The Time is Now

Sustainable & Climate Resilient Urban Development

Proceedings of the

International Workshop on Sustainable and Climate Resilient Urban Development

8-9 September 2010
New Delhi

Organised by:

Integrated Research and Action for Development (IRADe)
Institute for Social and Environmental Transition (ISET)

Supported by:

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Cover photos:

1. Women going to fetch water in Indore slum. Source: TARU
2. Woman in Indore slum carrying back water filled in cans. Source: TARU
3. Wading through waterlogged street in Gorakhpur city. Source: GEAG
4. Slum in Gorakhpur. Source: GEAG

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Acronym List

ACCCRN	Asian Cities Climate Change Resilience Network
AMDA	Association of Municipalities and Development Authorities
BEE	Bureau of Energy Efficiency
CDM	Clean Development Mechanism
DFID	Department for International Development
ECBC	Energy Conservation Building Code
GEAG	Gorakhpur Environmental Action Group
GLOFs	Glacial Lake Outburst Floods
GoI	Government of India
GTZ-ASEM	German Technical Cooperation-Advisory Services in Environmental Management
IAS	Indian Administrative Services
ICLEI	International Council for Local Environmental Initiatives-Local Governments for Sustainability
IIHS	Indian Institute for Human Settlements
IMC	Indore Municipal Corporation
IPCC	Intergovernmental Panel on Climate Change
IRADe	Integrated Research and Action for Development
ISET	Institute for Social and Environmental Transition
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
MGI	McKinsey Global Institute

MHA	Ministry of Home Affairs
MoES	Ministry of Earth Sciences
MoHUPA	Ministry of Housing and Urban Poverty Alleviation
MoUD	Ministry of Urban Development
MPUSP	Madhya Pradesh Urban Services for the Poor
NCR	National Capital Region
NIDM	National Institute of Disaster Management
NMSH	National Mission on Sustainable Habitat
NSSO	National Sample Survey Organization
NUTP	National Urban Transport Policy
PCI	Planning Commission of India
PMC	Patna Municipal Corporation
RAY	Rajiv Awas Yojana
RCH	Reproductive and Child Health Program
SDMA	State Disaster Management Authorities
SHM	Sustainable Habitat Mission
SLD	Shared Learning Dialogues
SMC	Surat Municipal Corporation
SME	Small and Medium Enterprises
SPUR	Support Programme for Urban Reforms
TERI	The Energy and Resources Institute
UIDSSMT	Urban Infrastructure Development Scheme for Small & Medium Towns
ULBs	Urban Local Bodies
ULCRA	Urban Land Ceiling and Regulation Act

The Workshop

Urbanisation and climate change are among the most fundamental issues facing India and global society over coming decades. The international workshop on sustainable and climate resilient urban development gathered a unique combination of decision makers, city mayors and local government representatives, local NGOs and international research experts. The intensive discussions and presentations held over a two-day period generated a wide array of conceptually grounded and highly practical insights and guidance on how India can begin to address urban challenges in the context of climate change.

The two day Workshop was jointly supported by the UK Department for International Development and the Rockefeller Foundation, US. The workshop was organized by the Asian Cities Climate Change Resilience Network (ACCCRN) India Programme partners IRADe (Integrated Research for Action and Development) and ISET (Institute for Social and Environmental Transition), with active support from other ACCCRN India partner organizations – TARU, GEAG and TERI.

Individuals present at the workshop who contributed in a substantive manner through presentations and discussions included:

Mr A. K. Maira,
Member, Planning Commission, GoI

Honourable (Mrs.) Anju Chowdhary,
Mayor, Gorakhpur

Honourable (Mrs.) Mamta Jaiswal,
Mayor, Howrah

Mr. Navin Kumar,
Secretary, MoUD, GoI

Dr. Shailesh Nayak, Secretary, MoES, GoI

His Excellency Sir Richard Stagg,
British High Commissioner to India

Mr. A. K. Mehta, Joint Secretary, MoUD, GoI

Ms. S. Aparna, IAS,
Commissioner, SMC (via video link)

Mr. Sridhar Chiruvolu,
IAS, Commissioner, PMC, Government of Bihar

Dr. Kirit Parikh,
Chairman, Expert group on Strategy for a Low Carbon Economy,
Planning Commission

Dr. Noor Mohammad,
Chairman, AMDA & Member Secretary, NCR Planning Board

Mr. J .B. Kshirsagar, Chief Planner, TCPO, MoUD, GoI

Dr. (Mrs.) P. Dhamija,
CEO, Energy Efficiency & Renewable Energy management Centre,
Department of Environment, Government of Delhi

Dr. Jyoti Parikh, Executive Director, IRADe

Dr. Marcus Moench, Director, ISET

Mr. S. Sundar, Distinguished Fellow, TERI

Professor Santosh Kumar,
Prof. & Head, Public Policy and planning division, NIDM

Dr. Cristina Rumbaitis Del Rio,
Associate Director, Rockefeller Foundation

Mr. Ashvin Dayal,
Managing Director, Asia Regional Office, Rockefeller Foundation

Mr. Mike Keegan, Transport Commissioner, London

Ms. Ashufta Alam,
Senior Infrastructure and Urban Development Advisor, DFID

Dr. Aromar Revi, Director, IIHS

Professor Chetan Vaidya, Director, NIUA

Dr. Vikas Desai,
Honorary Technical Advisor, RCH, SMC

Mr. V.P. Kulshrestha, City Planner, IMC

Mr. Harsh Vardhan Sharma,
CTC, MPUSP (DFID), Indore

Mr. G.K. Bhatt, Director, TARU

Dr. Shiraz A. Wajih, Director, GEAG

Mr. Emani Kumar, Director, ICLEI South Asia

Dr. Regina Dube,
Senior Advisor and Head, Sustainable Urban Habitat, GTZ-ASEM

Dr. Richard Slater, Team Leader, MPUSP (DFID)

Mr Rajarshi Rakesh Sahai, MPUSP

Mr. Satish Chand Aggarwal, DFID, SPUR Programme, Patna

Mr. Ajit Mohan, MGI

Ms. Manju Mary George, Vice President, Intellecap

Introduction

Climate change and urbanisation: The combined two processes represent some of the most fundamental challenges nations and indeed the world must face over the coming decades. For the first time in human history, more than 50% of the world now lives in urban areas. As a result they rely on institutional, physical and ecological systems for energy, transport and communication that extend far beyond local areas. These systems, which provide essential food, water, shelter and other needs on which lives depend, are exposed in one way or another to the direct and indirect effects of climate change. Whether the effect relates to direct impacts such as extreme temperatures, storms or floods in cities, or indirect ones, such as changes in global grain markets that lead to spikes in food prices that negatively affect the urban poor – the future challenges for urban administrations will be huge.

