (O_2) into the air. The atmospheric CO_2 reduced dramatically from 5500 ppm, (parts per million by volume) in the Ordovician period (about 500 million years ago in the Paleozoic era) to about 400 ppm by the end of Carboniferous period as the carbon was fixed into the vegetation, while the atmospheric O_2 levels correspondingly rose to around 35% (as compared with 21% today). However, a little later in the Mesozoic era (about 251 million years ago), it is believed that – as the Earth's plates kept drifting apart and the cracks

1 The Phanerozoic Eon was preceded by three other Eons in the Earth's geologic history: the Proterozoic Eon (meaning "earlier life" and roughly 2,000 million years in duration), the Archean ("rock forming" period of about 1,400 million years), and Hadean ("lifeless" for over 1,500 million years from when the Earth was formed)

2 http://science.nationalgeographic.co.in/science/prehistoric-world/carboniferous/

between them allowed hot magma to come to the surface – volcanic activity under the oceans once again released some CO_2 into the atmosphere. It took until the end of the Cretaceous period (about 66 million years ago) of the Mesozoic era for the levels to come down to 680 ppm, because the earlier CO_2 build-up and this period of warming again allowed an explosive growth in flowering plants, social insects, birds, and mammals (about 5,000 genera of different life forms emerged) – all of which once again fixed the carbon into their systems. Thus, CO_2 continued to decline to roughly 280 ppm until the beginning of the industrial revolution[3] roughly three centuries ago.

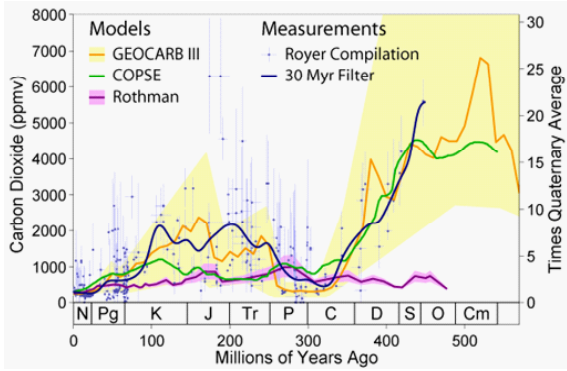


Fig.2: Carbon Dioxide levels in the Phanerozoic Eon

Source: http://www.skeptics.stackexchange.com/questions/8904/

Phanerozoic Eon (the eon of multi-cellular organisms that leave behind fossil traces) has 11 periods:

		mya
N	Neogene	23
Pg	Paleogene	66
K	Cretaceous	146
J	Jurassic	200
Tr	Triassic	252
P	Permian	299
C	Carboniferous	359
D	Devonian	416
S	Silurian	444
O	Ordovician	488
Cm	Cambrian	541

During the Industrial Revolution from 1760 onwards there was a dramatic change to machine production, new technologies for manufacturing, and the increasing use of energy. There was also the change from wood and other renewable bio-fuels to non-renewable oil and coal[4]. A conservative 2013 estimate by British Petroleum is that the proven coal, oil, and gas reserves all over the world will last us around 113, 53, and 55 years at current rates of production[5]. In other words, all the carbon fixed into these reserves over a period of 60 million years is likely to be released into the atmosphere within a short span of less than 400 years. It is this extremely rapid release of something that was accumulated over a very long period, and cannot be fixed back again in a relatively short time, that is responsible for violently upsetting the natural cycle of the earth and is the key ingredient of "unsustainability".

3 http://www.igsb.uiowa.edu/Mapping/greenhse/grnhouse.htm
4 http://www.worldcoal.org/coal/where-is-coal-found/
5 http://www.bp.com/en/global/corporate/search.html?searchTerm=proven+reserves&_charset_=UTF-8, 2013; could be less or more depending on exploitation rates and reserves found!

B. BREAKING THE CYCLE

Logically, therefore, there are two ways of approaching this problem of how to bring the cycle back to some sort of balance. One could either try to lessen the requirement of energy and, therefore, the change from solid or liquid carbon to the gas carbon dioxide; or one could extract more from this conversion while finding other sources of energy. The first way would require that the use of energy is reduced drastically and lifestyles changed. The second would mean trying to get more energy out of the non-renewable sources, finding faster methods of re-fixing carbon, and developing renewable sources of energy. Obviously, this is quite a complicated business and there are many suggestions that have come from a variety of thinkers and researchers on the subject. The Corner House in the UK has come out with an excellent collection[6] of such proposals at the Global, Regional, and Local levels (Fig.3).

Lohmann et al[7] have pointed out from the data presented by Corner House that:

- Different proposals are organised around different questions and audiences
- They rely on different ideas of how energy is and has been used in society
- They follow different political theories and processes
- They have different understandings of the relationship between the local and the global

Trying to show a way toward making an alternative discussion possible, they say, *"The question 'What's your alternative?' must itself be questioned. The word 'energy' means different things to different people. There is no one clear meaning. A struggle over mining and energy can be a struggle over how "nature" and "nation" are translated. Economic development and indigenous survival can be contradictory. Disadvantaged groups are often unable to press for translations that would advance their interests or rights and so obtain justice."*

6 Lohmann, Larry, Nicholas Hildyard, & Sarah Sexton;"Energy Alternatives: Surveying the Territory"; The Corner House, UK; http://www.thecornerhouse.org.uk/sites/thecornerhouse.org.uk/files/ENERGY%20ALTERNATIVES%20--%20SURVEYING%20THE%20TERRITORY.pdf, May 2013

7 Lohman, Larry; ed. "Carbon Trading, a critical conversation on climate change, privatization, and power"; Development Dialogue No. 48, September 2006; www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf

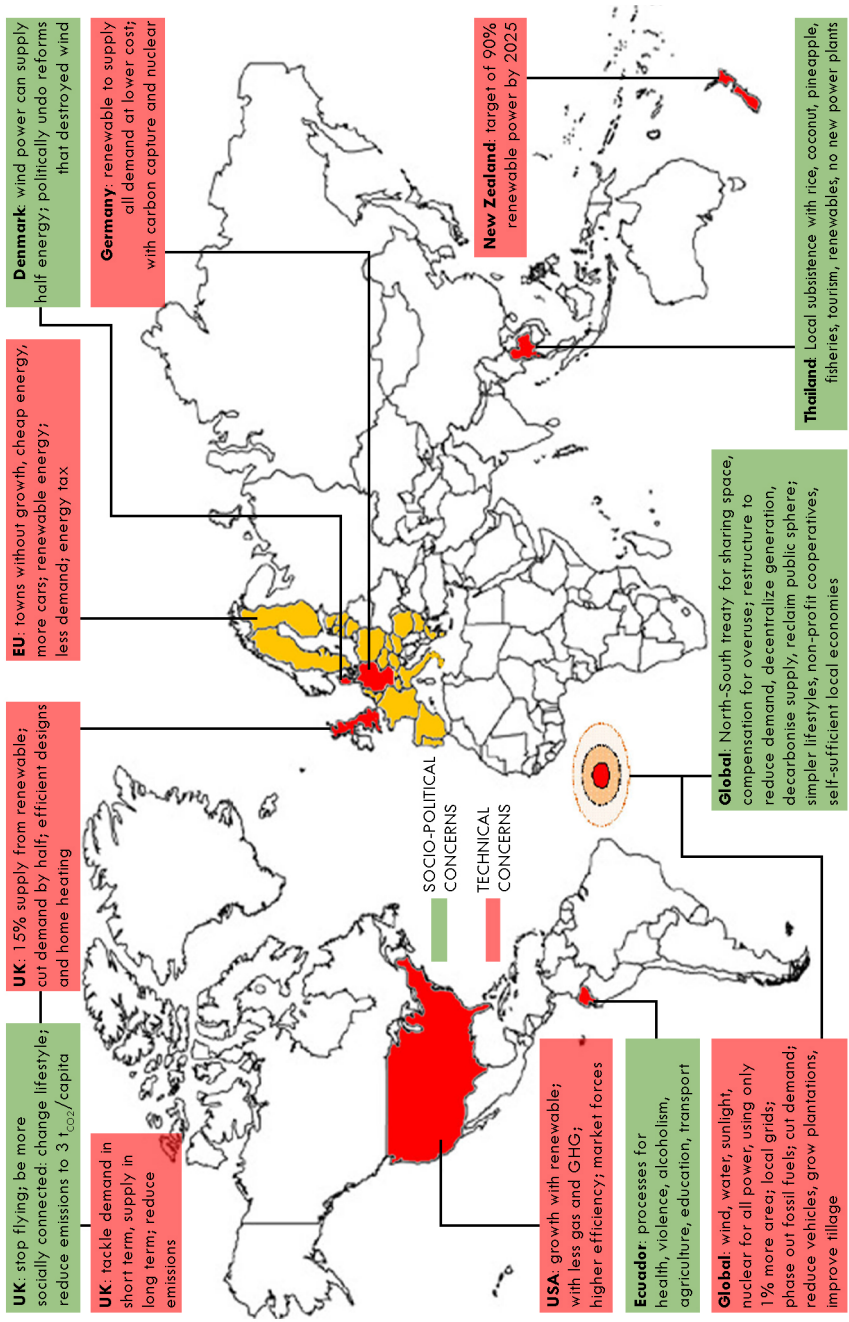


Fig.3: Initiatives and Proposals at Local, National, and Global levels
Source: Lohmann et al: Energy Alternatives

C. TWO PERSPECTIVES

Thus Fig.3 indicates that there are broadly two different sets of responses to the crisis, and these responses may have much to do with the size of the nation as well as its place in the ladder of 'development'. The first (boxes highlighted pale red in the map), mainly for the larger more 'developed' nations or unions, calls for a system of global governance that would try to build cooperation, use energy more efficiently, and with more equal access to new technologies. This also keeps in mind how the emerging economies have certain needs that can be met by the export of new technology. A range of procedures with provisions for technological and financial assistance to use less carbon has also been evolved. The challenges of differing economic and political interests of nations have been firmly placed on the international agenda. Issues of local, regional, and global impacts of climate change; of enough data to take informed decisions; of the choice between 'growth' and 'health'; of rights to resources; and the need for cooperation in knowledge sharing of 'best' practices have also been highlighted in international conferences.

Another response (boxes highlighted in green in the map), generally from the smaller nations where 'development' is lagging (even where they are part of larger unions), has been based on understanding the exploitative nature of 'development' itself: questioning whether water and other natural materials should be considered as 'commodities'; trying to focus on the life of the human being and not just of the nation; and taking into account the limitations of technology to solve social and environmental problems. These nations realise that using resources cannot continue at the same rate just by increasing productivity; that enormous military budgets are acceptable for political security and the protection of investments, but not for social welfare. If voices of resistance to this kind of exploitation are not heard, the resolution of conflicts is not possible. Private investment begins to take over the common resources; and 'climate change' offers opportunities to powerful players who make a business of disaster 'management' that actually makes more disasters a profitable investment, helped along by the State slowly retreating from providing welfare. The question for such nations then becomes how to make decision-making more democratic and directed to serve the needs of the powerless.

D. INDIA'S POSITION

The Indian government seems to have followed the lead provided by the 'developed' nations while pretending to be 'developing'. A good analysis of its policies has been recently provided by Dutta et al[8] who find that the pursuit of the "neoliberal model of economic growth has resulted in an alarming increase in … fossil fuel burning and deforestation" and yet the Indian government continues "to talk of substantial emission reductions", mainly through the Clean Development Mechanism (CDM) and Renewable Energy Trading (RET) projects. These market mechanisms do not help to reduce the impacts of climate change because they only help developed nations to purchase the carbon credits. So the authors argue that all technologies – whether renewable or not – begin to show increasing negative impacts when centralised and built on a large scale. But, in the name of democratisation, they continue to suggest more technologies like watershed management, suitable crops, managing floods, and localised water storage.

Table 1
Population and annual Carbon Dioxide Emissions, Selected Countries, 2004

Country/ Region	Population (million)	CO_2 Emissions (million tonnes)	Emissions per Person (tonnes of CO_2)
United States	294	5,815	19.8
China	1,303	4,762	3.7
Russia	144	1,553	10.8
Japan	128	1,271	10.0
India	1,080	1,103	1.0
Germany	83	839	10.2
United Kingdom	60	542	9.1
France	62	386	6.2
Bangladesh	139	35	0.3
European Union	386	3,317	8.6
World	6,352	26,930	**4.2**

Source: Jackson: The Challenge of Sustainable Lifestyles (based on IEA data)

8 Dutta, Soumya et al; "Climate Change and India: Analysis of Political Economy and Impact"; Rosa Luxemburg Stiftung South Asia, New Delhi, 2013

Jackson[9], on the one hand, shows that India is the fifth largest emitter of Carbon Dioxide in the world (Table 1), but the average per capita emission per annum (p.a.) amounts to only 1 tonne Carbon Dioxide (t_{CO2}), which places it far below the world average of 4.2t_{CO2}. On the other hand, for an Indian middle class household, earning around Rs 55,000 per month (pm), the carbon footprint is 2.7t_{CO2}/capita; while in a lower (working) class household, earning Rs 7,500pm, it is less than 0.5t_{CO2}/capita. In contrast, the Intergovernmental Panel on Climate Change (IPCC) has estimated that the world needs to reduce emissions by 80% over 1990 levels by 2050. This would mean reducing the average annual carbon footprint to well under 1t_{CO2}/capita. Jackson argues that to live within limits, a global population expected to reach 9 billion by 2050 would have to change patterns of consumption. So the choice is between "selfishness" that can "imprison, make lives poorer, and destroy the environment"; and the "common good" for "lives to become richer, more satisfying, and more fulfilling" (note that the words poor and rich are not used in money terms). There has to be a new governance for sustainable infrastructure, reliable public transport, recycling, energy efficiency, maintenance and repair, re-engineering and reuse. Social biases against these would have to be changed, and institutions for regulation and control would have to be set up by government to reduce consumption. Jackson, however, does not analyse the democratic politics necessary for this choice to be made.

9 Jackson, Tim; The Challenge of Sustainable Lifestyles"; http://www.worldwatch.org/files/pdf/SOW08_chapter_4_brief.pdf, 2008

E. DEMOCRATISING DECISIONS

What kind of energy consumption is required to make all human lives richer? Amulya Reddy[10] plotted energy use against quality of life indicators using World Bank data from 1994/1995, and argued that low energy use can "solve major global problems", as most development indicators may be achieved with an annual energy consumption of 1.2 tonnes of oil equivalent (t_{oe}) (Fig.4) – equivalent to an average emission of 2.5t_{CO2}/capita computed over 135 countries[11] .

