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India's Megacities and Climate Change:
Explorations from Delhi and Mumbai

Alankar

Climate Change and Cities

India's Megacities and Climate Change: Explorations from Delhi and Mumbai

This paper is a study of climate change discourse in urban India. It suggests that the policies being articulated to deal with climate issues are premised on incremental changes rather than radical re-planning of Indian cities. The paper tries to ask as to what explains this incremental approach. Is the threat of climate change simply adding further dimensions to existing urban concerns or does it offer a way to rethink conventional approaches towards dealing with urban environmental crises and in the process evolve new sets of technologies, expertise, power dynamics and also normative quotients and priorities? How are climate change challenges affected by issues such as politics, political economy, class and inequality? The paper first outlines the national context around the backdrop of global trends. It then focuses on specific climate change discourses in Delhi and Mumbai before turning to look at specific sectors such a transport, energy, waste, water and disasters. It concludes with final reflection and a future research agenda.

About the author

Alankar researches on urban environmental issues and is associated with SARAI Programme of the Centre for the Study of Developing Societies (CSDS), Delhi. Since 2009 he has been associated with different research projects conducted by the ESRC STEPS Centre at the Institute of Development Studies, University of Sussex, in collaboration with SARAI-CSDS. In addition to pursuing research, he also teaches political science to undergraduate students at the University of Delhi.

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By Alankar

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Acronyms

BEE	Bureau of Energy Efficiency
BMC	Brihan Mumbai Metropolitan Corporation
BRT	Bus Rapid Transport System
CCBDRRC	Common But Differentiated Responsibilities and Respective Capabilities
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CII	Confederation of Indian Industry
CNG	Compressed Natural Gas
COP	Conference of Parties
CRIT	Collective Research Initiatives Trust, Mumbai
CRZ	Costal Regulation Zones
DIMTS	Delhi Integrated Multi-modal Transport System
DMRC	Delhi Metro Rail Corporation
ECBC	Energy Conservation Building Code
GDP	Gross Domestic Product
GHC	Green House Gas
GRIHA	Green Rating for Integrated Habitat Assessment
IEG	Institute of Economic Growth
IGBC	India Green Building Council
IIM	Indian Institute of Management
INCCA	Indian Network for Climate Change Assessment
IPCC	Intergovernmental Panel of Climate Change
IT	Information Technology
LEED	Leadership in Energy and Environmental Design

MOEF	Ministry of Environment, Forest and Climate Change
MOU	Memorandum of Understanding
MMRDA	Mumbai Metropolitan Regional Development Authority
MNRE	Ministry of New and Renewable Energy
MSW	Municipal Solid Waste
NAPCC	National Action Plan on Climate Change
NEERI	National Environmental Engineering Research Institute
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Cooperation and Development
TERI	Energy and Resources Institute
WHO	World Health Organization

1. The urbanising and warming globe and its implications for Indian Cities

> Like it or not, the globe has an urban future. The world's urban population has more than quadrupled since 1950, more than half live in urban environments for the first time, and the trend is accelerating. The pressing question, then, is what type of urbanism will prevail.
> Peter Calthrope (2011: 3)

> The increasing concentration of the world's urban population and its largest cities outside the highest income nations represents an important change. Over the nineteenth and twentieth centuries, most of the world's urban population and most of its largest cities were in its most prosperous nations. Now, urban areas in low- and middle-income nations have close to two-fifths of the world's total population, close to three quarters of its urban population, and most of its large cities.
> IPCC, Assessment Report 5 (2014: 7)

Two distinct phenomena shape our planet: more than half of the world's human population is urbanised (World Watch Institute 2007); and global warming induced climate change is a grave threat. The former's relation with environment has been the focus of academic discourse from an ecological footprint perspective and an enhanced understanding of global warming has increased linkages between the two phenomena (De Sherbinin *et al*. 2007). Increased contemporary focus on carbon footprints differs from earlier conceptions of ecological footprints. In attempts to lower their rating as carbon emitters, many cities in the world have tried to shift carbon emitting activities outside their municipal boundaries, thus reinforcing a long term tendency of the expulsion of environmental risks from the core to the periphery. Ecological footprints, on the other hand, suggest a different orientation in which cities, as dynamic spaces of production as well as consumption, have to bear responsibility for the consequences of the sum total of their activities (Franchetti and Apul 2013: 6–17, Cartwright *et al*. 2012: 115–117, Da Schio and Brekke (2013).

Correctly assessed as a global concern, climate change is now increasingly linked to urban concerns in emerging scholarship, policy and lay people's discourses. Be it about the necessity of mitigation or requirements of adaptation, cities around the world are identified as critical sites. The growing city-based or dependent production and consumption of crucial resources and also the sheer numbers of poor people dwelling in urban centres in developing countries highlight how important it is for cities to prepare for climatic impacts and lower their anthropogenic contribution towards greenhouse gas emissions (Satterthwaite 2011; Satterthwaite 2008; Bicknell *et al.* 2009). In India, too, climate change is being viewed from multiple vantage points. On the one hand, climate change is unleashing serious threats to India's huge poor and vulnerable populations, its highly diverse ecologies, macro and micro economies and fragile socio-institutional linkages as well as contributing to its ongoing haphazard rural and urban transformations. (Revi 2008; INCCA 2010; Gupta 2005; Padukone 2010; Somanathan and Somanathan 2009; Kapur *et al.* 2009; Panda 2010; Sharma 2010), on the other there are evolving understandings that climate change is presenting some very crucial opportunities to India which, if considered sincerely, can help India's case domestically as well as internationally (Dubash 2013). There are also debates about issues concerning both mitigation and adaptation strategies and their relationship which this paper explores in the Indian context. The degree to which global warming has to be mitigated and by who still remains a contentious issue between developed and developing nations of the world but, at least theoretically, a

consensual position has been found internationally. This is known as, 'common but differentiated responsibility and respective capabilities' (CBDRRC) as set out in the United Nations Framework Convention on Climate Change, Article 4.1).[1] Mitigation is well entrenched within international deliberations due to associated financial and technological aspects, but mostly there appears to be consensus that adaptation is more crucial for developing and underdeveloped countries (Satterthwaite and Dodman 2013, Ayers 2009, Revi 2008). Satterthwaite(2014) argue that from a particular urban perspective, both the newer requirements of adaptation and mitigation along with longstanding issues of poverty reduction and disaster risk reduction add immensely to the existing problems confronting urban centres of low and middle income nations. Revi *et al.* (2014) strongly favour reconceptualising existing understandings of adaptation towards a newer 'transformative adaptation' which also addresses issues of development and mitigation. Roberts *et al.* (2011) argue, through the concept of 'ecosystem-based adaptation', that biodiversity and ecosystem must be considered critical elements in any climate change response strategy.

India's urban centres are already confronted by environmental concerns, such as increasing energy consumption, large scale pollution, a scaled up built environment at the cost of green spaces, unmanaged waste generation, unsustainable use of natural resources like water, pressure of increased population density. (Mukhopadhyay and Revi 2009). Added to these problems are the often unforeseen problems that arise from climate change. Regardless of whether climate change affects megacities like Delhi or Mumbai, the concerns of larger urban environmental problems related to water, waste, energy, housing, transportation will continue to pose more and more complex challenges. Thus we need to ask, what explains the incremental significance of climate change discourse with regard to the multi-faceted environmental issues which urban India faces today? Is the threat of climate change simply adding further dimensions to existing urban concerns, or does it offer a way to rethink conventional approaches towards dealing with urban environmental crises and in the process evolve new sets of technologies, expertise, power dynamics as well as normative quotients and priorities? How are climate change challenges affected by issues such as politics, political economy, class and inequality?

In cities like Delhi and Mumbai, more than half of the population lives in slums and is the most vulnerable to climatic impacts. The two cities also have large nation-level concentrations of urban middle and upper class populations. They are good examples of how a certain kind of consumption fuelled economic growth model is proving, not just ecologically unsustainable, but is also a catalyst of global warming. Unlike cities of the developed world where mitigation is the predominant requirement, Indian cities have multiple challenges to meet within the matrix of global warming induced climate change. How will those at the bottom of the pile be able to make their lives better while maintaining compatibility with the recent National Action Plan on Climate Change? How will India meet its priorities and responsibilities as world's fourth largest greenhouse gas (GHG) emitter at international negotiations and also deal with the aspirations of its growing middle and upper classes? It also needs to be noted that, 'lack of capacity and the political economy of poverty in Indian cities' (Hughes 2013) are entrenched issues of India's urban scenario.

This working paper hypothesises that concerns over climate change are currently well accommodated within traditional approaches of dealing with environmental issues, with some changing rather than being suggestive of a more fundamental reorientation of society and economy. Thus, the objective of the paper

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[1] http://unfccc.int/essential_background/convention/background/items/1362.php

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is to assess the directions in which policies for dealing with climate change are leaning in urban India. Specifically, the paper aims to explore:

- How climate change especially within India's urban context is broadly constituted. Do local (city) level interventions, envisaged as part of national climate change strategies, shift in accordance with shifting international configurations or are they relatively independent of them?

- Who are the important actors driving city level changes? Are they the local government or national government (and within that the Prime Minister's National Action Plan on Climate Change)? How do city-level climatic changes affect different social groups?

- What makes climate change a highly diversified phenomenon across sectors, such as transport, waste, energy, water, health, natural and built environment, and actors such as state, market, civil society and academia?

- How do policies and planning processes respond to climate change challenges and how are long standing concerns (e.g. waste, transport) being resignified in the wake of climate discourses?

- What new actors have emerged to offer expertise on 'green issues' in addition to the more traditional policy players and scientists dealing with climate change (e.g. the emergence of a large number of consulting institutions, ranging from how best to convert waste to energy or modify building design, smart signaling for intra-city transport)?

These questions will be investigated by examining nation-wide trends and policies and in particular examining climate change discourses and responses in two mega-cities, Delhi and Mumbai, that have different experiences of and responses to climate change. The paper first outlines the national context around the backdrop of global trends. It then focuses on specific climate change discourses in Delhi and Mumbai before turning to look at specific sectors such a transport, energy, waste, water and disasters. It concludes with a final reflection and future research agenda.