Nowhere is the above likely to be more true than in India. Although the level of urbanisation in India is lower than in many parts of the world, the nation is urbanising rapidly. As H.E. Sir Richard Stagg, the British High Commissioner to India stated in his introductory remarks to the workshop, "Having planned and sustainable urbanisation is key to India's medium-term economic growth." Urban areas in India account for over 60% of India's GDP (iGovernment, 2010). They are the engines of economic and social development. According to the McKinsey Global Institute (MGI), each year the urban population in India grows by more than 7 million people (MGI, 2010). New Delhi alone adds 500,000 people each year – more than the entire population of many western cities. However, much of this growth is occurring in an unplanned manner as medium and smaller cities that lack basic infrastructure expand upwards and outwards. As Mr. Ajit Mohan from MGI noted: ***most of urban India is yet to be built*** (Figure 1). This presents both a huge challenge and an equally huge opportunity.

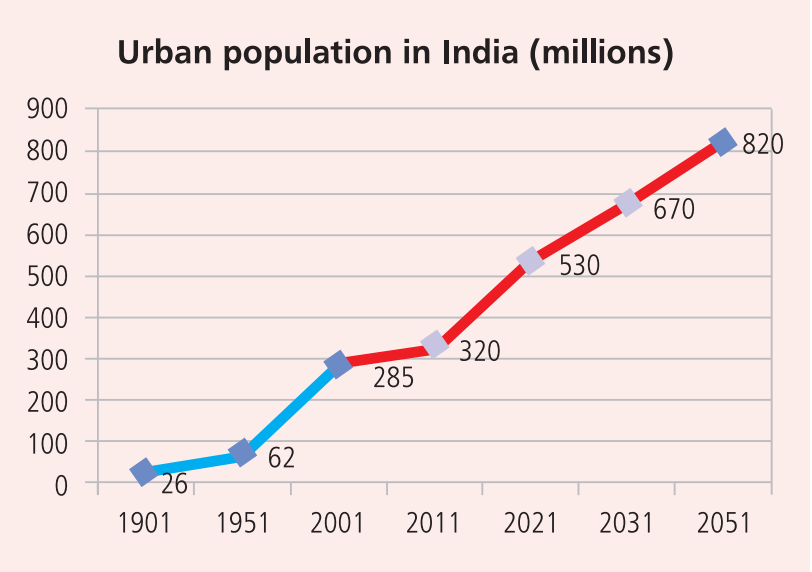

Figure 1: Historic (blue) and projected (red) population for cities in India 1901 to 2051. Adapted from presentation by Mr J B Kshirsagar, Chief Planner, TCPO, MoUD, GoI

Climate change represents an equally fundamental challenge. Projected increases in temperature will compound the well known heat island effect driving increased demand for air conditioning and other forms of climate control. This is not just a luxury. Human productivity, health and core systems such as demand and supply of energy are directly affected by temperature. The economic productivity of cities and

the wellbeing of their populations depend on the ability to moderate temperatures, whether that is achieved through the maintenance of green-cover, building design or air conditioning systems.

Beyond temperature, the impacts of extreme events will be major. As Dr. Shailesh Nayak, Secretary for the Ministry of Earth Sciences (MoES), emphasised in his presentation to the workshop, the intensity of extreme rainfall events is increasing. Intense rain falling on the poorly drained, impermeable roads and rooftops that make up much of the urban environment causes flooding (Figure 2). From minor disruptions in traffic to the massive levels of destruction experienced in recent flood events, the impacts of flooding on urban areas are of fundamental importance to their future. Mumbai,

Mumbai: 26 July *Delhi: 15 September* *Visakhapatnam: 16 October*

Kolkata: 21 October *Bangalore: 22 October* *Chennai: 26 October*

Source: Presentation by Prof. Santosh Kumar, NIDM

Figure 2: Exceptionally Heavy rains in Indian Metros- 2005- Are these rains the new normal?

Leh, the ongoing Indus floods and the failure of the Kosi levies: these are lessons for the future. Without systems for disaster response, maintenance of urban drainage and flood management, fragile urban populations will suffer. The challenge is multifaceted and extends beyond flooding. Dr. Santosh Kumar from the National Institute of Disaster Management (NIDM) also mentioned that sea level rise and potential changes in storm patterns threaten many coastal cities. Increases in the variability of precipitation will further stress the already strained capacity of urban areas to meet the water and sanitation needs of their populations while simultaneously intensifying competition between agriculture and other economic activities over available supplies. The impacts of urban demands on water supply often extend far beyond municipal boundaries to wider regional watersheds.

In a similar manner, urban economic and food systems extend outwards and are increasingly linked to global conditions. As India's dependence on global markets to meet food needs increases, the implications of global climate conditions for food production in distant regions will have greater and greater implications for the needs of urban populations. Although this may be less immediately evident, it is also the case for other forms of economic activity. As Dr. Aromar Revi, Director, Indian Institute of Habitat Studies (IIHS), commented, the world is now in the realm of dangerous climate change. The impacts of climate change are likely to ripple through global systems in ways that have profound but difficult to predict impacts on urban economies. The resilience of urban economic, governance, institutional and infrastructure systems in the face of both the direct predictable impacts of climate change and the less predictable but potentially massive ripple-through effects from changes in global systems is of fundamental importance to the wellbeing of India's burgeoning urban population.

Getting the process of urbanisation ***right*** is critical. Maintaining the environmental infrastructure on which basic food and water services depend, building the institutions and governance mechanisms required for socially inclusive urban societies, and creating the institutional and physical infrastructure for energy, transport and communications will require massive investment of human capital, finance, and other resources. How this investment happens will shape the future. The form urban systems take will be of fundamental importance to low

carbon growth and climate resilience. Millions of day-to-day decisions over coming years will determine whether or not urban populations suffer or "adapt" and "do well" as temperatures increase, food prices fluctuate and extreme events occur. These same decisions will also shape energy use and thus the process of global climate change itself.