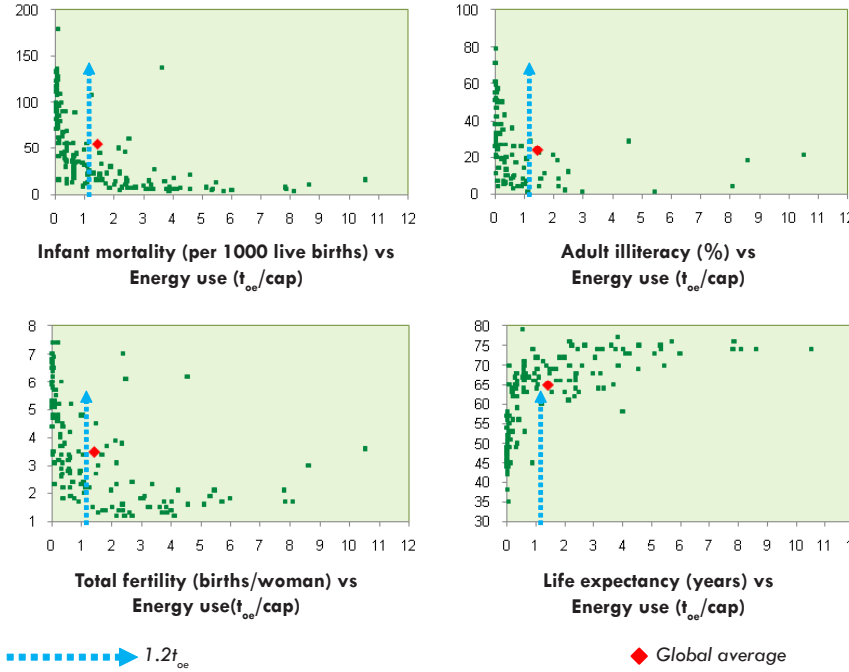


Fig.4: Energy use and Infant Mortality, Illiteracy, Fertility, and Life Expectancy

10 Reddy, Amulya K N; Energy and social issues, Chapter 2, in" World Energy Assessment: Energy and the Challenge of Sustainability";http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.196.4978&rep=rep1&type=pdf
11 http://data.worldbank.org/indicator/EN.ATM.CO2E.EG.ZS

Following Reddy, we plot World Bank energy use data[12] for the years 1990 and 2008/2010 for three specific indicators of infant mortality, life expectancy, and fertility rate (Fig.5).

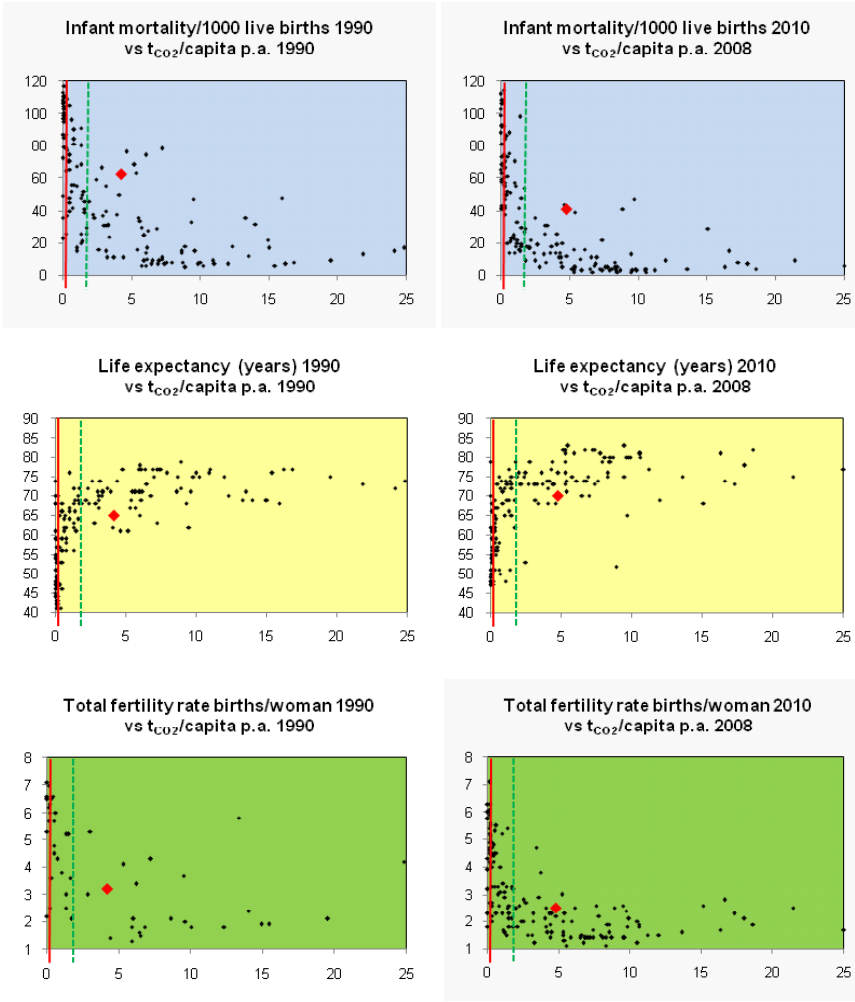


Fig.5: Carbon Emissions and Infant Mortality, Life Expectancy, and Fertility Rate

12 World Development Indicators, 2012, The World Bank; http://data.worldbank.org/sites/default/files/wdi-2012-ebook.pdf

What is fairly clear from the plots in Fig.5 is that while global average annual per capita emissions have increased from 4.2 to 4.8t_{CO2} between 1990 and 2008; infant mortality has declined from 62 to 41 per 1000 live births, average life expectancy is up from 65 years to 70 years, and total fertility rate has decreased from 3.2 to 2.5 births per woman from 1990 to 2010. Surprisingly El Salvador and Sri Lanka have achieved the 2010 averages (of infant mortality, life expectancy, and fertility rate) within the IPCC 2050 target of annual per capita emission of 1t_{CO2}; 13 other nations have also done so within 2.5t_{CO2} (as suggested by Reddy's data given in Fig.4). 11 nations have provided their citizens with a similar quality of life while remaining under the 2008 global average of 4.2t_{CO2}; and 9 nations have achieved two indicators while remaining within the above emission levels. Not one of these 35 countries (out of 135) is 'developed', yet demonstrates that a better quality of life is possible at low energy use levels[13].

13 It should be noted that there is still no consensus on what constitutes a 'sustainable' per capita t_{CO2} emission level as different figures are computed depending on estimated fuel mixes, life styles, and population levels. So the IPCC suggests a limit of 1.2 t_{CO2} (http://www.ipcc.ch/ipccreports/tar/wg3/index.php?idp=57), the UN has internally arrived at a target of 1.6 t_{CO2} (http://sustainabledevelopment.un.org/index.php?page=view&type=1006&menu=1348&nr=475); and the UK has accepted 2 t_{CO2} (http://www.theccc.org.uk/tackling-climate-change/the-science-of-climate-change/setting-a-target-for-emission-reduction/)

F. URBANIZATION & MITIGATION

But 'development' continues to have its own powerful defenders. The New Climate Economy, a global partnership of research institutes, has recently published a report[14] that echoes a central theme adopted by many research institutions and think tanks; that cities have a major role to play in mitigating climate change. The report was produced by a Global Commission of leaders from government, business and finance, advised by leading economists and supported by major international organisations, and shows that climate action can go hand-in-hand with strong economic growth. It recommends that in order to create better growth and a safer climate, action should focus on cities that generate around 80% of global economic output and around 70% of global energy use and energy-related GHG emissions. According to the report, compact and connected cities are demonstrating that they are economically healthier with lower emissions, as they have used the power of markets.