2. Global Scenarios, National Settings and Urban Contexts

India's positioning within the global matrix of climate change issue is clearly outlined through India's then Minister for Environment's, Jayanthi Natarajan, statements at Conference of Parties (COP) 2011 and 2012 in Durban and Rio De Janeiro.[2] The Minister reiterated India's commitment to address Climate Change stating, 'we are absolutely at the forefront of vulnerability of Climate Change'. However, 'as a developing country', she added, 'the principles of equity and CBDR[3] are central for us. India is asking for space for basic development of its people and poverty eradication' (Chaudhury 2012). 'India is a large country but with a very small carbon footprint', she pointed out, before going on to affirm the Prime Minister's pledge that *per capita* emissions in India will never exceed those of the developed countries.

Equity among nations, a common but differentiated responsibility and respective capability, anchored in a historical argument about justice and growth, drives India's climate policy in international settings (Kapur *et al.* 2009). This stance pursues commitments on mitigation in such a way that it marginalises space for discussions of development issues or indeed of adaptation to already occurring climate effects. The detailed *National Action Plan on Climate Change* outlined by the Prime Minister's Council on Climate Change in 2008 outlines another agenda.[4] It is guided by the following principles:

1. Protecting the poor and vulnerable sections of society through an inclusive and sustainable development strategy, sensitive to climate change;

2. Achieving national growth objectives through a qualitative change in direction that enhances ecological sustainability, leading to further mitigation of greenhouse gas emissions;

3. Devising efficient and cost-effective strategies for end-use Demand Side Management;

4. Deploying appropriate technologies for both adaptation and mitigation of greenhouse gases emissions extensively as well as at an accelerated pace;

5. Engineering new and innovative forms of market, regulatory and voluntary mechanisms to promote sustainable development;

6. Effecting implementation of programmes through unique linkages, including with civil society and local government institutions and through public private-partnerships;

7. Welcoming international cooperation for research, development, sharing and transfer of technologies enabled by additional funding and a global IPR regime that facilitates technology transfer to developing countries under the UNFCCC.

Climate concerns, in this view, are clearly not about the environment alone. They reflect instead economic priorities, financial and institutional arrangements, energy security and local level developments. They seek to protect the poor and the vulnerable as well as to engineer new and innovative markets. For the

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[2] Conference of Parties (COP) which is the supreme decision-making body of the United Nations Framework Convention on Climate Change. It is an association of all the countries that are Parties to the Convention.

[3] Common But Differentiated Responsibilities and Respective Capabilities (CBDRRC)

[4] http://envfor.nic.in/ccd-napcc

city focus of this paper, we need to ask which of these principles are attracting greater attention and financial commitments than others. But, as outlined below, climate change programmes in Indian cities appear to be far off from addressing many of the laudable principles outlined above.

Dubash *et al.* (2013) have critically appraised the growing body of institutionalised work designed to work out India's position on climate change like the National Action Plan on Climate Change (NAPCC), State Action Plans at the provincial levels and the Planning Commission's 'Interim Report of the Expert Group on Low Carbon Strategies for Inclusive Growth' at the Federal Government's level. They argue that:

> [...] there is no clear and consistent approach or framework that directs and guides these efforts. The "co-benefits" formulation in the NAPCC is promising: measures that "promote our development objectives while also yielding co-benefits for addressing climate change effectively (Government of India 2008: section 2)". Without clearer specification, however, a co-benefits approach risks being used in an ad hoc manner to either justify business as usual development policies, or to opportunistically sell a particular policy without sufficient justification of its advantages over other comparable policy options.
> (Dubash *et al.* 2013

Dubash *et al.*'s concerns about India allow us to make sense of a very different trajectory which the Brazilian state of Sao Paulo is following. Lucon and Goldemberg (2010) explain how the province of Sao Paulo has followed a more progressive and distinct trajectory than the Brazilian Federal Government towards combating climate change impacts. In conserving its natural resources (especially Amazon forests), focusing on generating about half of its energy requirements from renewable energy sources and by mandating GHG emission cuts, Sao Paulo has set new benchmarks within Brazil. The example holds crucial importance, particularly because large city regions of India such as Delhi and Mumbai can learn how newer and more pertinent strategies can be evolved that are distinctly different from the larger national framework on climate change in India which, as pointed out by Dubash *et al.* (2013), have yet to reach a certain cohesiveness.

In 2011, 31 per cent of India's population lived in its cities. By 2039, this is expected to rise to 50 per cent.[5] From an economic perspective, cities today contribute around three fifths to the total gross domestic product (GDP) of India (Shaw 2012: 50). On the other hand, slums now account for a quarter of all urban housing, the proportion increasing even more dramatically in the large cities like Delhi and Mumbai where close to half the population may be living in slums.[6] The economic significance of India's progressive urbanisation and the social disparity that is so characteristic of it, presents two distinct challenges in relation to climate change. On the one hand, economic growth results in growing emissions and invites proposals for effective and targeted mitigation; on the other, the large, and growing, slum populations necessitates developing greater adaptive capacities to cope with the climate changes that have already occurred, and those that may be anticipated in the near and medium term future.

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[5] http://indiagovernance.gov.in/files/urbandemographictransition.pdf

[6] http://bit.ly/1Gmw07a

3. Researching Climate Change in Urban India

In the light of this background, we chose to examine the initiatives and responses regarding climate change in Delhi and Mumbai.[7] This choice of the cities was dictated in part by their size. Both Delhi and Mumbai are among India's largest metropolises and are also growing very fast. Delhi had a population of approximately nine million in 1991, which has since grown to approximately 18 million and is expected to grow further to 22 million by 2021 (Government of Delhi 2010). Mumbai, over the same period, has grown from approximately 12 million to 20 million. On the other hand, the distinct topographical situations of Delhi and Mumbai present differences in the way climate change is perceived in the two cities. Mumbai, being a coastal city, has certain specific concerns such as the effects of sea-level rise. The rainfall pattern of the city, when seen in conjunction with its island terrain, suggests that soil erosion, landslides and flooding are likely to intensify. By contrast, Delhi, a land-locked city, is confronted by issues such as heat-island effect, dwindling water resources, waste generation and growing demands for more energy through fuels and electricity.

Being an exploratory exercise, this study chose to cast its net wide, even if a bit thinly, attempting to understand the salience of climate change through diverse voices, namely, government officials, experts, scholars, activists, non-governmental organisations (NGO), journalists, green consultants and, in Mumbai, the especially vulnerable community of fisherfolk. Field visits were also carried out at certain sites of actions/impacts like coastal and riverside slums, residential localities around incinerator plants and green buildings. Broadly, the research committed itself to explore the understandings around climate change issue and its interface with urbanity and urban transformation, deliberations through participation in workshops and conferences where the problematic of cities in India and climate change was articulated, and protest sites where some of these measures were contested. In sectoral terms, the research tried to analyse the changing role of urban transportation and the built environment, resource and products usage, water, electricity, waste generation, and the cities' ecological footprint to assess their relation with global warming.[8]

In the urban Indian context, the climate change conundrum gets further complicated by relative priorities around mitigation and adaptation, the former geared towards reducing the emission of GHGs while the latter is largely about increasing the resilience against the impacts of climate change. The initial simplicity of the meanings of these two terms also extends to their interrelation. Adaptation can only remain meaningful if mitigation is worked upon robustly. Beyond this broad understanding about their meanings and relation to each other, both the terms acquire much more complexities. According to UN-Habitat (2011) mitigation is the implementation of policies to reduce greenhouse gas emissions (through reducing resource inputs and emissions per unit of output) and to enhance carbon sinks.[9] To date, responses have been concentrated in five sectors:

- Urban Built Environment and Design, e.g. land-use planning, regeneration, increased density to reduce mobility demand, and promote walking and cycling;

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[7] More time was spent in Delhi than Mumbai on the fieldwork involved because the researchers are based in Delhi.

[8] Identification of these sectors is based upon the larger IPCC framework and within it the focus on urban areas. It is articulated in IPCC's Assessment Report 5 specifically in chapter 8. (http://ipcc-wg2.gov/AR5/report/final-drafts/) (http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Chap8_FGDall.pdf)

[9] The following sub-categorization is based upon UN-Habitat's Report on Global Human Settlements 'Cities and Climate Change (2011) pp 91-160 (http://www.zaragoza.es/contenidos/medioambiente/onu/538-eng-ed2011.pdf)

- The Built Environment, e.g. energy efficient materials and design, retrofitting, energy demand reduction;
- Transport, e.g. mass transportation, energy/fuel efficient electric cars;
- Urban Infrastructure, e.g. renewable and low carbon energy supplies, waste recycling;
- Carbon Sequestration, e.g. tree planting, carbon capture and storage.

Adaptation, initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects, is described in the following key sectors:

- Infrastructure and Settlements, e.g. drainage, storm surge barriers, wetland protection;
- Water Management, e.g. storage and conservation due to expected shortage of clean water;
- Transport, e.g. improved design and safety standards;
- Energy, e.g. infrastructure strengthening, source diversification.

In this context, Aromar Revi (2008) highlights that the overall risk in Indian cities typically is associated more with vulnerability than hazard exposure. Accordingly Revi's analysis focuses on an adaptation-led strategy to reduce climate change risk and increase urban resilience in keeping with India's development priorities and challenges. It shifts the emphasis from the mitigation and techno-centric response that has come to dominate the Organisation for Economic Cooperation and Development-led (OECD) climate crisis discourse, and suggests a more independent route to a more sustainable future. Most importantly, he argues, that reducing vulnerability – which typically contributes more to overall risk in India's cities - will mean a shift in public policy, mobilisation and enterprise from mitigation towards adaptation. Such a shift needs to be grounded in the institutional, socio-cultural and political realities of India and needs to focus on the poor and most vulnerable through a mix of policy, regulatory, fiscal and financial, institutional and mobilisation instruments. Economically too, studies conducted by the Indian Institute of Management (IIM) (Ahmedabad) suggest, there is a good case to be made for paying attention to adaptation in the here and now, for 'coping with the climate change impacts at the time of crisis will be around three times costlier than incorporating adapting features during the construction'[10] (Yumlembam 2011), However, as Adger *et al.* (2003) point out, this would have to be a dynamic strategy and not a onetime project, for although 'poverty and marginalisation are key driving forces of vulnerability and constrain individuals in coping and long-term adaptation, vulnerability to future climate change is likely to have distinct characteristics and create new vulnerabilities' (Adger *et al.* 2003). This is in a context where, in many developing countries, state-led reforms of the last 25 years have typically resulted in public provision of transport, healthcare, and water and sanitation services being abandoned by the state, or decentralised to the private sector and local authorities. All of which negatively affects the key determinants of adaptive capacity, such as stable and sufficient incomes, access to water, electricity, food, healthcare, education and other services and infrastructures (Lankao 2008).