Discussions at the international workshop on Sustainable and Climate Resilient Urban Development highlighted the above challenges. More importantly, however, they emphasised the *practical steps* and points of entry where action can now contribute to urban resilience and low carbon growth. In a very real manner, the discussions provide tangible guidance on courses of action for responding to three major challenges; climate change, urbanisation and poverty through their linkages. There is no single magic bullet. Instead, effective responses can only grow from diverse strategies that may on their own only address a small fraction of the challenge. Many "ten percent" solutions from major changes in policy and infrastructure design to local community action are required in order to transform development pathways toward resilience. *Perhaps the biggest challenge is to start*. Initial steps are required to build knowledge, capacity and gain experience. Initial actions for inclusive stakeholder involvement, interdepartmental coordination and development of information and planning: these are the very real but mundane steps out of which resilient urban societies will emerge.

Rather than a chronological sequence, this workshop report is organised as follows: Key issue areas that emerged in discussions across different workshop sessions are presented. These are: urban systems, knowledge, multi-stakeholder process, climate change resilience and socio-economic equity, and the sense of urgency captured by the term, "The Time is Now." These sections offer a synthesis of the issue and the Workshop dialogue along with insights and practical points of entry for action that emerged in the discussions. The report ends by highlighting potential next steps where action could catalyze processes for developing resilience. The appendices accompanying the main report provide detailed examples on recent initiatives to build urban resilience and details on those contributing to the workshop.

Urban Systems and Climate Change

Framing the Issues

Discussions at the workshop highlighted the fundamental role of systems in shaping urban areas and their resilience to climate change. In his introductory presentation on climate and urban resilience, Dr. Marcus Moench, Director, Institute for Social and Environmental Transition (ISET) emphasised that urban vulnerability to climate change can be thought of as a consequence of *fragile systems, marginalized populations and exposure to the impacts of climate change* (Figure 3). When institutional, financial or physical infrastructure and environmental systems are fragile, any disruption may cause them to fail. Dr. Noor Mohammad, Chairman, Association of Municipalities and Development Authorities (AMDA) and Member Secretary National Capital Region (NCR) Planning Board, illustrated this well in his presentation of the breach in the Kosi Barrage, which displaced over 3.5 million people last year. In that case, weak institutional systems for embankment maintenance combined with a poor physical infrastructure system design led to failure, even though river flows were below maximum levels commonly experienced during the monsoon. Similar issues occur when the environmental infrastructure that provides clean water, enables storm drainage or, as with mangrove ecosystems, provides coastal protection, goes unrecognized and is allowed to erode. The issue is not, however, isolated to institutional, environmental and infrastructure systems. When poor or other socially marginalised populations are excluded from access to basic systems, they lack the inputs required for productive livelihoods and are likely to face disproportionately large impacts when disruptions occur. The poor, women, children and socially marginalised groups often have worse access to basic systems and, as a result, often lack the resources required to adapt when change is required. Not all groups or systems are, however, equally at risk from climate change. The level of exposure to the impacts from changes in climate, whether direct or indirect, will determine the nature of the impact. Wealthy populations residing in beautiful coastal developments may be more vulnerable to the direct impact of sudden storms and sea level rise than poor populations living inland in less exposed sections of an urban area. At the same time, if the same storms and rises in sea level affect agricultural production, the urban poor resid-

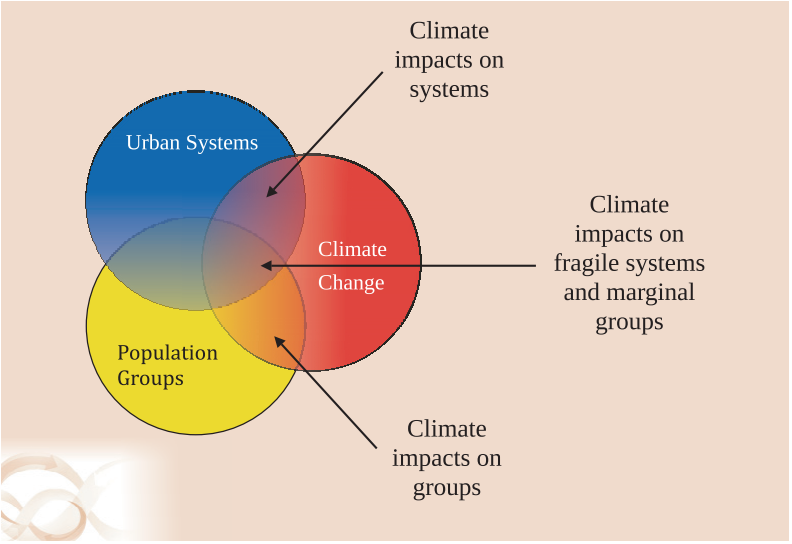

Figure 3: Venn Diagram of Urban Vulnerability to Climate Change where vulnerability = fragile systems + marginal populations + exposure

ing in "protected" inland locations may face major indirect impacts from food price spikes while wealthy populations living in "exposed" coastal locations barely notice. Vulnerability to the impacts of climate change is, as a result, a function of the fragility of systems, the marginality of populations and the degree to which both are exposed either directly or indirectly to the impacts of climate change.

Conceptual Pillars

Taking an entitlement perspective, systems can be seen as gateways to services and higher-level forms of organisation and development. Environmental systems are the "gateways" to clean water supply, temperature moderation, storm and extreme event protection, flood drainage and so on. Energy systems are the "gateways" that enable the functioning of communication, transport and shelter systems. These basic systems are, in turn, the gateways that enable social networks, finance, early warning, markets, government, education and other higher-level systems. Without energy you cannot have a communications system, without communications, you cannot develop financial, social networking or market exchange systems. Physical and institutional systems are interdependent. As suggested by Dr. Marcus Moench (ISET) and Mr. G.K. Bhat (TARU) in Session 1, an effective and resilient energy system requires strong organisations and institutional systems to design, develop and maintain it. The same can be said for environmental systems, particularly in urban environments where human activity has huge impacts on basic natural functions. If the institutional system is weak and fails, the physical system will also fail and vice versa.

The resilience of urban areas and the ability of populations to adapt as climate change progresses are dependent upon systems. Urban areas are vulnerable when the systems on which they depend have points of fragility where climate change could disrupt them. Resilient systems provide the basic services and resources that populations require to shift strategies or "adapt" as constraints and opportunities evolve with climate change. Furthermore, the fundamental role of energy in enabling the functioning of higher-level communication, transport and other systems is important to recognize, as reiterated by Dr. Regina Dube, Senior Advisor and Head, Sustainable Urban Habitat, German Technical Cooperation-Advisory Services in Environmental Management (GTZ-ASEM) and Dr. Jyoti Parikh, Integrated Research and Action for Development (IRADe). Due to this fundamental linkage, low carbon pathways for development are central to the ability to adapt to climate change as well as to reducing the greenhouse gas emissions that drive it.