Many Indian policy makers also argue that development problems may be solved by moving people from the villages into the towns, so that growth will increase and the benefits trickle down to the masses. The Planning Commission says that India's urban population will go up from 377 million in 2011 to about 600 million in 2031. Even though there will be severe shortages, the Commission wants a faster rate of job creation, self-employment, and supply of services in the towns to accommodate the growing population. The plan is to strengthen governance, planning, financing, capacity and innovation. One vehicle for this was the Jawaharlal Nehru National Urban Reforms Mission (JNNURM), launched in December, 2005 for a period of seven years in 65 major cities, with the aid of a loan of US$ 6.4 billion from the Asian Development Bank, along with 23 'reforms' to make the schemes attractive to private investors[15].

However, the Government's own assessments at the end of 7 years show that the Mission has failed in improving local governance or completing the infrastructure and housing projects, promoting participation and benefitting the poor, or implementing reforms to attract private investment. Even the Swarna Jayanti Shahari Rozgar Yojna (SJSRY), covering about 4000 towns,

14 Better Growth, Better Climate: The New Climate Economy Report; The Global Commission on the Economy and Climate, 2014; http://newclimateeconomy.report/

15 http://www.slideshare.net/title=urbanisation-in-india-12th-plan-2012-2017&user_login=PlanComIndia

has barely been able to generate 1.2 million jobs in 15 years at an average cost of Rs 30,000 per job. Yet, without analysing why the performance of JNNURM was so bad, the money was almost doubled by the previous government, and is now being fed into the 'Smart Cities', even though the planners know that urbanisation doubles the per capita energy requirement[16]. And they all agree that it is the "*poor people living in slums (who) are at particularly high risk from the impacts of climate change and natural hazards*" and will suffer the most[17].

16 http://www.unfpa.org/webdav/site/global/users/schensul/public/CCPD/papers/Satterthwaite%20paper.pdf
17 http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/

G. THE 'VULNERABLE' POOR

This vision, of the poor being the "most vulnerable", runs like a bleeding artery through most discussions on the impacts of climate change. In 2007 Greenpeace[18] conducted an extensive survey of 819 households scattered across various income classes in 12 cities and some rural areas, to assess their energy consumption and converted them into CO_2 emissions. They found that the weighted[19] carbon footprint of the rich earning more than Rs 30,000pm was less than the global average of $5t_{CO2}$ but in excess of the sustainable global level of $2.5t_{CO2}$ needed to limit global warming below 2°C[20]. In fact the carbon footprint of the 151 million people earning more than Rs 8,000pm was already exceeding sustainable levels. The only thing that kept the overall annual per capita emission in India below $2.5t_{CO2}$ was the very low energy consumption by 823 million poor earning less than Rs 5,000pm and emitting less than $1.55t_{CO2}$ (Table 2), in a nation where the official average poverty line in urban India in 2007 was Rs 2262pm.[21]

Table 2: Annual per capita CO_2 emissions for different income classes

Monthly Income Class	Population (million)	Share of Global Emissions (%)	Per capita emissions (t_{CO2})	Weighted per capita emissions (t_{CO2})
> 30K	9.96	0.15	1.494	**4.97**
15-30K	18.80	0.17	0.936	**3.12**
10-15K	53.24	0.43	0.827	**2.75**
8-10K	69.18	0.56	0.819	**2.73**
5-8K	155.73	1.05	0.685	**2.28**
Average	1129.86	5.60	0.501	**1.67**
3-5K	390.80	1.79	0.465	**1.55**
<3K	432.16	1.43	0.335	**1.11**

Source: Greenpeace; Hiding behind the Poor

18 "Hiding behind the Poor": A report by Greenpeace on Climate injustice; Greenpeace India Society, October 2007
19 Since Greenpeace estimated energy use only for electricity, fuel, and transport, they multiplied all values by a weight of 3.3 to arrive at the total energy use
20 Energy use (in bold) was assessed for electricity, cooking, and transport, and weighted values computed by multiplying by 3.3 to account for other uses, while accepting the 2030 target of 2.5 tCO2 estimated by World Resources Institute
21 http://planningcommission.gov.in/news/prmar07.pdf and http://mospi.gov.in/NSS_Press_note_531_25may10.pdf

While there are obvious problems of arriving at the weighted values by multiplying all estimated use across all income classes by 3.3 to account for other uses, Greenpeace comment that "*Being unable to afford any better, the poor are forced to settle in marginal or highly vulnerable areas ... With climate change leading to a further decrease in already scarce resources like arable land and water, poor populations are going to be pushed further to, or even over, the edge. The poor lack the resources, and are unaided when it comes to governmental support, to adapt to rising temperatures. Infrastructure like shelters and sea walls to protect poor people from extreme weather events and sea level do not get funding. Economic constraints render the poor incapable of securing their future. The poor's subsistence is dictated by their daily challenges and they don't have the luxury or the facilities to prepare for future risks and to adapt to dangerous climate change ... To create space for the remaining 980 million people in the country to develop without heating the planet above 2°C, India needs to find a way to reduce the* CO_2 *emissions of the upper 150 million people*".

H. A SUBALTERN VIEW

Let us take another look at the energy consumption figures cited by Greenpeace for electricity, cooking, and transport for different income classes (Table 3). Cooking energy does not vary much across classes, but electricity consumption can increase five-fold and transport costs go up seven-fold as incomes increase. It is also clear that the income classes earning less than Rs 8,000pm are consuming energy within the global sustainable limit of 2.5t_{CO2}. So, for the rich to also become sustainable they would have to bring down their total emissions by about 50%, while the poor could increase their emission load by 100% – and this would clearly impact on lifestyles. Specifically, on electricity, cooking, and transport the rich would have to cut down by 59%, 0%, and 64%, and the poor could increase by 125%, 41%, and 158% respectively, to remain within the boundaries of sustainability. Instead of asking what would happen to the world if everyone were to consume energy at the level of the rich 'developed' American, we can now enquire why everyone is not consuming at the level of the above-poor 'developing' Indian?

Table 3: Annual per capita CO2 emissions in kg of different income groups for different uses

Use Function	Different Income Groups (Rs per month)							
	<3k	3–5k	5–8k	8–10k	10–15k	15–30k	30k+	All
Electricity	198	279	445	549	521	646	1091	326
Cooking	97	130	137	147	124	131	120	105
Transport	40	56	103	131	174	159	284	70
Total	335	465	685	819	827	936	1494	501

Source: Greenpeace; Hiding behind the Poor

The above data suggests that the above-poverty-level Indian earning between Rs 5-8,000pm is actually a "best practice" model, along with a possible lifestyle improvement of 100-150% for the classes whom Greenpeace defines as poor! This, of course, is sustainability only as defined within the framework of climate change, to prevent the planet from tipping over a 2°C increase. The poor, thus, may not be the "most vulnerable" although they do not have access to good land, potable water, health care, appropriate services, adequate credit, and other resources. But will further impoverishment

because of climate change really tip them over the edge? Are they really incapable of securing their still sustainable future with their own knowledge? And if they were to wrest sufficient resources from a reluctant State to improve their access to energy double-fold, would their potential to survive disasters remain at a "low" level?

Most analysts and theoreticians seem to forget that, in practice, the poor illustrate the most amazing capacity to survive. Over and above the resources to which they have limited access, it is their power to use their own labour that enables them to adapt, migrate, and progress in a manner that is not only sustainable from the view of climate change but also may be sustainable in terms of overall resource availability. Some of the data to support this view is now beginning to emerge from micro-studies in the work of those organisations which are active in mobilising the working poor to demand their equal and fair share in the social, economic, and ecological spheres, as distinct from the political equality that the Constitution of India bestows on them. We shall cite here some of the data that has been collected in urban areas to make a case for this interpretation of the working poor – as being extraordinarily adaptable in adversity and as the best practitioners of climate change mitigation.