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[10] The study entitled 'Managing Climate-Induced Risks on Indian Infrastructure Assets' was carried out by Amit Garg, faculty at IIM-Ahmedabad (Yumlembam 2011).

4. Delhi and Mumbai – Unpacking multi-layered climate change discourse

The focus of climate change in Delhi and Mumbai, for all their differences in topography and the nature of likely climate impacts, is similar in both cities. Mumbai does not yet have an official climate change plan, but signed a Memorandum of Understanding (MoU) with the Energy and Resources Institute (TERI) in April 2010 to conduct a two year study across the State of Maharashtra of which Mumbai is the capital.[11] The study seeks to analyse projected climate change impact on four key sectors: hydrology and water resources; agriculture; coastal areas; marine ecosystems; and livelihoods, including impacts on migration, and work out a vulnerability index for the identified sectors, resulting from variables including temperature change, sea level rise and the frequency of extreme events. TERI will also suggest an adaptation strategy for Mumbai to deal with the complications arising from climate change (Ghoge 2010). Popular engagements with climate change, however, have begun to be articulated. According to a study by Kumar, Jawale and Tandon (2008) Mumbai has a high exposure to risks associated with climate change, especially rises in sea levels, due to its high density of population and its commercial and industrial buildings. Additionally, much of the reclaimed land is in low-lying areas. Extreme precipitation is likely to increase over the western coast and west-central India and the increase in rainfall and the rise in mean sea level, together with poor drainage, is likely to increase the frequency of floods. In the low lying areas, these are likely to result in death and displacement. Salt water intrusion is also likely to affect the stability of high-rise buildings. Disease incidence, especially of malaria, diarrhoea and leptospirosis, are also likely to be exacerbated. Heat stress is likely to be felt in myriad ways, ranging from cramps to exhaustion and strokes. A set of civil society actors describe the impacts more dramatically:

> The Gateway of India, once a popular tourist attraction and symbol of Mumbai's historical significance, submerged under rising sea waters. The Maharashtra Nature Park, once a dumping ground, now a forest preserve for rare bird and butterfly species. The discussion tonight at the Mumbai City Dialogue on climate change evoked these two striking images of two possible futures for the city. One is the fate likely if nothing is done to combat climate change. The other, a model of the ways in which citizens and the city can ameliorate the situation and create a sustainable future before it is too late.
> Asia Society (2007)

The responses are even more striking. Kumar *et al.*'s (2008) health based analysis suggests the following: better drainage; new building practices to lower salt content of building materials; greater investment in health sector; anti-erosion measures; protection plan for mangroves and wetlands; greater energy efficiency and enhancement of the urban ecosystem. The response from the Asia Society is in the form of city dialogues with concerned citizens and prominent leaders from across the spectrum of the city's civil society, business, science and government addressing the implications of climate change for Mumbai, and the city's responsibilities and opportunities for confronting it. One promised a better, and perhaps more universal, infrastructure; the other a dialogue of experts. Neither seemingly had much space for communities that are vulnerable in their own distinct ways:

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[11] http://www.teriin.org/index.php?option=com_ongoing&task=about_project&pcode=2010GW01
http://www.metoffice.gov.uk/media/pdf/c/a/GOM_brochure_for_web.pdf

Machimarnagar is a unique traditional fishing village in the midst of a huge commercial city and urban landscape, with 95 percent of the working population involved in fishing. There are 2000 fisherfolk in the village. Generally men go to the sea for fishing and women sell fish in the dock. Until a decade back villagers used to get fish within 100 metres of the sea coast but now they have to go far beyond that distance. Without using the technical language of climate change discourse, the villagers point out that since the past decade there has been instances of unusual storms in the sea, as a result the water in the sea gets colder and as a result fishes have not been laying eggs on the conventional pattern. Primarily, fish only lay egg when the temperature of water is comparatively warmer. Resultantly, in the last few years the number of fishes in the sea has gone down. Another strong reason behind this is alarming level of pollution of the sea which receives maximum sewage from the city. The reclamation of land by the government and real estate private builders to construct residential and housing complexes is another contributory factor. Even though there have been a number of protests by the villagers during the reclamation process, nothing conclusive or consequential in the favour of fishing community has ever happened. On some occasions, there has also been oil spillage in the sea water, due to Mumbai coast being an important on-shore drilling site and which severely affects fishes and eventually the villagers. The Maharashtra government has some positive official provisions for the fisherfolk but Machimarnagar's residents' account suggests that the implementation as per such provisions has deliberately been hampered by vested interests. For example, in order to get loan to buy a fishing boat, the villagers need to bribe various concerned officials up to Rs. 2,00,000 to 3,00,000. The government formally keeps a track of their deteriorating livelihood but until now has failed to do anything substantial to reverse the situation. The fishers have been demanding jetty-boats for the past 25 years but so far their request has been ignored. The research team was also informed that the fragmentary electoral divisions and contestations due to the multiplication of political parties in Maharashtra has impacted the unity of the fisher as different groups are affiliated with different political parties. The villagers believe that if the government does not take any action soon then there is not much hope for the fishing profession to sustain its future in this old locality of Mumbai. Contextualizing, the scenario as expounded by the villagers, we find that the changing sea water dynamics juxtaposed with the effects of urbanisation (materially, politically, institutionally, socially and ecologically) have cumulative effects on the lived experiences and livelihoods of the fishing community of Mumbai leading to multiple forms of marginalization.
(Alankar *et al.* 2011)

It is not as if alternative pathways, highlighting specific risks, are entirely absent. 'Mumbai in the time of Climate Change' (Kalaghoda Festival 2011) featured panels on Climate Science and Climate Negotiations, and a distinctive take on Low Carbon Paths, highlighting city's history; connecting producers and consumers; and the irony of city makers as homeless people. An OECD study points to the benefits of taking into account both the direct and indirect costs of extreme weather events in order to have a better adaptation assessment, both in ensuring the analysis captures the full economic benefits of adaptation and also identifying options that can help to manage indirect risks of disasters, especially for the urban poor. A workshop, 'Vulnerability to Climate Change', organised by the Centre for Information and Documentation featured sessions on the impact and vulnerability of climate change on fishermen and

coastal communities.[12] The difficulty is in assessing how far these views are mainstreamed, given the rather limited information available.[13]

Delhi, by contrast, has an official climate change agenda. However, unlike Mumbai, this is not backed by any specific risk scenario, detailed or otherwise. Also, again in contrast to Mumbai, the focus is entirely on mitigation. The Government of Delhi's self description of its engagement with climate change bears this out.[14] In February 2007, the official website of the Government of Delhi stated that the State Government first initiated the idea of adopting a Clean Development Mechanism (CDM) concept in all infrastructural agencies in a meeting by World Bank officials with Chief Secretary. This was followed by a lot of meetings and action from various agencies. In the following month, a seminar was organised with experts from World Bank, Japan Industrial Development Co-operation, IIM Bangalore, TERI and the Clinton Foundation in which all the Developmental agencies made their project presentation and experts highlighted potential CDM avenues. Again in June 2007 a round table conference was organised. Attended by the Chief Minister of Delhi, interaction with the experts from Bureau of Energy Efficiency (BEE), Ministry of Environment, Forest and Climate Change (MOEF), GTZ, World Bank and Central Electricity Authority (CEA) was organised for all the ten infrastructure agencies. In August the same year meetings were held with noted CDM Consultants, IL&FS Ecosmart, Price Waterhouse Coopers, Ernest and Young, ONGC and ICF International, where modalities, formulation and submission of CDM projects were discussed. The objective in this instance was to sensitize the infrastructural agencies about the procedures and formalities required for preparation of CDM projects. Following these various meetings and consultations, the infrastructural agencies agreed to adopt the following concepts in making CDM projects:

- energy conservation
- use of compact fluorescent lamps (CFL) and electric chokes
- solar water heating systems
- efficient street-lighting
- efficient use of water pumps
- energy efficient buildings
- promotion of LEDs
- solar air-conditioning
- afforestation

Having marked itself out as something of a leader in the field, the Delhi Government presented the Climate Change Agenda for Delhi 2009–12 in November 2009, inviting praise from the Union Minister for its specific 65 point agenda.[15] Since then, officials of the State Government have presented details of these points on various platforms. The presentations are typically prefaced with observations on GHG emissions and the National Action Plan on Climate Change and its eight core missions: National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for a "Green India", National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge for Climate

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[12]   http://ced.org.in/cedintra/index.php?option=com_content&view=article&id=379:vulnerability-to-climate-change-mumbai-thane-coast&catid=162:meetings-of-2010-2011&Itemid=132

13 The OECD paper on the impact of climate change in Mumbai, referred to above, explores only the upper-bound climate scenario which, it cautions, is insufficient to design an adaptation strategy.