Overall, recognition of the key role of urban institutional, environmental and physical institutional systems in climate resilience is one of the core conceptual pillars recognised by most of the panellists and participants in the conference. A systems perspective is fundamental to any understanding of the links between urban resilience and climate change. As Mr. G. K. Bhat (TARU) emphasised in his presentation during session three, "There is a need for us to understand climate change impacts 'holistically' to tackle the problem effectively."

Practical Examples

The above conceptual foundations were widely illustrated through practical examples by participants in the workshop.

1. Solid Waste Management Systems

Perhaps the most widely mentioned issue in the workshop was the basic challenge of solid waste management and drainage that plagues most cities in Asia (Figure 4). This was highlighted by many

Figure 4: A heap of used polythene bags in Gorakhpur. Typical of the challenges many cities in Asia face where solid waste builds up within an urban environment which leads to clogging of drainage and flooding. Source: GEAG

presenters including Dr. Shiraz Wajih, Gorakhpur Environmental Action Group (GEAG), who while presenting the case of Gorakhpur said that the city's vulnerability is aggravated manifold due to this problem (see Box 1: Understanding Climate Change Risks in Gorakhpur). As urban areas expand, natural ecosystems and the waste treatment and drainage services they provide are disrupted. Storm water and other manmade drainage systems where they exist are often partial or incomplete. More fundamentally, even where such systems exist they are generally clogged with human waste. Plastic bags and other objects clog gratings and pipes. Solid waste is often disposed of in the channels of urban streams and sewers. Institutions for maintaining and cleaning drains are weak and ineffective. As a result, when storms occur, flooding ensues. Disease also spreads as water pools and untreated sewer water spreads into residential and commercial areas. This problem has particularly large impacts

Box 1: Understanding Climate Change Risks in Gorakhpur

Gorakhpur is a rapidly growing city located in a low lying region in the middle Ganga basin. In the last decade a number of basic infrastructure facilities have been established, but the development of the principal urban systems required to support the rapid growth have not proceeded at the same rate as the expansion of the city. Flooding, water logging and other water related problems are considered to be the most evident challenges in Gorakhpur today, and these are likely to increase substantially with climate change.

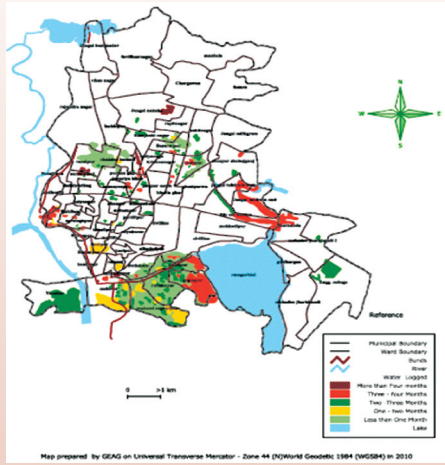

Figure A1: Map of Gorakhpur City showing areas prone to water logging

The drainage system of the entire city is affected by water logging. The most severely affected though is an area that comprises 18% of the city that includes parts of the central section as well as parts toward the south and west of the city (Figure A1). The threat of water logging has escalated in recent years partly due to changes in rainfall but also by the degradation of water bodies, unplanned development and land encroachment. Though there has not been much increase in total rainfall, the average intensity in the summer months has increased. This has resulted in some areas of the city now being water logged for 5 to 6 months in a year.

Unmanaged solid waste disposal and faulty drainage channels and particularly low lying areas are other factors that exacerbate both water logging and associated problems with disease. Due to a lack of an incinerator or water treatment plant, the problem of solid waste, siltation of drains and pollution of water bodies has become acute.

Prolonged water logging together with poor waste management has caused an increase in the incidences of vector borne diseases and related health problems, as well as contamination of groundwater. Malaria and dysentery have historically been a problem; recent years have seen a rise in diarrheal diseases, hepatitis, fluorosis and Japanese encephalitis.

Source: Gorakhpur environmental Action Group, GEAG

on the poor who generally live in urban flood plains and similar areas where solid waste is disposed and drains are poorly maintained.

This existing problem will greatly exacerbate the direct impacts of climate change on urban areas. Higher intensity storms, when they occur as projected in the presentation by Dr. Shailesh Nayak (MoES), will increase both flooding and the spread of disease unless effective mechanisms for improving urban drainage systems are found and implemented. This challenge is primarily institutional. In many cases urban drains are designed with sufficient capacity to accommodate increases in rainfall intensity. Systems for waste removal and drainage maintenance are the primary challenge. Since poor and other marginal communities generally live in areas where drainage systems are poorly maintained, improvements in drainage and solid waste management will be of direct and immediate benefit to them.

2. Environmental Systems

The critical role of environmental systems in providing the basic resources on which urban areas depend was a main theme in many presentations, including those by Dr. Regina Dube (GTZ) and Dr. Shiraz Wajih (GEAG). In addition to the drainage role already mentioned, water supply, temperature control, food and other services were highlighted in city presentations. Mrs. Mamta Jaiswal, Honourable Mayor of Howrah, emphasised that damage to the coastal environment and the natural infrastructure (mangrove) has exposed the city of Howrah to hazard risks such as cyclones and severe winds (see Box 2: Combating Climate Change – a case of Howrah city). In Howrah, the poor who live in low-lying areas and along river channels are among the most affected by non-maintenance of environmental systems. However, the challenge is not isolated to urban areas. Many environmental systems cross rural-urban boundaries. Mr. S. Sundar, Distinguished Fellow, TERI, emphasised this in his talk during the concluding panel discussion of the workshop: *"Since there is a lot of synergy between urban and rural areas we cannot forget rural areas as impacts of climate change knows no boundaries and [our] endeavour should be to build a resilient region and perhaps a resilient country."*

3. Water supply systems:

Linkages between water supply and energy and the challenges in supplying adequate water through redundant and resilient systems were highlighted

Box 2: Combating Climate Change: A case of Howrah city

The city of Howrah is the second largest in West Bengal with a population of about one million (as per Census 2001) and an area of 51.74 sq.km. Howrah is considered the elder twin of Kolkata, separated by the Hoogly River, which flows in between. Air pollution levels in Howrah have reached critical levels as indicated in a report by the Ministry of Environment and Forests (MoEF), mostly due to industries. Rapid and unplanned urbanisation with minimum open spaces further degrades the urban environment, and in some areas, impacts the quality of drinking water.