I. DELHI'S LABOUR

Surveys done in the city of Delhi in the period 2008-11 by the Hazards Centre[22] have yielded some very interesting findings. The Centre's researchers collected data in 2011 about resource use by 300 families belonging to different income groups, broadly termed as High Income (>Rs 30,000pm), Middle Income (Rs 10-30,000pm), and Low Income (<Rs 10,000pm) groups, primarily based on the type of house they lived in, and then applied that data to a base survey of 2800 households carried out in 2008. The survey revealed that the land allotted per family for housing gradually decreased from 250m^2 to 70m^2 in the early 1950s (it was 2500m^2 for the really wealthy and privileged), but this had been reduced in stages to an allotment of 12.5m^2 for the poor resettled from slums by 2002, while it remained at above 100m^2 for the wealthy (Table 4). Considering that the average urban land per family actually available in the city in 2011 is of the order of 50m^2, it is clear that the wealthy are using at least five times more land than is sustainable, while the poor are in plots that are within sustainable limits.

Table 4: Residential land allocation for different class families in Delhi

Year	1948	1962	1971	1975	1980	1985	1990	2001
Area (m^2)	250	200	80	40	32	25	18	12.5
Area / capita[23]	50	40	16	8	6.4	5	3.6	2.5

The studies have also revealed the unequal distribution of the 100 litres per capita per day (lpcd) water available in the city (Fig.6). While the high income group (HIG) actually uses more than 120lpcd (sometimes as high as 550lpcd in elite areas of the city) and the middle income group (MIG) uses 55lpcd, the low income group (LIG) receives only 26lpcd. This indicates that the water use of the wealthy is four times that of the poor. These figures also relate to the pollution of the resource, as 80% of the water used flows into sewers and is responsible

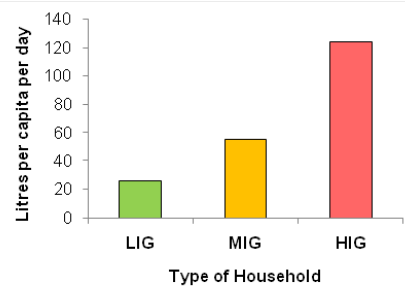


Fig.6: Water consumed by different class families in Delhi

22 All data in this section has been taken from two booklets published by Hazards Centre, New Delhi: 'Climate Change in Urban Areas', 2010, and 'Urban Footprint', 2011

23 An average family size of 5 has been assumed for urban areas although Census data suggests it has varied from 5.1 to 5.5 in this period

for wider environmental impacts on water and land. The 20% rich are clearly far more responsible for this, while if everyone were to consume as little as the poor the underground or surface sources of water would be correspondingly sustained. The related climate change impacts, based on the energy required for treating the source of water and transporting it over long distances through pipes (or tankers), would also be considerably reduced. In effect, there is enough water for everybody provided it is distributed equally and limits are imposed on high consumption.

Domestic energy use follows an identical pattern (Fig.7). The surveys revealed that the HIG was consuming 140units/household/day of electricity as compared to the 7units/household/day by the LIG, while an average 30units/household/day was available from energy supply. Increasing the supply by either importing energy from far away or setting up new power plants in the capital city, in order to meet the rising demand from the wealthy would obviously affect the quantity of non-renewable fuels burnt (given that as much as three-fourth of energy supply in India is generated from coal-burning plants) and the related impacts on land, water, and air. It would also leave little energy for consumption by other classes, particularly in times of severe shortages as global temperatures rise. But if the generation and distribution system is geared towards meeting the needs of the poor and providing a minimum 15units/day to each family (or 3units per capita), while higher consumers are also charged at higher rates on a sliding scale, then that could reduce impacts dramatically while leaving aside sufficient energy for multiple other uses.

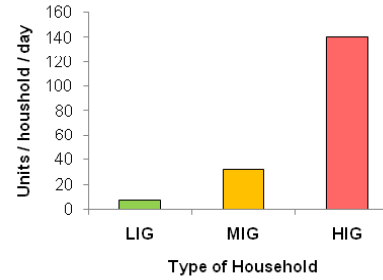


Fig.7 Electricity consumed by different class families in Delhi

Finally, the use of different modes of transport has its inevitable consequences as the rich tend to use energy-intensive private modes such as cars for long distance travel and auto-rickshaws for short distances; while the middle group and poor use buses and two-wheelers

for distances of 20-30km, the difference being that the middle group also uses cars for short distances while the poor tend to use cycles or to walk (Fig.8).

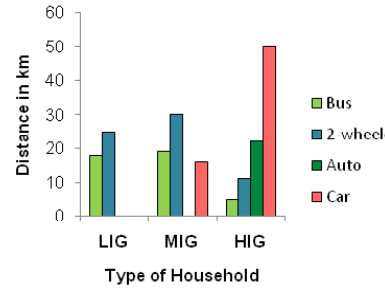


Fig.8: Distance travelled by different modes and class families

As Fig.9 indicates, for the entire city, cars carry only 8% of all commuters, use up much more road space per passenger, and the monthly expenses for the commuter are significantly higher than for bus users. The CO_2 emission per passenger-kilometre (p-km) from cycles is nil, while that from buses has been computed to be six times less than for cars. Clearly, sustainability is heavily favoured by the resource use of the poor as cycling (or walking) entails the optimum use of space and the minimum amount of energy with mitigation of climate change. It should be noted here that the new Metro has a huge investment, low ridership, and high energy intensity, although it is often falsely presented in the media as a 'green' initiative.

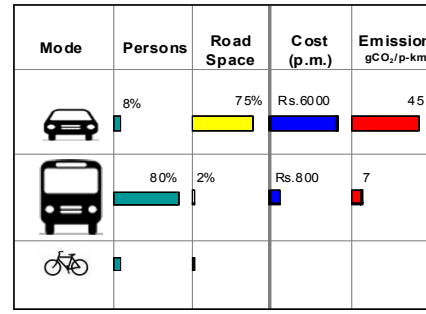


Fig.9: Transport modes and their resource use in Delhi

A consolidated carbon footprint of different classes for electricity, transport, and cooking was computed in this study (Fig.10) illustrating that the annual per capita energy use of the high consumption class is more than 8 times (compared to 2.5 times in the Greenpeace study) that of the low consumption class

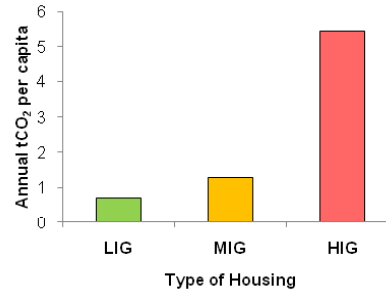


Fig.10: Carbon footprint of different class families in Delhi

– although their average energy use is only 1.2 times more (see Table 3) than for the Greenpeace study. It is this factor that must be considered when the issue of sustainability is discussed, particularly in the context of climate change. It should also be remembered here that the discussion so far has only been about resource use. If resource restoration (that is, renewing the material for further use and extracting the carbon dioxide from the air and fixing it back into hydrocarbons), as is practised by the working poor (in numerous occupations like waste-picking, sanitary work, gardening, washing, fishing, animal husbandry, child rearing, etc) is taken into account, then the difference would be much, much higher.