[14] http://delhi.gov.in/wps/wcm/connect/environment/Environment/Home/Climate+Change/

[15] Press Information Bureau, 'Delhi first State to release Action Plan on Climate Change,' The Minister, however, noted the shortfall in regard to cleaning the Yamuna, http://pib.nic.in/newsite/erelease.aspx?relid=53889

Change.[16] Official presentations then continue by pointing out the harmonisation of the Delhi agenda items with these core missions (minus the mission on Himalayas and sustainable agriculture). We shall look at these agenda items below in our examination of the specific sectoral issues. However, it is crucial to point out at the very outset that missing from all this is any mention of the principles that underlie the core missions mentioned above. Also, the Government of Delhi seeks the support of the community, for the Government cannot do it alone, but makes no reference to the particular communities that may be the most vulnerable. The closest the Government comes to an understanding of its limits is to suggest that, while Delhi has done a lot it has not focused adequately.[17] Adaptation, in this version, involves intervening to change public behaviour, bringing awareness amongst people, especially with regards to the three Rs, Reduce, Reuse, Recycle, through public awareness campaigns such as Earth Day, Environment Day, Eco Clubs.[18]

This is not all. As we shall have reasons to point out in greater detail below, what is happening through the projects outlined under CDM is the opening up of more possibilities of 'green business', rather than an effective mitigation, and possibly other environmental costs. With the opening up of monetisation of carbon business in the form of carbon trading, green consultants have started to turn it into a profitable business by soliciting deals between emitting industries of the developed countries with those of developing countries which rely on either less emissions or renewable sources of energy. The Intergovernmental Panel on Climate Change (IPCC) designed Carbon Certification and Trading System allows for transfer of carbon credits between industries of developed countries and of developing countries under an emission-cut strategy. The mapping of these new business enterprises therefore should form a critical component of any long-term research on Climate Change in Delhi. The question of who gains and who loses in these new business models is equally pertinent. Pradip Saha[19] raises the significant question of how the current models avoid sharing of mitigation benefits in a monetised form with non-emitters like rickshaw pullers and informal waste recyclers who are either, by default or by design, also contributing to mitigation through their livelihood practices. Ravi Agarwal[20] questions the assumptions underlying waste to energy projects and their definition as renewable energy projects, highlighting simultaneously the environmental health dimensions in the form of the release of toxins, the business model that must be provided with heavy subsidy to make the project successful and the livelihood issues that confront the community of existing waste pickers due to increased privatisation and corporatisation of waste management services. In other words, while the sceptic may have been gradually persuaded by the science of climate change, the projects for mitigation and the negotiations around them do seem to produce new climate cynics, especially among activists and media persons.[21] Several environmentalists

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[16] See for instance the presentation by Sh. Rakesh Mehta, Chief Secretary, Government of Delhi and by Sh. Dwarkanath, Senior Scientific Officer with the Environment department of the Government of Delhi.

http://cmsvatavaran.org/cmsvata/Rakesh.pdf;
http://siteresources.worldbank.org/INTCARFINASS/Resources/Session5_Dwaraknath.pdf

[17] See presentation by Parveen Dhamija, CEO, Energy Efficiency and Renewable Energy Management Centre, Government of Delhi. http://moef.nic.in/downloads/others/States-SAPCC-delhi.pdf.

[18] As gleaned from interviews with the Secretary and Senior Scientific Officer (Department of Environment, Govt. of Delhi).

[19] Environment Communicator with the Centre for Science and Environment, Delhi. Interview with author along with the research team.

[20] Director, Toxics Link, Delhi. Interview with the author along with the research team.

[21] Chetan Chauhan, Correspondent, Hindustan Times. Interview with author along with the research team.

and activists have pointed out that most efforts being undertaken by government, in the name of climate change, are not exactly new or substantive but rather are extensions of older policies and programmes.[22]

Either way, whether focusing on mitigation or adaptation, there remains the question of governance, especially at the local level where a city's evolving governance structures may not fit with the problem they address and where lack of institutional capacity constrains authorities' management efforts (Lankao 2007). This paper continues below to explore some of these issues by examining key sectors such as transport, energy, waste, water and disasters.

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[22]Kakolay   Chatterjee   and   Mayan   Aggrawal,   'Govt's $300   billion   Green   War,   a   Sham?',
(http://www.dnaindia.com/india/report_govt-s-300-billion-green-war-a-sham_1699584)

5. Case Studies: Sectoral Issues

Satterthwaite (2008) and Dodman (2009) discuss that, rather than arguing whether it is cities that mostly contribute to global warming or not, the focus needs to be on the activities which contribute to greenhouse gas emissions, whether urban or non-urban and cumulatively look at both consumption and production.[23] We thus could ask: is increasing urbanisation itself propelling us to a scenario where global warming is soon going to turn catastrophic? Alternatively, can certain alternative/regulated forms of urbanisation avoid such a scenario?

The concentration of transportation and industry in urban centres means that cities are sources of CO_2 and other greenhouse gases. Such things as changing land and water use patterns, energy intensification, generation of waste reasonably demand specific foci. To address this imperative let us begin now to elaborate how the discourse unfolded in our research, in sector specific ways.

5.1. Transport

Worldwide it is argued that the transport sector is one of the biggest consumers of fossil fuels and is thus a significant factor in the increasing emission of GHGs[24] (Singh 2010, ADB 2009, CSE 2009, Bandopadhyay and Thukral 2010). In the present economic climate, the development of urban transport is also linked with wider parameters of growth and development. Certainly, in the Indian urban scenario, evolving equations such as gentrification, expanding economic activities and social differentiation play a role in transport dynamics of a given city. For example, in both Mumbai and Delhi there has been continuous change over the last 100 years in terms of the modes of transport, both public and private, motorised and non-motorised. From the perspective of climate change, the issues which need careful analysis are the growth and density of motorised transport, the amount and quality of fuel used as well as the mode and technology of transport. According to government estimates of the total carbon emissions in Delhi, 46 per cent are from the transport sector alone.[25] Climate change and urban transport concerns have focussed on two key issues, emission reduction and energy efficiency. The start towards achieving emission reduction was by default and not intentional. In July 1998, the Supreme Court, on the recommendation of the Bhure Lal Committee, ordered the conversion of all public transport vehicles of Delhi to compressed natural gas (CNG) mode (including buses, taxis and auto-rickshaws). Importantly this decision was not linked to global warming or climate change concerns. Instead, the rationale behind it was purely an exercise to abate vehicular pollution in Delhi. Also, it is noteworthy that in the history of motorised transport of Delhi there has always been a far greater use of private transport than public transport. Thus, the decision of the Supreme Court was not taking into account all the factors contributing to the pollution situation. From the State's perspective, only during 2009, when the Government of Delhi introduced an action plan on climate change, did emission reduction in the form of GHGs finds a specific mention (Mehta 2009). It included actions such as promoting state-owned DTC buses to be the largest fleet in the world

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[23] Satterthwaite and Dodman argue for inventory of activities emitting GHGs.

[24] After electricity, industry and agriculture, transport is the biggest emitter of GHGs. From a particularly urban point of view, within India, transport comes second
(http://www.unep.org/transport/lowcarbon/newsletter/pdf/LowcarbonFactsheet.pdf)
(http://moef.nic.in/downloads/public-information/Report_INCCA.pdf)

[25] Pravin Dhamija, CEO, Energy Efficiency & Renewable Energy Management Centre, Department of Environment, Government of Delhi (http://moef.nic.in/downloads/others/States-SAPCC-delhi.pdf)

run on CNG despite the fact that conversion to CNG, as already mentioned, had not been intentional but was a result of forced implementation to comply with the decision of the Supreme Court.

Around 5 per cent of Delhi's population drive private cars and about another 15 per cent use motorbikes and other similar forms of motorised private vehicles. More than half of the city's population walks or uses public transport, predominantly public buses. Sahai and Bishop (2009) write that Delhi's population (who have the highest *per capita* income in India) and the prevailing urban sprawl in the city have produced a very high demand for motor vehicles. Aditya Nigam argues that,

> Private transport has transformed the external landscape of the city in fundamental ways. In the last two decades we have seen the lives of Indian cities restructured around the automobile. Over the years the car has become a symbol of status of power. Gradually, status and power were determined not merely by the ownership of the car, but also by the number and size of cars that one possessed…it became an instrument of domination on the roads…another grammar of power appeared on the streets and public spaces…it now demanded space and more space…everything was colonized by the automobile, in motion or parked … green spaces of the city and poorer settlements…the colonization of the urban space in favour of the rich…the private automobile transformed the grammar of power so much that soon all of 'Development' began to revolve around its needs; its speed, unrestricted flow and its 'rest'.
> Nigam (2011: 7–11)

In 2008, there were 5.5 million vehicles in Delhi. By 2013 the figure had reached about 7.5 million, the largest number in any city in the world.[26] Nearly 1000 more are added on a daily basis. To tackle the congestion on the city roads, in the last decade Delhi has seen a massive expansion of a network of flyovers and underpasses, but although this has made signal-free long road stretches possible, the congestion worsened.[27] In 2008, the Delhi Government initiated the Bus Rapid Transport System (BRT) on an experimental basis on a particular stretch called *Moolchand-Ambedkar Nagar corridor* where there is a dedicated corridor on the road which is meant exclusively for buses. The logic is to promote the use of public transport and discourage the use of private vehicles, given that a smoother flow of buses on the BRT corridor is ultimately beneficial to a larger number of people and is environmentally less polluting because buses use CNG as fuel rather than petrol/diesel. However, despite all the clear sustainability benefits and massive public support, Hidalgo and Pai (2008) note that the elitist bias of the media and the problematic implementation by the Delhi Government made this project very controversial since it began. Presently, the matter is *sub judice* at the Delhi High Court. In July 2012, the Delhi Government submitted an affidavit in the court where it strongly backed its intention to continue with the BRT system on the existing corridor, as well as plans to introduce it in other areas of the city. The Government has stated clearly that through this project it aims to encourage more people to use public transport and give up the use of private vehicles. The affidavit states that, 'Government has understood the value of seeking out alternatives to cars and has recognized buses as the best option'.[28] The significant issue remains how, in the larger scheme of things, where the automobile industry's growth is seen and projected by national and state governments as a standard for economic growth in the country, where the privatisation and corporatisation of public services like city public transport, water, and electricity are being promoted, where the media plays a very influential role in public policy formulation and simultaneously thrives on revenue from advertisements by automobile manufacturing companies, can state governments promote

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[26] http://www.business-standard.com/article/pti-stories/74-53-lakh-vehicles-in-delhi-survey-113031900581_1.html

[27] See Nigam (2011: 15-16) for the worsening of traffic situation both in Delhi and Mumbai despite web of flyovers.

[28] Nair, Harish V. 'Govt Junks research Body Report on BRT' Hindustan Times, New Delhi, 24th July 2012

policies which encourage the use of public transport in a way which intends to discourage use of private vehicles? Such contradictions and complexities in the context of mitigation efforts for greenhouse gas emission exist at all levels in climate change discourse in India.