The impacts of climate change are likely to exacerbate existing risks in Howrah, including flooding of the Hoogly River and sea level rise. Howrah lies just 100 kilometres from Sunderbans, the world's largest mangrove that is threatened to be submerged by a rising sea. Climate change will exert additional stress on already stressed (urban?) environments and city infrastructure.

The Howrah Municipal Corporation (HMC) was selected for a study across all the 50 wards on State of Environment reports and environmental management and action plans under the Kolkata Urban Services for the Poor (KUSP)—a project supported by DFID. The study considered 14 parameters and identified the environmental risks for each. These were, inter-alia, level of urban basic services, solid waste management, electricity, level of air pollution and level of water pollution. The results present ward level performance on various parameters. About 40 (80%) wards were rated "moderate" on aggregate parameters while the rest (20%) were below moderate.

As a follow-up, the study report was approved by the HMC Municipal Environment Committee, which is chaired by the Mayor. Subsequently, an Environment Vision Document was prepared and clearance obtained from the Mayor in Council and councillors. The priority actions identified in the vision document were converted into project proposals for implementation. This model is followed in 39 Urban Local Bodies (ULBs) in the Kolkata Metropolitan Area. Interestingly, the vision document mentions strategies to climate proof and environmental management through actions such as upgrading the basic services, disaster management, traffic rationalisation and implementation of green tax. The actions proposed are in varying stages of implementation – they need support from various government departments and donors and need to be linked with the larger strategy of the State to address climate change impacts.

Source: Poster presentation, Howrah city

Figure 5: Water tanker delivery of water supplies to an at risk community in Indore. Many residents with plumbed water supplies live with one or two days of water a week during parts of the year. Source: ISET

throughout the workshop. In Indore, for example, presentations by TARU and Mr. V.P. Kulshrestha, City Planner, Indore Municipal Corporation (IMC), illustrated the challenges of delivering the main public source of piped water through a long pipeline from the Narmada River (see Box 3: Understanding water issues in Indore). Delivery of water for the urban area requires pumping the water up and into the urban pipeline network, which requires an enormous amount of energy, and in turn, incurs a high cost for water. The system is vulnerable to climate impacts on the source of water (precipitation dependent), potential impacts on the availability of energy for pumping and the ability to maintain and expand the pipe

Box 3: Understanding Water Issues in Indore

Indore, a city and trade center located in Madhya Pradesh of approximately 2.9 million people, lies in the dry region of the Khan River basin. Water scarcity is a primary threat due to rapid urbanization, decrepit infrastructure, a decreasing water table, precipitation variability and governance issues leaving the city with water demands that far exceed supply. The Narmada River is the primary source of piped water to the city. This supply is energy intensive as it requires being pumped from approximately 70 km away and relies on unmaintained infrastructure for water delivery resulting in 40% transmission loss. Approximately 70% of the water supply to Indore is from the Narmada River with 30% supply from borewells, both public and private. The Narmada source provides water to those with piped connections (approximately 50% of Indore) with 20 minutes of flow every other day. The Indore Municipal Corporation (IMC) also supplies tankers as per demand, however this process is highly politicised. On top of transmission losses and low connectivity, the city's infrastructure is old and decrepit, allowing contamination to enter the pipelines from sewerage and solid waste. Climate change in the form of precipitation variability exacerbates these existing issues and creates a further challenge for planning.

Due to the lack of sufficient water supply in Indore, a varied and informal (private) water sector sprouted up in the 1990's. Private tankers began supplying water to communities, however this water is being utilised for household use only and not for drinking as communities do not trust the quality. Two communities primarily supply tanker water to the city: Niranjinpur at 60% and Bijelpur with a few nearby areas at 40%. Narmada piped water is the primary source for drinking as its quality is perceived to be good. The informal sector composes only 10% of the drinking water supply, 70% of which is packaged drinking water regulated by the Bureau of Indian Standard (ISI marked) and 30% is non-regulated chilled water supply (non-ISI marked).

The key challenge that people face in Indore is highly irregular Narmada water supply and variable quality and costs from the informal sector. At the household level, drinking water consumption is largely met by the low cost and unregulated non-packaged drinking water, which brings up issues of equity and health. Further compounding these stressors, there is no effective complaint redressal mechanism in either formal or informal water sectors. Currently, the lack of sufficient and effective water metering hampers the ability to collect revenue on current IMC water supply, depleting the capacity of the IMC to maintain and update infrastructure. The Narmada Phase 3 (NP3) project proposes to supply an additional 360 mld of water to the city,. However, with decrepit infrastructure, current transmission losses, and excessive energy costs to pump water long-distance, the overall success and adequacy of the project remains to be determined.

Source: Poster presentation, Indore

network. Work by ISET, TARU and the municipal authority highlights the role private wells and informal water markets play in attempting to meet existing water demands, particularly for the poor and others who are not adequately served by municipal systems. It is important to recognise how improvements in water harvesting and groundwater management can contribute to resilience of the urban area as a whole, and more specifically poor and marginalised communities, if the relatively fragile formal water system is disrupted.

4. Disaster Management Systems

The links between effective disaster management systems and urban climate resilience were highlighted in many presentations, including the comments by Mr. Aromar Revi, Indian Institute for Human Settlements (IIHS) in the high-level panel discussion. Effective urban climate disaster management requires institutional communication for everything from the coordination of relief, to weather forecasting and early warning. It also requires a combination of environmental systems (such as mangroves and open areas to buffer floods) and physical flood control systems. The New Delhi meteorology department has just begun to provide six-hour advance forecasts of extreme rainfall events, as described by Dr. Shailesh Nayak (MoES). This type of capacity, if it can be improved and spread to smaller cities, could provide the critical advance warning required for cities and their residents to take action and avoid losses. Achieving this will require improvement in modelling capabilities as well as basic systems for detailed hydro-meteorological data collection.