The above discussion on the unsustainable use of natural resources that completely disturbs natural cycles, accompanied by the degradation of resources, the social and environmental impacts that are borne by large populations, and the role of different social classes gives some idea of where sustainability manifests itself. The widely accepted view amongst policy-makers that technology and finance can successfully mitigate the impacts of climate change is also called into question given that much 'development' in the past has ridden on the back of such financial and technical transfers. In addition, the propaganda that the poor are going to be the worst victims is challenged by the data that shows that the working poor are actually the only ones who are living within the carrying capacity of the earth. Arguably, therefore, the best practice of sustainable resource use is demonstrated by the "vulnerable", poverty "stricken" masses of toiling people who have developed the capacity to survive under the "worst" possible conditions; while it is the high consumption addiction of the wealthy which has to be mitigated.

J. VISAKHAPATNAM HOUSING

We now turn to the creative labour of urban workers in other cities to understand how that plays a role in mitigation of, and adaptation to, climate change, as revealed by other studies that have been carried out by other groups. The Greater Visakhapatnam Municipal Corporation (GVMC) in Visakhapatnam envisaged in 2005, under JNNURM, to provide 50,000 Domestic Units (DUs) for the slum population at a cost of Rs 50,000 lakh[24] – each DU would cost Rs 1 lakh. From 2005 to 2014, a total of 24,423 flats were approved in 12 multi-storied projects at a total cost of Rs 76,422 lakh – in other words, the cost of each DU climbed to Rs 3 lakh. A study of this pattern of housing by the Association for Rural and Tribal Development (ARTD) revealed that most of these flats had been constructed in the far outskirts of the city, with consequent adverse impacts resulting in lower incomes, loss of employment, rise in transportation expenses, poor quality of water, and increasing costs of health and education[25].

Hence, in 2013, when the settlement of Surya Tejanagar was to be resettled at a project cost of Rs 1011.46 lakh for 204 DUs (almost Rs 5 lakh per DU), the residents were mobilised by ARTD to design their own housing. 95% of the families had migrated to the city more than 15 years ago, and while some were working as drivers, carpenters, masons, plumbers, and other skilled occupations, more than half were daily labourers. Their monthly incomes of Rs 5-8,000 placed them in the sustainable range as defined by the Greenpeace study. They commuted up to 10km to get to work, the majority by bus and the rest cycling or walking. Most families were concerned that if they were "resettled" or relocated they would lose investments made in the past in land, houses, and services. On the other hand, they proposed that if they were given legal tenure on 40m^2 plots at the same location, their homes would remain and they would be able to preserve their past investments, retain their livelihoods, and the cost of improving services for low-rise houses would be considerably lower than what was being proposed by the Municipality. A comparison of the costs of the different plans is given in Table 5.

24 One lakh is 100,000
25 ARTD, 'Community Participation in Resource Use and Planning: The Case of Surya Tejanagar, Visakhapatnam'

Table 5: Cost per DU under different plans in Visakhapatnam				
Scheme	Year	No. of DUs Planned	Investment in Rs Lakh	Investment per DU in Rs Lakh
1st Municipal Plan	2005-06	50,000	50,000	1.00
2nd Plan	2005-14	24,423	76,422	3.13
3rd Plan	2012	240	1131	4.72
4th Plan	2014	204	1011	4.96
People's Plan	2014	196	100	0.51

K. JAIPUR RAPID TRANSIT

In Jaipur, the Bus Rapid Transit System (BRTS) is being constructed to improve the public transport system, decrease dependence on private motorised transport modes, improve air quality, road congestion, and journey speeds. In Phase I of the project, 46.7km length of corridor is being built at a cost of Rs 479.6 crore[26] (a little over Rs 10 crore/km). This cost is half the Rs 20 crore/km generally required for dedicated corridors in a BRTS, as no segregated space has been set aside for cycles and pedestrians to separate them from other motorised vehicles. The corridor of Package I (Route No.1, ochre-coloured, in Fig.11) has been functional since 2010, and a survey was carried out in 2014 by Labour Education and Development Society (LEDS) on this corridor to study whether the project has helped meet the transportation needs of the people[27]. The 95 respondents who were covered under the survey reported a change in the mode of transport ever since the BRTS came up (Table 6). What is significant is that the use of non-motorised (and non-polluting) modes such as walking, cycling, and rickshaw has reduced significantly, while bus travel and commuting by car has gone up!

Table 6: Mode of travel of respondents in Jaipur

Mode of transport	Earlier	Present
Walking	4	1
Cycle	26	3
Cycle-Rickshaw	9	2
Bus	17	37
Tempo	4	6
Auto	8	2
Chartered Bus	1	2
Taxi	6	2
Two-wheeler	15	12
Car	3	11

26 One crore is 10 million
27 LEDS, 'The Jaipur Bus Rapid Transit System: Solution to a Problem or Problem Succeeding Problem', 2014

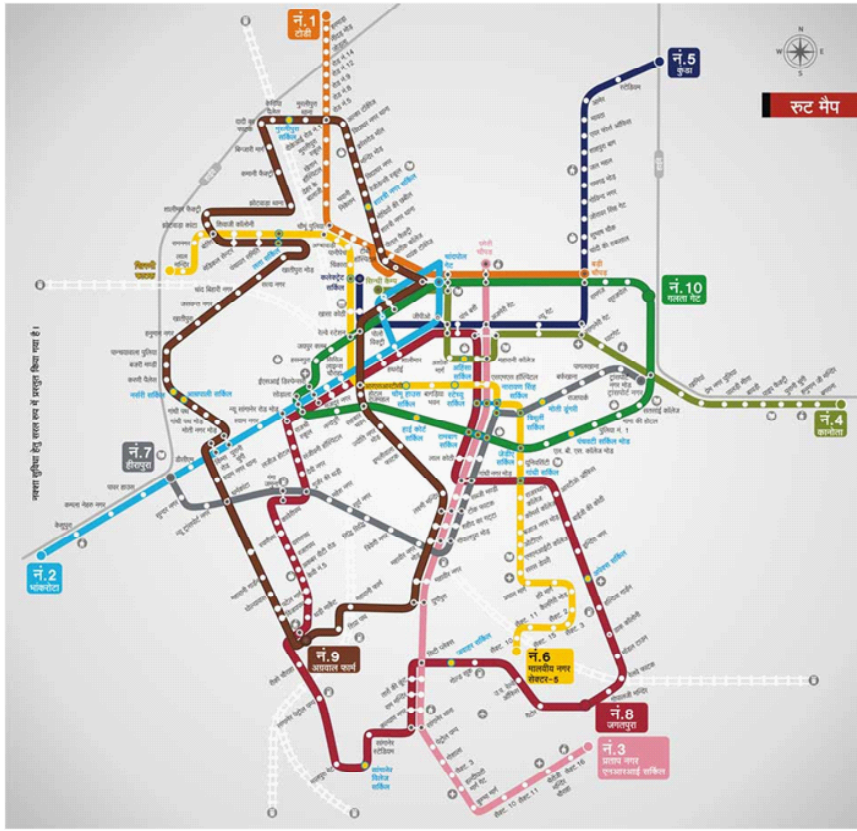


Fig.11 Planned BRTS corridors in Jaipur

The BRTS was expected to cater to the needs of the commuting public by shortening travel time and decreasing costs so that more and more people would voluntarily choose to travel by bus. However, most respondents reported that travel time has increased; travel distance has also increased from an average of 17.16km to 20.16km, and expenses on the daily commute had increased. This puzzling aspect of the BRTS is explained by respondents, who say that the corridor takes an indirect route which increases the distance as well as travel time, bus tickets are expensive, and at times commuters may have to change buses. Yet they take the bus because of ease of travel and the non-availability of other options. At the same time, the newly-laid carpet of the corridor is more favourable to motorised private

cars. Hence, commuters find it difficult to use their earlier modes and, while respondents reported that the space for pedestrians has increased, they felt that the space for cycles has decreased. In addition, those respondents whose livelihoods were directly affected also complained that the space for hawkers and vendors and for labour chowks had also decreased.