Delhi's first Metro Rail started in 2003 and has today expanded to cover and connect regions lying beyond the borders of the city. When the planning for the Metro was first done, there was never any specific link posited between the metro rail and climate change. Today, however, the metro rail is publicised as an energy efficient CDM project serving the important aim of tackling climate change.[29] Sreedharan (2009) strongly argues that Delhi's metro rail transportation exemplifies how technological innovation within existing transport infrastructure can go a long way in dealing with climate change concerns. He provides a blueprint, through a case study of Delhi Metro's initiatives, of how through newer technical designs a balance can be achieved between development needs and effective mitigation efforts for a country like India. Through using regenerative braking systems, Delhi Metro has pioneered ways of not just using non-fossil energy. It has also gradually embarked on a path to reduce use of private vehicles in Delhi by expanding its network. The Delhi Government too has celebrated Delhi Metro's work towards energy conservation through a regenerative braking system (Asian Age 2011). Not surprisingly, given this favourable presentation, the United Nations has certified Delhi Metro as the first metro rail based system in the world to get carbon credits (Asian Age 2011). Not all agree with this though. The significance of the Metro for a city like Delhi, especially for long-distance travel is undeniable, but this alone may not suffice. S. N. Sahai at Delhi Integrated Multi-modal Transport System (DIMTS) and Simon Bishop offer instead Integrated Multi-modal transport systems as a more effective solution towards low carbon transportation (Sahai and Bishop 2010). Policy signals are mixed in Delhi. On the one hand, increased need for keeping motor vehicles moving has resulted in massive allocations of cash for road widening projects and flyovers. On the other, there is an inherent contradiction between these increased allocations and the aim to move towards more equitable distribution of road space and the promotion of non-motorised transport. The Metro is an important component of this public transport mix but so are buses, and a synergy between the two is much desired. Delhi's focus on a metro, they suggest, has not been able to release pressure on the roads from private motorised transport since the bus share has fallen. Quite clearly therefore, the Metro, by itself, would have a limited impact. They cite favourably a *Lancet* study of 2009 on five different greenhouse gas scenarios relating to transport in Delhi, and ways to intervene effectively in this regard:

> Prioritisation of walking and cycling and restricting vehicles through policy interventions like carbon rationing, road pricing, and traffic demand management, combined with improving conditions for those using public transport (Metro and bus), would reduce emissions more than twice as much as those from a strategy focused on vehicle efficiency improvements and Metro development.
> (Lancet 2009)

There are issues too relating to the sharing of carbon credits. Delhi Metro Rail Corporation earns straight monetary benefit by being accredited as a carbon saving mode of transport (The Hindu 2011; Economic Times 2008). However, what about other carbon saving modes that remain out of the equation? Pradip Saha, formerly of *Down To Earth*, rhetorically asks, 'what is the reason for allowing non-motorised modes of public transport like hand-pulled rickshaw to remain out of such monetary sharing when it too contributes substantially to keeping the environment clean?'[30] Another dimension to this debate is added

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[29] CDM is one of the most advanced business model in the economics of climate change whereby carbon credit transaction takes place in monetary terms.

[30] Interview with Pradip Saha

by Saxton (2011) who cites a study conducted by the Delhi Metro Rail Corporation (DMRC) and Institute of Economic Growth (IEG) to suggest that increased real estate values from Metro developments are computed without tallying damages to displaced Delhi slum-dwellers.[31]

Another initiative with respect to Climate Change in Delhi is an Air Ambience Fund, an initiative first proposed in 2008 to tax diesel in the city and use the amount for development and use of clean air technologies, waste management and such other related activities that promote clean air policies so as to reduce air pollution, especially vehicular pollution in the city. Once again, it would seem, the fund as a climate change initiative, is possibly a new description for an old initiative.

In Mumbai too city officials have presented solutions ranging from technological to behavioural change. The city media is used to promote campaigns on walking and there has been significant infrastructure put in place for building skywalks in the heavily congested city especially around railway stations. Inspired by Delhi, Mumbai has initiated its own public-private venture of bringing in the Metro Rail into the city. Fuel norms have been made more stringent and star-ratings to tackle engine-energy consumption have been other initiatives. These can be certainly seen as a direct intervention in the transport policy related to the issue of climate change. Like Delhi, the conundrum remains somewhat similar for Mumbai whose vehicular population too increased steeply in the last three decades. Whereas the increase of private cars was six fold, from 150,000 to 900,000, the public transport fleet of buses only doubled, from 2133 to 4300.[32] Today, the city is following a similar trajectory to Delhi in terms of its problems of congestion, pollution, etc. and also moving towards a similar set of solutions by creating more space for private vehicles and their passage, rather than alternatives which could make more difference in a changing climate scenario.

Based on the above discussion, four imponderables remain: a) Given the non-negotiability around vehicular ownership, just how much impact the different interventions can have is open to question; b) Given continuing urban sprawl, especially in Delhi, what are the real gains of new public transport networks? C) How does one account for the material and capital intensive nature of the infrastructure, including the Metro? And, d) Are the re-descriptions of exiting projects a case of merely deploying terminology that has greater global purchase or do they signal genuine opportunities that allow a marriage between global climate change agendas with locally driven, self-articulated, developmental needs?

5.2. Waste

The growth of urbanisation in India is closely linked with the generation of waste which produces methane, one of the leading GHGs. India generates 70 million tons of municipal solid waste (MSW) annually (UNEP 2010: 16). With the urban population increasing between three and three and a half per cent a year, increase in waste generation is around five per cent annually. In cities like Delhi and Mumbai the municipal corporations mainly transport the waste from *dhalaons* (waste dumping site of a locality) to the landfill site. Another feature of this sector is the presence of informal waste workers who collect the waste from each household and segregate the recyclable waste at the *dhalaon* before the waste is transported by the municipal bodies to the landfill sites. It is estimated that currently there are between 250,000 – 300,000 waste pickers in Delhi and Mumbai each.

Rapid urbanisation has resulted in an intensifying of the waste burden in urban areas and rising emissions from waste. Emissions from the waste sector in India have grown more than 30 per cent since 1995. There

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[31] Saxton, Aditi (2011) 'Mind the Gap', http://www.motherlandmagazine.com/ecology-issue/mind-the-gap

[32] http://www.mesn.org/data/JVlrBusPriorityLane.pdf

are two levels of policy interventions made in Indian cities to reduce GHG emissions from MSW, composting and waste-to-energy plants. One of the ways to look at both composting and waste-to-Energy plants is from the perspectives of decentralisation and corporate techniques. Ravi Agarwal of *Toxics Link*, a Delhi-based NGO, argues that if the issue is looked at holistically, the manner of composting is more ecological and involves people directly. From the livelihood perspective it is beneficial for the largely poor informal sector waste workers. On the other hand, the waste-to-energy mechanism is more of an industrial enterprise which involves big players, as is seen in the case of the projects under trial now across India. In the specific case of Delhi, the Delhi Government signed an MOU with Jindal Ecopolis (a private corporate arm of Jindal Group) whereby a waste-to-energy plant was to be constructed at Okhla in Delhi. The contract provided for a subsidy of Rs 20 million for each megawatt of energy produced. The plant has faced resistance from three groups. The first are those who live in the middle-upper class residential localities around the four to 5 kilometres radius of the plant who complain of environmental pollution leading to health deterioration due to the incineration technology being used in the plant. Their main concern is not related to methane emission contributing to global warming but only the location of the plant which, they argue, needs to be moved. The second are environmentalists who have argued against the plant from the perspective of both environment and peoples' health and link it with global warming due to the incineration technology being used. The third and last is the opposition from those who fear a loss of livelihood for the informal waste workers given the greater corporatisation of the industry and the use of technologies that not only promote top-down interventions but are also less ecologically sound than the more community oriented technologies, such as composting, which reinforces the ecological logic of reuse, recycle and reduce.[33] One further argument on the technological issues involved, raised by Patnaik (2009), is that rather than incineration, which causes air, land and water pollution and is thermally inefficient, there should be greater use of the gasification process. This is combustion in a controlled atmosphere in a near absence of oxygen which produces a gas commonly known as Syngas which can then be burnt to produce energy or processed further to yield ethanol and diesel. Mahesh Babu goes a step further and argues that incineration technology should be done away with totally in favour of composting by building plants across the country as a policy.[34]

In the last few years, all the major waste fill sites of both Delhi and Mumbai have reached their limits. The problem of waste disposal in both cities has acquired a new complexity and magnitude. Planners and decision makers are being confronted by twin problems. One, protests from the residents of the areas whose localities lie close to the newly identified future waste fill sites, and two, the necessity to find areas where new landfill sites can be marked out without ecological concerns. In this regard, activists like Sunita Narain and Gopal Krishna have argued that Indian megacities such as Delhi need to discard the practice of disposing waste in a few large designated waste fill sites and rather need to now design a method whereby every zone and locality of a city has its own waste management system and designated space.[35] Climate change thus has to be tackled at the level of reducing methane emissions from waste fill sites and creating more decentralized waste management systems involving local people.

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[33] From interactions with residents around Okhla plant, experts like Ravi Agarwal, Gopal Krishna, Bharti Chaturvedi and coordinators of the informal waste workers union.

[34] Mahesh Babu, Chief Executive Officer of IL&FS Ecosmart (IL&FS Ecosmart offers environment management solutions to study the feasibility of compost plants that will convert waste to fertiliser, and waste-to-energy projects).

[35]   http://www.thehindu.com/todays-paper/tp-national/tp-newdelhi/delhi-master-plan-should-make-waste-disposal-area-mandatory-in-each-zone/article5495846.ece   and   http://www.toxicswatch.org/2013/09/why-will-delhis-poorer-localities-allow.html

Finally, there is the political economy of waste from global to local. Ravi Agarwal points to the triangle of production-consumption-disposal of waste at the global as well as at regional levels. For example, electronic utilities/gadgets used in the developed world get manufactured largely in Asia, and then dumped as e-waste (carcinogenic) back into the poorer regions of the world. India, of course, is hardly alone in this regard. Hassan tells us how nuclear waste of the west got illegally dumped at the coast of Somalia for many years and the tsunami of 2004 in South, South-East and West Asia pushed all this nuclear waste into Somalia's coastal land. It brought in newer kinds of diseases and devastated the Somalian economy. One result was the rise of piracy on the Somalian coast practiced by certain Somali sufferers of the tsunami and its aftermath crises (Lalieu and Colon 2010). Both examples highlight how current and often illegal practices of waste generation and disposal can lead to new forms of dystopias as well as environmental and economic uncertainties alongside climate change risks in an unknown future.