5. Health Systems

The presentation by Dr. Vikas Desai, Technical Advisor, Reproductive and Child Health Program (RCH), Surat Municipal Corporation (SMC), highlighted how the resilience of cities depends largely on the heath of the citizens. Increasing (or bolstering) citizen health requires investment to sustain activities such as vector borne disease control (monitoring of mosquito populations, spraying, ensuring drainage, etc), build skills, set up a strong disease surveillance system, medical care support, an urban planning framework and support from academic institutions. To achieve this, the city of Surat has established decentralised health services and is backed with an efficient team of doctors, health care workers, allied municipal departments and efficient infrastructure. Strong public health systems often have particular benefits for the poor who live in areas exposed to disease and are unable to afford access to private medical facilities.

6. Shelter Systems

Numerous presentations identified the design of buildings and shelter as central to the future resilience of floods. In Gorakhpur and Surat, as presented by Dr. Shiraz Wajih (GEAG) and Mr. G.K. Bhat (TARU) respectively, raised buildings contribute to flood resilience. Many cities in the ACCCRN network are including shelter design as part of their overall climate resilience planning. Surat has even held a design competition for "flood adapted" buildings. In other cities, the use of building design to moderate extreme temperatures was highlighted. Overall, shelter system design is central

Figure 6: Surat's improvement of urban habitat for slum dwellers. Source: Presentation by Ms S Aparna, IAS, Commissioner, SMC

to the resilience of urban areas. As presentations from Surat emphasised, ensuring buildings and shelters are designed in ways that enable access for poor and marginal communities is central to achieving socially inclusive, low carbon, climate resilient development (Figure 6).

7. Transport Systems

The role of transport system design in urban resilience was highlighted in a number of presentations. As demonstrated by the impacts of flooding of the Kosi River, roads and railways are often designed with inadequate reference to natural drainage systems. As a result, they fail at critical points, blocking drainage and increasing the impact of flooding. Underpasses and bridges over rivers represent critical points where failure during floods can undermine transportation systems. This is not simply an infrastructure problem. It is a systemic problem that reflects fundamental gaps in knowledge systems about flood-adapted infrastructure design and a lack of coordination between government departments. In other words, the challenge is as much institutional as it is the physical infrastructure. While the above examples focus on floods, the mobility of goods, services and people is of fundamental importance to wider factors, from food supply to economic flexibility. These factors affect the resilience of wealthy and poor populations residing within cities. As a result, climate adapted, low carbon transport systems are central to both climate mitigation and resilience.

8. Planning and Implementation Systems

Developing more effective mechanisms for incorporating climate and resilience considerations in planning and implementation strategies was discussed as central to resilience in many presentations. The issue that surfaced during discussions in Session-6 flags effective implementation and enforcement as key challenges. The obstacles here are tangible. Urban plans are developed in virtually all cities in India. At present they rarely incorporate climate considerations, rarely incorporate the perspectives of poor or otherwise marginal communities, and are rarely implemented. Building the capacity to incorporate climate information and the perspectives of diverse communities was a main thread throughout the workshop. Further challenges were described by Dr. Anju Chowdhary, including the unwillingness of departments charged with implementing plans to coordinate their activities, limited funding, and local authorities lacking the power to implement plans. In order to reverse these trends, it is critical that institutions at the city level and above coordinate across sectors on planning and implementation and financial mechanisms are made available to local governments to initiate action on the basis of these plans.

Actionable Responses

The above examples illustrate the range of key systemic issues that must be addressed to build urban resilience. Multi-stakeholder approaches that enable the voices of all communities to be heard are essential to meeting the needs of poor and marginal communities. As Dr. Jyoti Parikh (IRADe) emphasised in her presentation, adapting to climate change will require tangible steps to address physical infrastructure needs such as: a) remodelling drainage systems to accommodate sudden downpours; b) high capacity water supply and storage systems for drought periods; c) embankments of low-lying areas especially for coastal cities; d) stronger buildings, bridges, flyovers, and water supply and treatment plants capable of withstanding storms. Resilience also requires a combination of scientific and softer institutional approaches to gauge the vulnerability of populations to climate change. These

include: a) incorporating disaster management measures while planning new projects; b) building the capacity of key city bodies and other stakeholders; c) developing benchmarks so that new developments can adhere to the tenets of sustainable developments; and d) conducting relevant research and analysis to gain city level insights on combating the impacts of climate change.

While some cities, such as Surat, have a long history of proactive responses to major challenges, others are now beginning to take action. The IMC, for example, as depicted in the presentation by Mr. V.P. Kulshrestha, has taken up several initiatives that indirectly address resource and environmental management concerns. These include energy audits, rainwater harvesting, setting up open spaces within the city, landscaping area parks, plantation drives, developing lakes, and establishing a company to manage public transport. The City of Gorakhpur is engaged in similar proactive projects. As mentioned by Dr. Shiraz Wajih (GEAG), Gorakhpur was recently awarded a major project by the Government of India to rehabilitate lakes within the city and has submitted proposals to begin experiments with drainage solutions at the local ward level.

Challenges & Solutions

Many of the main challenges for building urban system resilience involve gaps in institutional systems linking emerging knowledge on climate and resilient development with planning and action. They also reveal gaps in the general understanding of how environmental, energy, scientific, communication and transport systems serve as gateways to adaptive capacity and the resilience of urban areas. In addition, basic challenges exist in the lack of convergence between the actions of government departments, in the absence of political will, in the interference from political factions, (as indicated in discussions from Sessions 1 and 6) and vested interests of different players.

Potential solutions to these institutional challenges (or simply "gaps") discussed at the workshop involve translating understanding of systems and the fundamental roles they play into practical courses of action. Achieving this will be a long-term process. Points of entry for starting this process identified at the conference include:

1. Improving the quality and accessibility of available data on climate change and weather forecasting, as stated by Dr. Shailesh Nayak (MoES). This is essential to generating tangible inputs to local planning and weather forecasting.

2. Improving the ability to identify, analyse and understand the linkages between the institutional, environmental and physical infrastructure systems on which urban areas depend. While action may depend on sector-specific interventions, unless systems and their relationships are well understood, resilience cannot be strengthened. As reiterated by Dr. Marcus Moench (ISET), *methodologies for understanding systems and institutional behaviour and linking those methodologies to planning and strategy development are essential*.