This Jaipur data is curiously different from studies[28] conducted on the BRTS in Delhi (which has clearly segregated paths for cyclists and pedestrians) in May 2012, that clearly indicated that though the number of buses were less than 6%, they carried up to 66% commuters during peak hours, and throughput went up. Modal values of 74% during peak hours for buses, auto-rickshaws, and bicyclists showed that the BRT had been highly accessible for public transport, while police records also showed that fatalities declined in the corridor. The air monitoring study indicated that the values of all parameters were considerably lower on the BRTS as compared to a parallel road. And interviews with bus passengers, car and two-wheeler drivers, auto/taxi users, pedestrians, and bicyclists – the majority of whom were frequent travellers on the corridor – revealed that 46% felt that travel time had decreased; 45% said pollution had gone down; 50% felt that lack of lane discipline was a major issue; 58% were happy that travel has become safer. Overall, almost 90% were in favour of continuing the BRT and its expansion – particularly 94% of bus users, 92% of pedestrians, and 86% of two-wheeler drivers.

28 Hazards Centre, 'The Bus Rapid Transit System in Delhi', Delhi, November 2013

L. ALLAHABAD BUSES

The city of Allahabad has 5 lakh registered vehicles but only 36 State Transport buses, 226 privately operated mini-buses, 995 tempos, and a number of autos and cycle rickshaws to cater to the need for public transport. 150 buses were approved under JNNURM to improve the public transport system and to decrease the dependence on private motorised transport modes, at a cost of Rs 28.70 crore and a public company, Allahabad City Transport Services Ltd, was formed in 2010 to operate these buses. In 2014 a survey was carried out by Vigyan Foundation to assess whether the project has helped meet the transportation needs of the people[29]. 100 respondents were queried, 54 of whom lived in pucca houses, although only 28 owned them, and 64 of the houses were less than $50m^2$ in size. 60 were engaged in temporary work, 68 were skilled, 89 were employed in the unorganised sector, and 52 earned less than Rs 5000pm. The majority travelled by bus, tempo, or auto-rickshaw, although for shorter distances they walked, cycled or took a cycle rickshaw. In other words, they belonged to that category of people who should have had the lowest carbon footprint in the city, and logically the bus system should have been designed to suit their needs.

However, assessing the new buses that had joined the fleet, 52 were of the opinion that there was no change in the travel time or cost, with some reporting that the condition of the road is so bad that it does not make any difference what one travels by. The biggest problem reported was that of un-fixed/unregulated timings of the vehicles. While a few felt that the number of buses had increased, travel had become more comfortable, and there was an improvement in public transport; the overwhelming majority was not satisfied with conditions of signalling, congestion, road-crossing, accidents, women's safety, and pollution (Table 7). In addition, for this class of users, the general perception seemed to be that there was no benefit for pedestrians and cyclists, although cars, parking, and buses had got more space.

29 Vigyan Foundation, 'The Allahabad Public Transport System', 2014

At the same time, hawkers and vendors, labour markets, auto-rickshaw stands, and public toilets had made marginal gains. This has to be seen in the context that almost all the respondents reported that the public transport system and the roads in the city have not been designed according to the people's requirements. Furthermore, issues of steady livelihoods, wage payments, and harassment figured prominently in the perception of this set of respondents.

Table 7: Improvements in public transport in Allahabad

QUESTION	YES	No
Increase in no. of buses	32	-
Travel has become comfortable	32	-
Improvement in public transport	32	-
Improvement in traffic signalling	-	84
Decrease in traffic congestion	0	100
Crossing a road has become easier	0	100
Decrease in traffic accidents	0	100
Increase in women's safety	0	100
Increase in pollution	84	-
Increase in number of cars	32	-
Has space on the road increased for:	YES	NO
Pedestrians	0	100
Cycle	0	100
Cars & private vehicles	100	0
Buses and Public Transport	100	0
Hawkers & Vendors	64	36
Labour chowks / markets	44	36
Auto-rickshaw stands	44	36
Parking	100	0
Public conveniences and toilets	44	-

M. KOLKATA'S BAN

Kolkata has a long history of how transport corridors have been built to reduce congestion and, in the process, displaced the work and housing of the poor who have earlier occupied that space in a highly dense city. It is also the only large city in India where trips by cycle (11%) outnumber trips by cars (8%); there are more bicycles than either 2- or 4-wheelers; 50-75% of informal sector commuter trips are accounted for by cycling or walking; and users include petty traders, suppliers, carpenters, masons, newspaper vendors, office clerks, milk-men, and courier delivery boys. Official data shows that only 1.5% of road accidents occur due to the fault of cyclists against 71% due to faults of motor vehicle drivers; cars account for nearly 50% of the air pollution load; and the city's economy is reeling due to an increase

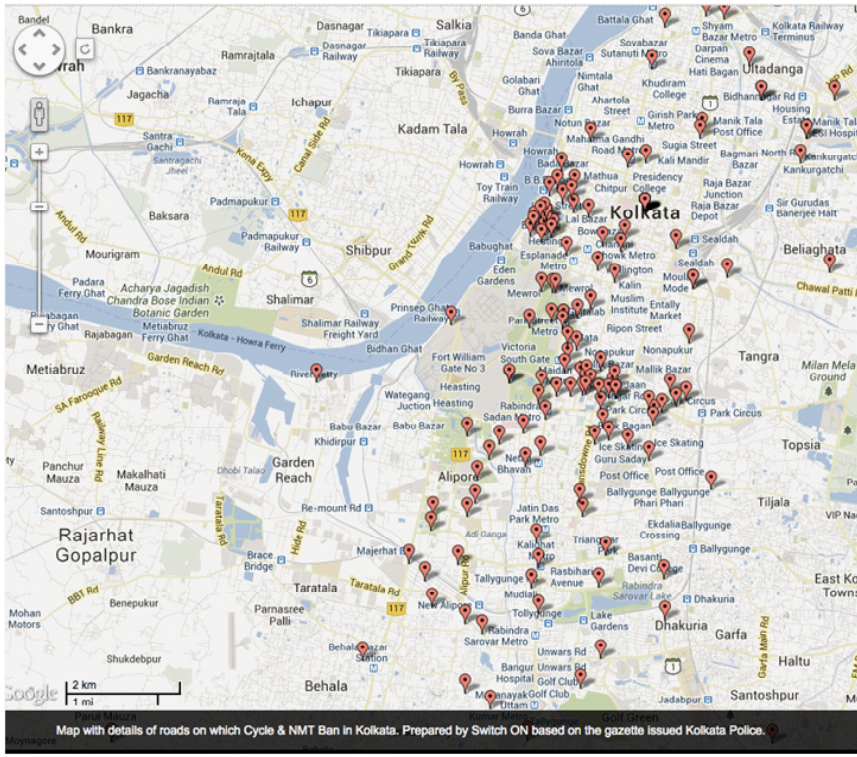


Fig. 12 Roads in Kolkata on which non-motorised vehicles have been banned

in fuel costs. Yet, in 2013, the Kolkata police barred bicycles and all other Non-Motorised Transport (NMT) vehicles on 174 thoroughfares under the West Bengal Traffic Regulation Act of 1965, which includes almost all the major avenues in the centre of the city as may be seen from the map in Fig.12.