5.3. Energy Efficiency

Energy efficiency, across sectors, has emerged as the key marker of climate change discourse. Electric energy consumption, building design and construction materials are all directly related to GHG emissions. Peter Graham argues that:

> The environmental performance of buildings is fundamental to our capacity to adapt to climate change. Reducing energy consumption and associated GHG from buildings not only reduces the potential severity of climate change, but delivers savings, reduces demand for energy generation, creates employment and can improve public health.[36]

This is especially so in a context of increasing urban populations leading to increasing energy demands. In India programmes are underway to bring electricity to more than 400 million people that lack access to basic energy services. Providing such basic services to all will require a three to four-fold increase in primary energy supply and a six-fold increase in electricity generation over the 2005 capacity by 2030 (Planning Commission of India 2006). Increases in total energy consumption and associated GHG emissions are thus almost inevitable, requiring us to probe deeply the correlations between energy-generation, energy-efficiency and energy-saving with regards to GHG emissions. The question is not of efficiency alone but also of its social and location. Thorshiem (2006) points to its increasing substitution by coke and gas, and the delivery of smokeless fuels within households. However, he writes,

> Despite the fact that gas and coke were smokeless at the point of consumption, their production was an extremely dirty process that damaged the health of workers and nearby inhabitants and poisoned the air, soil and water with a host of hazardous by-products. Gas and coke did not eliminate pollution; instead they displaced it from one environment and group of people to another. In addition to redistributing the burden of pollution spatially and socially, the manufacture of gas and coke also displaced pollution chronologically by bestowing a toxic legacy on future generations.
> (Thorsheim 2006:136).

In the building sector, the response has been in terms of developing building codes. TERI took the lead in developing Leadership in Energy and Environmental Design (LEED) India, Green Rating for Integrated

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[36] Peter Graham**,** Technical Consultant, UNEP Sustainable Buildings and Climate Initiative and Head of Discipline, Architecture and Design, The University of New South Wales, Australia.
http://www.unep.org/urban_environment/Urbannewsletter/IssueSept10/index.html#Cities

Habitat Assessment (GRIHA), and the certification of 'Green Building'.[37] The Energy and Resource Institute pioneered the national GRIHA that aims at ensuring that all types of buildings become green buildings. The Confederation of Indian Industry (CII) promotes the Indian Green Building Council (IGBC). The IGBC has licensed the LEED Green Building Standard from the United States' Green Building Council and currently is responsible for certifying LEED-New Construction and LEED-Core and Shell buildings in India. Additionally, the Bureau of Energy Efficiency (BEE) had launched the Energy Conservation Building Code (ECBC). The code is set for energy efficiency standards for design and construction with any building of minimum conditioned area of 1000m^2 and a connected demand of power of 500 KW or 600 KVA. In practical terms, at the Ninth Green Energy Summit organised by India Energy Forum in New Delhi in 2009, the then Chief Minister of Delhi proposed an energy audit of all government buildings.

Similarly, in the power sector, companies like Tata have labelled certain projects like electricity production and distribution (their monopoly in the city of Mumbai) as climate responsive with the stated goal of Tata Power Ltd being to develop efficient technology contributing towards emission reductions.[38]

In pure monetary terms it is said that saving one-megawatt of energy (through energy-efficient means) requires a quarter of the costs required to generate one-megawatt of energy. Pradip Saha provokes us to interrogate this equation beyond the logic of market and questions whether looking singularly at energy-efficiency as a market initiative traps our cognitive faculties? As in the transport sector regarding buildings and power, the questions of growth and efficiency remain open issues. Currently, financial incentives seem to be driving this market, but great deal of uncertainty remains, both fiscal and technological. This is evident in, for instance, the untested potential of LED technologies, the subsidies required to create a mass market for them and the trade-offs between subsidies for such technologies and those for the more, so called, natural green habitats (by way of minimalist power consumption) of the urban poor. The politics of the use of renewable energy technologies and systems, usually negotiated by national governments through the carbon credit mechanism, is also volatile and remains open to ethical probing. In this regard Agarwal and Narain (1991) had argued for a *per capita* basis of calculating emissions and mitigation costs instead of national costs basis so that the issue could be justly resolved in the favour of poor people rather than being stuck into misleading diplomatic entrapments.

5.4. Water and Health

Water and health are some of the most traditional themes of urban management that are being reworked in the context of climate change. The scenario presented is a familiar one. In the short run, greater health risks on account of more frequent flooding. In the long run, scarcity of water on account of glacial melting, adversely affecting those populations who live next to snow fed rivers leading to both greater distress migration and to greater stresses on urban resources (Thakkar 2012). The questions here are of (un)certainty and calculations. What is the pace at which Himalayan glaciers are melting? When can we begin to see the stresses on this account? Which areas are going to be the most affected? What are going to be the likely health impacts? How much evidence is evidence enough for undertaking remedial and anticipatory measures? How does policy respond to correlations rather than definitive causes? Kovats and Akhtar (2008) in a study of the potential impact of climate change on the health of urban populations,

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[37] There are two prominent green rating systems that co-exist in India. One system, Green Rating for Integrated Habitat Assessment (GRIHA), is the national rating system for the country endorsed by the Ministry of New & Renewable Energy (MNRE), Government of India. Another system, Leadership in Energy and Environment Design (LEED), has been launched by the India Green Building Council (IGBC).

[38] http://www.tatapower.com/combat-climate-change.aspx & http://www.tatapower.com/services/power.aspx

especially in Asian cities, review the scientific evidence for the effects of temperature, rainfall and extreme events on human health, in particular the impacts of heat waves and floods. Methods for assessing the risks of climate change are undergoing development, they suggest, while recommending a shift of focus away from global and regional to local studies. A study entitled 'Climate change and its economic impact on Mumbai' conducted by the Mumbai office of National Environmental Engineering Research Institute (NEERI), offers more definitive figures. Mumbai, the financial capital of India, the study argues, could face damages worth Rs.35,00,000 crores (US$561,581 million) by 2050 because of climate change. Between 1901 and 2007, it registered a mean temperature rise of 1.62°C. The sea level around the island city is rising by 2.4 mm every year. Together they would unleash a chain of disasters such as flash floods, disease outbreaks, building collapses, dislocation and death. High temperatures and a moisture-laden atmosphere would lead to high humidity, increasing the prevalence of vector-borne diseases. By 2050, lung diseases like asthma and various allergies, associated with rapid growth of fungi like *Aspergillus* and *Alternaria*, would be common. There would be a cumulative loss of income due to a surge in diseases like malaria, diarrhoea and leptospirosis. Increase in the incidence of these diseases would also result in loss of income due to nonworking days and deaths. Computed losses on the basis of disability-adjusted life years (DALYs) is estimated to be to the tune Rs.1,550million (US$25.1million), Rs.5,970million (US$96.632million) and Rs.24010million (US$38.847million) on account of malaria, diarrhoea and leptospirosis, respectively.[39] According to another report on Delhi, there were 9,750 cases of typhoid in 2000 which increased to 20,864 by 2008. There were 0.13 million cases of diarrhoea, which increased to 0.24 million in 2007 (Vadivelu and Kedia 2010).

There are clear windows of opportunity here for simultaneously improving health and cutting GHG emissions. These would include policies related to transport systems, urban planning, building regulations and household energy supply which have a bearing on some of the largest current global health burdens, including approximately 800,000 annual deaths from ambient urban air pollution, 1.2 million from road-traffic accidents, 1.9 million from physical inactivity, and 1.5 million from indoor air pollution (Campbell-Lendrum and Carvolan 2007).

There is however, a need for a pause here in order to understand how inferences are being drawn and towards which purpose. A glimpse of this is available through a response offered by Samuel Randalls (2011) to the Lancet Commission report on 'Managing the health effects of climate change' (Costello *et al*. 2009) which attempted to frame climate change as an important health issue which ought to be at the core of academic debate, advocacy, policy, and political action. In response, Randalls suggests that:

> This is about mobilizing climate and health research as the next battleground for convincing political leaders of the threat of climate change. In an arena of such scientific uncertainties as climate and health relationships, the temptation to draw on limited studies to legitimate an argument can be overwhelming especially when engaging directly with the public or policy makers.
> Randalls (2011)

The statistics presented in the report, he points out, 'strengthen the political argument of the report that is aimed at generating 'a new public health movement' empowering people to integrate climate change 'into the entire discourse of the present.' Maps are used to highlight the fact that the carbon footprint of the poorest 1 billion is around 3 per cent of the world's total footprint. Yet these communities are most

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[39] The calculation of DALYs is based on WHO guidelines and income levels prevalent in Mumbai.

affected by climate change'.[40] In the process, the map of climate change mortality has gone from a scientific estimate to a politically actionable fact, a process that has not only stripped away uncertainties, but also more importantly has drawn strength from becoming a floating signifier with a perceived certain scientific basis in the reference (Randalls 2011). Given the uncertainties involved in climate and health relationships Randalls however argues, it would seem more prudent to focus on addressing health issues and adaptation in general, rather than specifically making political pledges to do something about the human-caused parts of climate mortality. Uncertainties need to be recognised rather than obscured through excessive precision in reporting model outputs or no error bars whatsoever (Randalls 2011).