3. Mainstreaming climate change in the master plans of cities coupled with enforcement of laws and sensitising policy makers, as highlighted by Dr. Chotani, Director, Association of Municipalities and Development Authorities (AMDA). Testing systems for developing and supporting the implementation of land use, master plans, and zonal plans to include climate change concerns is essential. This includes testing institutions and approaches for integrated land use and

transport planning. Dr. Marcus Moench (ISET), Mr. G.K. Bhat (TARU) and Dr. Shiraz Wajih (GEAG) all warned that planning would remain ineffective unless there is broad stakeholder and political ownership of the results. *Steps to build this ownership through multi-stakeholder processes are essential.*

Box 4: Sustainable and climate change resilient urban development – policy and programme entry points

- The National Mission on Sustainable Habitats (NMSH) is committed to promoting sustainability in urban habitats by enhancing the energy efficiency of buildings, solid waste management and the shift towards public transport.
- Jawaharlal Nehru National Urban Renewal Mission (JNNURM): JNNURM (2005-2012) seeks to create economically productive, equitable and responsive cities, of which 65 have been selected throughout the country. JNNURM adheres to two missions which provide entry points for urban climate resilience. The first mission, 'Urban Infrastructure and Governance,' aims at reforms and planned development of cities through efficient urban infrastructure and service delivery mechanisms, community participation, accountability of ULBs/ Parastatal agencies and preparation of City Development Plans. The second mission, 'Basic services to Urban Poor,' is focused on the integrated development of slums through initiatives that provide shelter, basic services and other essential amenities for the urban poor.
- Rajiv Awas Yojana (RAY): RAY was initiated in 2009 and aims at providing low cost housing as well as basic infrastructure and services for the urban poor. Recognising that the rise of slums is rooted in the lack of proper urban planning, the scheme focuses on issues that lead to the development of slums, including shortages of land, housing infrastructure and basic services.
- Energy Conservation Building Code (ECBC) 2007: The objective of ECBC is to reduce energy consumption by setting minimum energy performance standards for commercial buildings. These include building envelopes, mechanical systems and equipment such as heating, ventilation and air conditioning systems, interior and exterior lighting system, service hot water, electrical power and motors.
- The Bureau of Energy Efficiency (BEE) is a statutory body under the Ministry of Power within the government of India. It has several programs which target high energy end use equipment and appliances and propose minimum energy performance standards.
- The National Urban Transport Policy (NUTP) calls upon state governments to discourage the use of personal vehicles by promoting public transportation. The JNNURM has made funding for transport projects conditional upon NUTP compliance.

Source: TERI

4. Exploring synergies between existing programmes of the Government of India (GoI). This includes strengthening the climate resilience of basic infrastructure systems and the institutions on which they depend as they are designed and built (see Box 4: Sustainable and climate change resilient urban development –Policy and Programme entry points).
5. Developing projects or activities that encourage interdisciplinary work and interdepartmental coordination.
6. Piloting activities that have a major direct impact on key climate vulnerabilities such as urban drainage. This could include simple systems to ban plastic bags or testing community based institutions for maintaining existing drainage systems.
7. Exploring market based mechanisms for insurance and construction where private sector incentives can be shaped in ways that contribute to resilience.
8. Recognising the critical role of 'soft' options, as compared to only engineering solutions.
9. Sharing examples of approaches to dealing with climate change that already exist and collecting additional ones from the local level, as flagged in the policy session by Mr. Aromar Revi (IIHS).
10. Modifying existing programmes to better support adaptation needs, such as redirecting and realigning ongoing investments and programmes as well as urban redevelopment initiatives. This could include:
    - o Developing land use and planning systems that respond to climate change, including approaches that link urban biodiversity with effects of climate change;
    - o Crafting urban infrastructure systems in response to climate change;

- Addressing rural-urban linkages, such as resource/material flows and competing resource needs;
- Initiating law enforcement at the state level to control plastic use; and
- Strengthening health monitoring systems and staff in municipal corporations.

Key Insights

In urban areas, adaptation and mitigation are linked in fundamental ways. Urban populations depend on systems to meet their basic needs and to adapt as conditions change. Most of these systems, in turn, depend on energy. Low carbon growth paths are, as a result, fundamental to climate adaptation as well as climate mitigation.

Because systems are complex and interlinked, as Shri Navin Kumar Secretary, Ministry of Urban Development (MoUD) emphasised, "There is strong need for comprehensive, integrated urban planning." Planning, however, only translates into implementable courses of action if the results are broadly owned and supported at the city level. As a result, multi-stakeholder processes for planning and learning are essential. These processes must be supported by detailed information on the systems involved, their interdependencies, the factors that contribute to resilience, and how they may be affected by climate change.

The results of systems analysis will not be "rocket science." Instead they must translate into practical courses of action – such as pilots for the design, maintenance and cleaning of drainage systems – that are central to addressing current and projected problems associated with climate change. The results of these efforts must reflect the social and institutional factors that determine the functioning and sustainability of basic environmental and physical infrastructure systems.

Knowledge

Until fairly recently, climate change has been framed as a global scientific issue, not one that a local actor, say the mayor of a medium sized city in India, should consider. However, the reality is that in order to mitigate climate change there needs to be many actions at the local level, and that since people at the local level are and will continue to experience climate change, adaptation to it will also happen at the local level. Thus in short – climate change is a local issue. Additionally, due to its crosscutting nature, addressing climate change will also mean that local actors will need to consider new means for cross-sector and cross-organizational communication. Thus, it is essential for city stakeholders to understand what is known and what is unknowable about climate change, what it may mean for their city, and how to plan with the most vulnerable in mind.

Working with Climate Change Knowledge

In order for local players to act upon the pressing issues of climate and development, they need to understand how climate change translates down to the local level of their city. This is not simply a matter of understanding the science of climate change, but also knowing the projected impacts and uncertainties associated with climate and impact scenarios. The ability to act requires a new understanding of how to work with and plan for uncertainty and requires the means to develop approaches to utilise the knowledge of uncertainty in everyday applied activities - from urban planning to bridge design. Mr. Sundar, Distinguished Fellow, The Energy and Resources Institute (TERI), in his talk summed this up pertinently when he pointed out that providing knowledge on climate change issues/impacts and building capacity to take relevant actions across city and state levels are key to bringing all actors together on a common platform.

Addressing Institutional Knowledge Constraints for Action

"We have the historical and institutional systems to deal with most risks and we need to build on what we know."

Dr. Aromar Revi, Director, India Institute for Human Settlements IIHS

The broad, multi-sectoral impacts of climate change, coupled with dynamic social, environmental and politico-economic systems, will likely challenge the way we organise ourselves. Organisational information silos, usually effective in providing sector-focused services, will require more points of bridging and new systems of information exchange. Addressing climate change and its pervasive nature will require the participation of more stakeholders from a broader spectrum of society. This translates into a real need at the city level to understand how human systems function. Working knowledge of these systems will help to bridge the communication gaps that grow between sectors and segments of society and to understand how to work with inclusive processes to promote climate resilience.