In response, the group 'SwitchON' began mobilising users of NMT as well as concerned citizens in Kolkata to protest against the ban. The campaign called Chakra Satyagraha was extensively covered by the media as cycling enthusiasts gathered at Victoria Memorial in protest; nearly 500 cyclists walked from Chowringhee Square to the Maidan; and 5,000 citizens (including newspaper and milk vendors, cart-pullers, rickshaw-pullers, handicapped in wheel chairs) protested through 'baul song' and street plays highlighting the loss of livelihoods due to the ban. SwitchON also conducted a congestion survey in key points of the city[30]. Pilot surveys were first conducted between 9 to 11 in the morning and 11.30 to 1.30 in the afternoon and it was found that there was not much difference in traffic congestion during these two periods. SwitchON researchers then selected 6 foot-bridges and 2 major crossings where the ban was in force. Traffic counts were conducted at peak hours at the foot-bridges from 9 in the morning to 1.30 in the afternoon, in 10 minute slots, with 5 minute gaps in between. The data is shown in Fig.13 and clearly indicates that:

1. Bicycles constitute 2.6% and are more than other NMT that constitute only 1.3% of the total traffic volume. This marginal number cannot be held to cause congestion.
2. Private cars constitute 31.5% of the total number of vehicles, but carry only 4.9% of commuters.

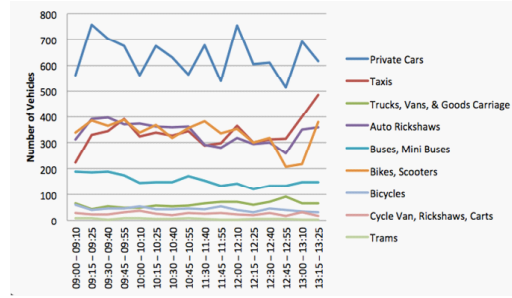


Fig.13 Vehicle counts at six footbridges

3. Buses and mini-buses constitute only 9.8% of the total number of vehicles, while transporting 75.2% of commuters.
4. 52.2% private vehicles transport only 8.1% commuters, but 43.8% public vehicles carry 91.3% commuters.

30 SwitchON, 'Ban on Non-Motorised Transport in Kolkata', 2014

CONCLUSIONS

An examination of the carbon cycle shows that it took the sun's energy 60 million years to fix the carbon into solid or liquid forms, which human beings are likely to release into the atmosphere within a span of 400 years. It is this disturbance of the cycle that is responsible for climate change and "unsustainable" development. The larger 'developed' nations appear to address this imbalance by using energy more efficiently with new technologies; but the smaller 'developing' nations seem to better understand the exploitative nature of 'development' itself. India's policies are mostly sectoral and adaptation measures have been pushed to the background while mitigation has focused on technology. Democratisation of decision-making has not been promoted to replace non-renewable sources and control consumption. What also emerges from a world-wide analysis of annual energy consumption is that at $1.2t_{oe}$ per capita, infant mortality, fertility, and illiteracy fall dramatically while life expectancy rises.

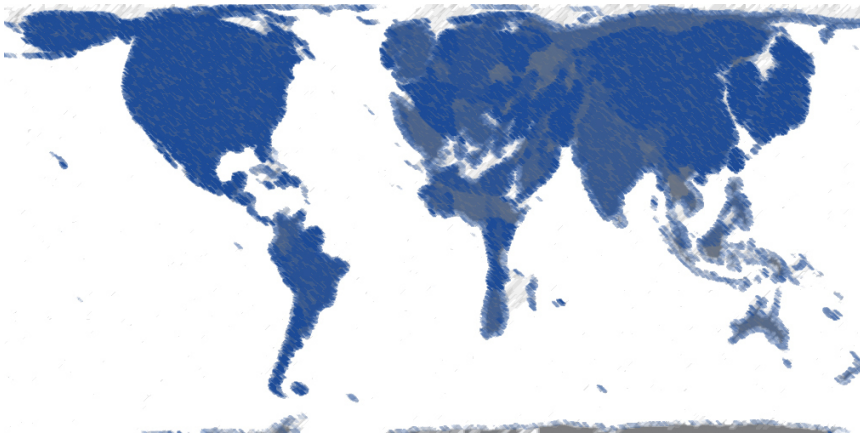
India has an average per capita emission of $1t_{CO2}$ compared to the world average of $4.2t_{CO2}$, but a middle class household, earning around Rs 55,000pm, has a carbon footprint of $2.7t_{CO2}$ per person. What reduces the overall per capita emission is the very low energy consumption by the population earning less than Rs 7,500pm and emitting less than $0.5t_{CO2}$. Most policy makers and analysts agree that if everyone in the world lived the way Americans do, annual global CO_2 emissions would be five times the current level by 2050, and that it is the poor who will suffer the most from the impacts of climate change. But should we not be asking what would happen to global climate if everyone were to consume energy at the level of the working Indian? What analysts do not perceive is that it is the power of the poor to use their own labour that provides the springboard from which they adapt, migrate, and progress in a manner that is not only sustainable from the view of climate change but also may be sustainable in terms of overall resource availability and regeneration.

Micro-studies from Delhi illustrate that the resource use of the rich leaves a carbon footprint more than 10 times that of the poor. And if resource restoration by the poor through their works is taken into account, then the difference would be even higher. The demand by Visakhapatnam slum dwellers for tenure on 40m^2 plots, as against the G+4 housing offered by the Municipal Corporation, would not only protect past investments but also significantly reduce the cost of services. The non-participatory design of the bus rapid transit project in Jaipur has reduced the use of non-motorised and non-polluting modes by the poor while commuting by car has gone up. In Allahabad, the poor agree that the public transport system and the roads in the city have not been designed according to their needs of livelihoods and mobility. And in Kolkata bicycles constitute one-twelfth the number of cars while providing more trips, yet non-motorised vehicles have been banned from most roads in the city for causing 'congestion'.

Thus, while the data clearly shows that the poor are demonstrating the best practice for mitigating and adapting to climate change, policy makers seem to have a perspective that differs aggressively from this subaltern view. As Miller and Sorrell[31] have argued, the "*most promising mitigation option is to weaken the link between economic growth and liquid fuel demand*". Yet the vision of incessant growth continues to drive our society, without any consideration of the energy required to power this growth. Greenhouse gas emissions, global warming, and climate change will, therefore, continue to haunt the earth as long as this vision persists. The curious thing is that the answer does not lie in a theoretical vision, but in the actual practice of the working poor – this is what needs to be grasped by those who wish to struggle for a better society. As Rosa Luxemburg said on the eve of her murder, "*The masses are the decisive element; they are the rock on which the final victory of the revolution will be built*"[32].

31 Miller, Richard G and Steven R Sorrell; "The future of oil supply"; Phil. Trans. R. Soc. A 2014 372, 20130179, published 2 December 2013;http://rsta.royalsocietypublishing.org/site/2014/2006.xhtml

32 Luxemburg, Order reigns in Berlin, Collected Works 4, in the Rosa Luxemburg Internet Archive



Hazards Centre

A UNIT OF SANCHAL FOUNDATION

92-H, III FLOOR, PRATAP MARKET
MUNIRKA, NEW DELHI - 110067
PH: 26714244, 26187806
EMAIL: hazardscentre@gmail.com
WEBSITE: www.hazardscentre.com