The situation with respect to water is alarming in its own right. According to a World Bank study, of the 27 Asian cities with populations of over 1 million, Chennai and Delhi are ranked as the worst performing metropolitan cities in terms of hours of water availability a day, while Mumbai is ranked as second worst performer and Calcutta fourth worst (Government of India 2001). The situation is only likely to worsen in the near future. More than 26 cubic miles of groundwater are reported to have been depleted from aquifers in the states of Haryana, Punjab, Rajasthan and the National Capital Territory of Delhi since 2002. The stresses that this leads to, quite evidently, are exacerbated by socio-economic differences. For the better off sections the problem is mostly temporal, cyclical in nature and the socio-economic status shapes the coping strategies which in turn influence the institutional responses. On the other hand, for the poorer sections of the community the difficulties in terms of access to water are perpetual in nature which is a result, both of institutional practices and socio–economic status. Responses to these situations vary. On the one hand there are the more traditional responses, such as large engineering works, drawing water from further and further away, while possibilities of regenerating water locally are ignored. This is the way Delhi and Mumbai have supplied water in the past, this is what they intend to do in the near future, with likely adverse impacts upstream and high costs to residents below. On the other hand, there are specific climate change indexed references. In Delhi, these take the following forms:

- compulsory rainwater harvesting in building plots greater than 200^2m;
- groundwater withdrawal subject to permission of the Jal Board (public water utility);
- on-site sewage treatment plant and effluent treatment plant mandatory in upcoming construction projects;
- recycling and reuse of treated wastewater for flushing, horticulture, cooling, etc.;
- installation of low flow water appliances.[41]

Other initiatives include the rejuvenation of 620 identified water bodies and promotion of water conservation measures.[42] However, it is striking that all this figures largely as part of 'Water Conservation', and in the absence of any commitments towards a more equitable distribution of water in the city it remains open as to who benefits and loses in this project of conservation. Take for example the case of Delhi where public utility accepts that water is not supplied through any dedicated in-house supply to *at least* about one third of the city's population (Economic Surveys of Delhi 2001 to 2007). The problems associated with water in cities are political in nature yet the government, while trying to incorporate concerns of climate change, is trying to articulate technical solutions to such political problems.

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[40] The 1 billion and 3 per cent numbers come from a 2007 United Nations Development Programme report.

[41] Dharmendra, Secretary, Department of Environment, Government of Delhi.

[42] http://cmsvatavaran.org/cmsvata/Rakesh.pdf

5.5. Urban Calamities

The spectre of persistent but random urban calamities haunts most cities, especially those situated next to coasts. In recent years, according to Sunita Narain (2011) floods in India have grown in their intensity and rain events have become more variable and extreme. Floods are ancient phenomena but climate change has changed their frequency and intensity. Major floods that happened once in a century might now happen at interval of a decade or two. The flood season may become longer or, alternatively, get concentrated in a few, rather heavy, showers that overwhelm the existing drainage systems. Cities that either lack the necessary infrastructure, or fail to maintain drainage infrastructure, or enhance it to cope with greater and sudden floods, are likely to be at great risk. In the present scenario, this is the fate that affects almost all Indian cities, Delhi and Mumbai included.

During the fieldwork, this aspect came through most vividly in accounts of the Mumbai floods of 26 July 2005 when within a span of 24 hours the city saw the highest amount of rainfall in the last 100 years. Aromar Revi (2005) puts the deluge in perspective by writing that it, 'points to the lack of a clear appreciation of the implications of the city's hazard exposure, the vulnerabilities of its people, infrastructure and institutions and the absence of coordinated interventions to mitigate risks'. The research team interviewed the following scholars and experts, Anand Patwardhan (IIT-Mumbai Professor), Archana Patankar (Somaiya Institute), K Narayanan (IIT-Mumbai Professor). These were all part of an OECD funded research project around climate change in the aftermath of 2005 July floods.[43] Their study suggests that the flooding caused direct economic damages estimated at almost US$ 2bn and 500 fatalities. The study states that total losses to the marginalised population from the 2005 floods could be about US$250m, which represents a limited share of total losses but a large shock for poor households. It argues that continued rapid urbanisation could further increase the risk level and that adaptation could significantly reduce future losses. For example, estimates suggest that by improving the drainage system in Mumbai, losses associated with a 1-in-100 year flood event today could be reduced by as much as 70 per cent (Patankar 2011).[44] Thus, assessing the indirect costs of extreme events is an important component of an adaptation assessment, both in ensuring that the analysis captures the full economic benefits of adaptation and also identifying options that can help to manage indirect risks of disasters (Hallegate 2010).

There are several responses that have developed in the wake of the Mumbai flood. One response has been to shift key financial infrastructure and IT enabled services from Mumbai to cities that are less at risk. Other studies, such as the comparative study of Mumbai, Manila and Bangkok, which witnessed massive floods in 2005, 2006 and 2009, focus on 'disaster risk reduction as an important context for mainstreaming city level adaptation into decision-making.' There are four key activities which include:

- quantify immediate to medium term physical, economic, environmental and social outcomes resulting from selected weather events;
- Characterise vulnerability by examining the trends in impact indicators;
- characterise responses in terms of costs, distributional effects and efficiency;
- identify opportunities and means for incorporating climate risk into local and regional decision making.

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[43] http://re.indiaenvironmentportal.org.in/files/flood-risks-climate-change-impacts-and-adaptation-benefits-in-mumbai.pdf

[44] *Ibid.*

The research on Mumbai highlighted that the official response from the administration was not effective. Instead, it was the voluntary organisations and individuals who responded. Officials did respond much later with the Brihan Mumbai Metropolitan Corporation (BMC) drafting a disaster management plan. The Government has also started thinking about improving storm water drainage and supporting people living in low lying areas. For example, in Thane, the BMC has been undertaking adaptation. The Costal Regulation Zones (CRZ) rules allow redevelopment of slums and villages on the coast. In Patankar's opinion, however, neither the CRZ nor the disaster management plan mention what happens if the sea level rises. There is also the compartmentalisation of authority and responsibility between Mumbai Metropolitan Regional Development Authority (MMRDA) and BMC. Most critically, even though the disaster management plan underscored that it was the ordinary people who pulled the city back to normal, there is no recognition of local knowledge and strategies. Mapping the response, even if in retrospect, is very important, in order to gain insights from the local strategies.

The architect Prasad Shetty points to another dimension.[45] In the course of a long walk around the Goregaon-Malad localities of Mumbai, Shetty described to the research team how significant creeks around the city are being captured by growing urban desires. Mumbai saw its evolution into a modern city over the seven islands which together make up the city. The creeks around the three sides of the Mumbai coastline have performed roles of biophysical cushions. Not only have they allowed a space for sea tides' daily movements and thus resisted the incursion of the waters into Mumba,i but they are acknowledged for maintaining the rich biodiversity which the city shores have. In the context of climate change these creeks play a very vital role. The high tides of the sea make these creeks swell with water and thus their natural muddy, swampy terrain has been for long treated as land belonging to no one in the official records. In the last decade, at various coastal locations of Mumbai, the land of these creeks is being discreetly cemented over by the real estate developers. Once the creeks lose their buffer zone property, such land is reclaimed for construction purposes and then conveniently 'regularised' by the municipality of Mumbai, thus benefiting the builders. In the event of climate change, with its twin effects of sea level rise and incessant rains flooding the city, it will be the loss of these creeks which is likely to further worsen the situation. Shetty also points to the rapidity of single storey structures, especially in the slum areas such as Dharavi, yielding to tall residential and commercial complexes, possibly leading to the poor slum dwellers having to move further to the dangerous coastal peripheries. For example, it has been proposed to move the slum dwellers of Dharavi to the marshy swamps of North Mumbai. The stylish Bandra-Kurla complex and the Dharavi slums seem to have an entwined history, and changes in one locality has serious and debilitating impacts on the other. Mahadevia (2005) contends that besides thousands of residents, Dharavi has many local economic activities that would be displaced, all in the name of improving the panoramic view from glass windows of Bandra-Kurla complex. Betigeri (2011) interestingly describes the phenomenon of Dharavi as a 'post-slum' where, though the people have to lead a cramped life, they have water, electricity, jobs, hunger-free lives and strong community ties.

The question to be asked therefore is, what is the meaning of the infrastructural transformation? Indian cities, Ravi Sundaram[46] suggests, suffer from an infrastructural envy in relation to Chinese cities. Indian elites are shamed by the overflowing drains and the presence of human and other organic waste around them. In the coming years therefore it is not unimaginable to see greater investments in public infrastructure such as drainage networks in a bid to make Delhi emulate Shanghai! However, there is no guarantee about the universality of access to such an infrastructure. There are no guarantees either that the needs of the poor, especially of those living in the low-lying areas of the floodplains of the river, would

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[45] Prasad Shetty is an urban architect working with Collective Research Initiatives Trust, Mumbai (CRT).

[46] Ravi Sundaram, Senior Fellow, Centre for the Studies of Developing Societies, Delhi.

gain priority. Current trends would certainly suggest otherwise, as Delhi has moved to displace the over 350,000 people that lived on the low-lying flood plains of the Yamuna, not on account of the risks that they face in the event of the river flooding, as it did in 2010, and as it had done before in 1995, 1978, going all the way back into the colonial period, but because of the risks that they presumably pose to the river on account of pollution (Baviskar 2011). There is the promise of provision of sewer systems and storm water systems in the unauthorised colonies of Delhi, but once again the poor themselves find no direct mention.

5.5. Climate Change in Urban India – Policy vs. Project Disconnect

Understandably there is a relation between a policy and a project. A policy provides a vision towards an objective and a project is an instrument to realise a policy. From the perspective of climate change what we see in large metropolises of India is that there is a critical disconnect between what the policy prescriptions are and the way projects are being pursued on ground. Let us take examples of four core sectors; natural green spaces within city, transportation, waste management and water management.

On the question of natural green spaces within the cities, both in Delhi and Mumbai, there is a large difference between policy and what is being practised. The Delhi Government lists the conservation of Delhi Ridge as its priority under the official climate change action plan.[47] In reality, the long standing Aravali Ridge has for decades been getting encroached[48] and today is being further thrown open by the government itself for purposes of construction and as a tourist destination. On the other hand in Mumbai the creeks, surrounding the city on three sides and forming a boundary between sea and land are being left unmanaged and thus being encroached by the real estate builders. If both Delhi and Mumbai have to justify their policy towards environmental conservation in the wake of climate change then it looks like that both city governments are not operating at the right level when it comes to implementation of their policy vision.

Looking at transport sector and its relation with GHG emissions, both cities have carefully addressed the question on the policy level but at the level of allowing the policy to materialise it is very much the state policies which are becoming the bottleneck. Take the example of the relationship between Delhi Metro Rail and its policy vision of extending its services to everyone in a densely populated city like Delhi *via* its rail network. To realise this aspiration is to bring people to a more eco-friendly mode of transport, the Metro Train, by making a switch from personalised modes of transport, like cars, based on a far greater fossil fuel consumption. A related context is the recent entry of e-rickshaw. A small but very effective mode of connecting transport, the e-rickshaw entered Delhi in the last two to three years despite the lack of any policy promotion by the state. These electric-battery operated tricycles have become very common for the passengers on road and have truly made a difference on the issue of mobility by allowing people to reach metro stations, and other places, easily. The problem arose when the law intervened on behalf of a public interest lawsuit which raised the question of legally regulating this new mode of transport. Thereafter both the Delhi Government and Municipality have stated clearly in their responses to Court that because it is difficult to categorise these rickshaws into motorised or non-motorised modes they find difficult to delegate the responsibility to any of the state agencies. Currently, the courts have forced the

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[47]   See   Delhi   Government's   Climate   Change   Agenda   2009–12,   p.20, (http://www.delhi.gov.in/wps/wcm/connect/9b217b004041c62ea420ac34262e20fd/Climate_Change_Agenda+09-12_+Booklet_Env.pdf?MOD=AJPERES&lmod=-331870168&CACHEID=9b217b004041c62ea420ac34262e20fd)

[48] http://www.indiaenvironmentportal.org.in/content/12359/delhi-ridge-a-lifeline-in-danger/

agencies to take a clear position or it will have to ban this latest mode of city public transport! The contrast between Delhi Government's policy vision of promoting eco-friendly public transport and its ambivalent approach towards very ecologically sound e-rickshaws makes the climate change concern much more complicated. There is also the case of Mumbai's Bandra-Worli Sea Link. It is long stretch of flyover built over the Arabian Sea Coast connecting the northern suburb of Bandra with Worli located in the south of the island city. The only purpose for which the project has been constructed is to ease out the traffic flow in the heavily congested city. Well before the work on the project began there were serious objections raised from ecological, social and policy perspectives.[49] The core of the arguments suggested that the project would not contribute to the policy goal of easing the traffic flow, on the contrary it would worsen the situation. Also, the more significant and larger objective of encouraging the use of public transport and its smooth flow in the city has not achieved any renewed boost as the bridge is mostly serving the perpetually increasing personalised transport in the city. Furthermore, the toll is very expensive and thus the Sealink is only used by the upper middle classes.

On the question of drainage mismanagement, in Delhi which is witnessing the irredeemable pollution of the city's mainstay River Yamuna, there is another policy-project disconnect visible. To solve the twin problems of sewage dumping into Delhi's drains and then discharged directly into Yamuna, and also to create more space for vehicular parking in the city, the Delhi Government has decided to cover all the big drains of Delhi with concrete. From both points of view, the project is destined to work against sound environmental policy. The river and drains of the city need to be rejuvenated by opening up their choked channels rather than covering them and releasing toxic gases, a major concern for climate change. Also is it appropriate for a city's government to keep carving out space for more cars in the city which needs to mitigate global warming by curbing the fossil fuel based transportation?

The issue is also of concern when looking at better water management of water resources of the city. A clean and rejuvenated river Yamuna is high on the priority list of the official climate change agenda for Delhi. The covering of the large drains of the city which are the only remaining natural sources of rainwater flow into the river from the whole city is clearly a highly anti-ecological strategy. The relation between large drains and their cleaner management is directly linked to a free flowing river Yamuna. Within a climate change resolving framework, the relation between managing city drainage and the upkeep of Yamuna needs to be much more holistically thought through, rather than is the case at present.

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[49] http://www.iptindia.org/wp-content/pdf/report/An-Enquiry-Into-The-Bandra-Worli-Sea-Link-Project.pdf

6. Media, Urbanisation and Climate Change

The research team had interactions with journalists from two important media groups, *The Times of India* and *The Hindustan Times*, to discuss the theme of mediatisation of climate change discourse in the context of changing urbanisation. Two interesting themes emerged: the obsessive preoccupation of the media with climate change as a subject of international negotiations, and the near lack of any link being posited between city events and climate change, except occasionally as in the case of the incinerator plant at Okhla that drew widespread protest. Given the centrality of media discourse to the framing of the national and city level climate change agendas, these trends deserve greater scrutiny (Shanahan 2007). Billett's (2010) findings reveal that the Indian media have tended to under report the issues of intra-national inequity of GHG emissions, failing to point out the differences in consumption patterns between impoverished Indians (with negligible GHG emissions) and Indian middle and upper classes. Boykoff (2010) analyses the quality and content of diverse newspaper reports discussing climate change, examining how media representations of climate change in India may be shaping perspectives on market-based, privatized, and technologically focused climate mitigation and adaptation initiatives.

The use of media, especially celebrity endorsed media, in India to encourage behavioural changes to help combat climate change is another prominent feature. Brand and Brunnengraber (2012) have discussed the fact that dominant media constructions of climate change have invariably presented or rested upon a homogenised national discourse settings.

> In turn, it unduly downplays the degree of difference among societal actors and groups a priori. What has been under-researched so far is the degree of eventually diverging and contentious constructions of meaning attributed to the climate change phenomenon within societies.
> Brand and Brunnengraber (2012)

Their study pushes for the need to pay attention to, 'differences between established, mainstream (mass) media and online-based, alternative media.' The media's range, if explored beyond the popular and dominant can help significantly towards democratisation of opinion building around the issue of climate change. More than just discussing or accommodating scientific and expert driven knowledge on climate change there is need to bring forth the heterogeneity of climate change understandings within society.

The growth of media is today strongly attached to increasing consumption of goods, products and services within society. Such increasing consumptive patterns of people today, changing them from citizens to consumers fuels not just media but also the way nationally and internationally economies are modeled. Consumption is entrenched within the global warming context. Urbanisation is a key constituent in increased consumption. Can there be a decoupling possible between urbanisation and consumption in ways to abate climate change and could it be possible for media to play a role?

6. Conclusion

If, for much of the Nineteenth and Twentieth Centuries, the city was posited as a bounded space of sociological problems and infrastructural lack, in search of spatialised and technological solutions, the urban condition today invites more philosophical reflections on the possibilities of life itself, in the city and outside it Sharan (2014: 214). And as the prospects of climate change are internalised ever more, the moves in this direction increase further, for what can be the 'outside' anymore when gases banished into the outer sky centuries ago return to haunt us, humans, and every other life form today. What, anymore, is an 'externality' when everything that we do, the way that we produce, transport, consume, and discard, has a carbon tag attached to it? Indeed the challenge is deep and fundamental (Sharan 2014: 6).

Nature has become a premise of urban life, replacing local, geographical borders with global challenges (Andersen and Nielsen, 2009). Climate change has amplified the linkages between urban areas and environmental alterations. Concentration and scaling up of infrastructure, transport, energy-use, generation of waste and the resultant GHG emissions explains the role of urban in exacerbating global warming. The issues of pollution, over-use of resources, unequal resource allocation, depletion and consumption between social groups and regions have long been themes of academic and popular discourses, policy analyses, state-led initiatives, market workings and media discussions. Climate change discourses now problematise these long-standing issues in a novel and subsuming manner but climate change also brings in newer concerns such as the need to take uncertainty and unpredictability seriously.

Cities in developing countries like India confront climate change challenges in different ways. On the one hand, there is a huge and burgeoning population of extremely vulnerable groups living in equally vulnerable areas of cities that are directly affected by climate change. On the other hand, these very cities are becoming centres of rapid economic growth and development and have growing numbers of consuming classes raising the scales of GHG emissions. At the global level, the huge difference between the low *per capita* emissions of developing countries and high *per capita* emissions of the developed nations has played a highly political role in the deadlock in various international negotiations. Interestingly the scenario which complicates the positions of developed and developing countries on the question of mitigation and adaptation (including issues such as equity, CBDRRC, finances, technology), also resonates at the level of cities in developing countries between the poor majority and the middle/upper classes, but often deep structural inequalities and issues concerning a wider political economy are not adequately acknowledged at the national level.

This paper has demonstrated that mega-cities in India are confronted by huge environmental challenges concerning waste, energy consumption, water pollution and access and climate change is adding new uncertainties to existing challenges. Taking climate change and its accompanying uncertainties could offer a possibility to reimagine Indian urban futures in a way that is more sustainable and just. However, this paper has demonstrated that policies and practices around climate change in urban India are only tinkering at the margins and not moving significantly away from 'business as usual' scenarios. Instead, they are promoting new green enterprises, but which not necessarily leading to environmental sustainability. Also as demonstrated in the cases examined, the poor and vulnerable groups are usually left out of the equation and continue to bear the brunt of environmental policies and planning.

There is also an uncontested belief that 'urbanisation is the future'. Such a belief is used to justify all forms of ecological modernisation, migrations and changing land use patterns. It also leads to assumptions which make nature subservient to technological issues. Colin Todhunter (2012), in the Indian context, calls the

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blind aping of the notion that 'urban is good' supported by free market economic ideas as *'Planned Obsolescence in India'*. Choosing business models like CDM needs to be questioned about its nature of distribution of benefits, its relation with larger socio-economic goals and its impact upon questions of ecological sustainability.

The experience of last two decades clearly shows that India is rapidly moving towards greater urbanisation. The currently evolving form of urbanisation is getting so entwined with the notion of economic growth that social and ecological questions and challenges are gradually getting decoupled in India's policy priorities. Dealing with climate change challenges requires concerted efforts at all levels, ecological, social, economic, institutional and political. This paper has tried to show that currently such synchronisation is not only missing but rather that this unsynchronised scenario itself is not without efforts at constructing it; producing benefactors and losers simultaneously.

7. Future Research

Recently, Amartya Sen (2014) pointed out that despite having many engaging and well researched studies of particular environmental problems such as global warming which should be appreciated, we do not have anything like an overall normative framework, involving ethics as well as science that could serve as the basis of debates and discussions on policy recommendations. This research has tried in whatever little way it could to move in the direction which Sen acknowledges as crucial. This study, designed as an initial probing exercise, has thrown up some issues that require further probing. These are:

- mapping the interplay between mitigation and adaptation strategies and the potential of current policies to make significant interventions towards combating/ coping with climate change;
- examining climate change initiatives from within a highly politicised urban domain with historical relations of power and hierarchy, across class and communities;
- examining efficiency, especially energy efficiency, simultaneously as an economic, technological and ethical choice;
- revisiting notions of vulnerability and resilience in the wake of climate discourse, mapping these socially and epistemologically;
- exploring local, indigenous and communities' knowledge about climate change impacts and what could shape an interface between these and continuing research and policies.

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