Local Knowledge

Although climate change is a relatively new issue to many, it is important to remember, as Dr. Aromar Revi (IIHS) pointed out in his presentation, that many of the impacts associated with climate change (e.g. floods, droughts) are already well known and for which there is already local capacity to handle. This should be acknowledged and built upon. Often times this capacity is not recognised and thus not incorporated into planning approaches. Starting from that base it should also be recognised that climate change will lead to new impacts for which there is little history, such as glacial lake outburst floods (GLOFs) and sea level rise, as well as potential new, unknown risks. Climate change also has the potential to alter the frequency and intensity of events, such as droughts and floods, beyond what our experience and knowledge are equipped to handle. All of this will happen within a new social and environmental frame of large scale urbanisation with which India, and the world, has very little experience dealing.

Based on the aforementioned climate challenges, as Dr. Aromar Revi (IIHS) emphasised, it is important to start by building on capacities that already exist. This can be achieved by: 1) empowering local populations (locals actually do know what to do to some degree for many of the future hazards. In many cases they may just need assistance in knowing how things might change); and 2) encouraging donors and other international actors to avoid wasting time reinventing the wheel by attempting to build capacity that already exists. Overall, despite the lack of experience, it is important to start by recognising the fact that for many issues some level of local capacity already exists.

Knowledge Needs

In the workshop the need for knowledge was noted in several areas: the need for better knowledge for decision-making, the need for knowledge sharing, the need to work with local knowledge, the need to improve community awareness and the need to build capacity in the young to know how to address the issue. While the need for improved knowledge emerged very regularly, what this actually would mean in practice was not, as explored further below, clearly discussed. As a result, in addition to the direct expressions of need for knowledge, it appears essential to improve understanding of what types of information are needed for what types of decisions and at which points in the decision-making process, knowledge could and should be used. Although this was not directly stated, some discussions at the workshop implied that more focus is required on decision-making processes and how improved climate information can be used to support them.

Some participants in the workshop emphasised the need for more precision in climate projections (better output data) and seemed to be equating this with "better knowledge." They appeared, in essence, to be requesting better models. From a scientific perspective, however, this request highlights the need for educating and working with decision-makers to understand the uncertainties and limitations of climate scenarios. Climate scenarios are not probabilities of the future: They are generated by taking current conditions and stories of future emissions, population and land use to see how the climate might respond, if a particular story is selected. In essence, climate scenarios are "what if" scenarios of potential climate futures. For the most part, the nature of output data from climate models and how it might or might not be used in planning was not discussed during the workshop. While the general sense of the discussion implied a need for greater precision in climate forecasting, there was little discussion of whether or not improvements in precision can scientifically be generated for many key parameters. Climate projections – even those produced by high-

Box 5: Tools and Methodology for Vulnerability Analysis: Experiences from Surat and Indore

Overall, a common approach in understanding city contexts, multi-stakeholder processes, and leveraging current and past experiences was used to assess vulnerability in Surat and Indore. In both cities, City Advisory Committees were established as nodal points for promoting broader stakeholder engagement in the various stages of the vulnerability assessments (identifying vulnerability issues, developing methodology framework and its implementation). The results of the vulnerability assessments, sectoral studies, pilot projects and resilience planning process--dealt with separately in the report--were fed into broader and continual stakeholder engagement processes. It can be observed that the circumstances in Surat were different than that of Indore. While Surat is well managed and has a high level of social cohesion and industrial development, Indore is currently being challenged by resource constraints, where infrastructure growth has not been able to match urban growth, and industries are located outside of the city. Furthermore, impacts from climate change also vary between the two cities. While Surat is affected by recurrent flooding, the biggest climate related risk for Indore is water scarcity and drought. Delivery of water supplies from Narmada may alleviate this. Scarcity has, however, been a major challenge throughout recent history and could re-emerge as a problem as the impacts of climate change increase. However, it can be noted that health risks due to water and vector borne diseases are common in both of these cities though Surat has learned ways to mitigate it through deploying an effective health monitoring, surveillance, and health care system.

Because census surveys are costly, a GIS based sample analysis was primarily used to unpack and process the diversity of livelihoods, access to infrastructure and location dependant variables in these two cities. In addition, it aids in capturing the diversity of issues across the city. One-meter resolution multispectral imagery has been available on free sources like Virtual Earth and Google Earth since 2000. These images help to understand the roof types, building sizes and classification of road infrastructure in order to provide categorization for regions within the city.

The GIS aided urban vulnerability analysis takes advantage of spatially explicit data and uses a variety of indirect indicators to better understand the socioeconomic and vulnerability parameters. These include location (core, periphery, distance from markets/industries, etc.), road access, building sizes and roof types. Such data is easily discernable by 1 m resolution False Color Composite imagery. The classification scheme is further improved upon by rapid ground surveys. This process is followed by sample location selection for community and household surveys. The output map with the associated set of attributes is useful for selecting sample locations and communities. A rapid (hydro-meteorological) risk analysis in each city was carried out based on secondary data on past events reported from the city, drainage and contour maps, hydro-meteorological, tide and other relevant data sets. The maps generated are used in selecting the sample sites for vulnerability surveys. The data can be further developed upon in order to analyze climate risks that include other sectors, such as energy and solid waste management.

The community and household level surveys conducted at the sample locations in Indore and Surat were identified and validated on GIS maps. The surveys used structured and semi-structured interviews covering various indicators related to both capacity (income stability, social grouping and education) and vulnerability (loan/ insurance, drainage/ sewerage and housing). The data was fed into the GIS database in order to aggregate the data at community, ward and city levels.

Source: Presentation of G.K. Bhat, TARU

resolution models – inherently contain a relatively high degree of uncertainty. This raises the importance of shifting the focus from trying to reduce uncertainty before making a decision to learning how to account for uncertainty, understand what implications it might have for a decision and how to work with it. As a result, the discussions implied not just a need for improved climate projections but also improvements in understanding how the types of information that can be generated could effectively contribute to planning and decision-making processes.

Considering the scope and nature of the challenge, it was also seen that there was need for knowledge sharing and the need to work with local knowledge, which means engagement with multiple stakeholders particularly with communities at risk. The need to improve community awareness was highlighted, as was the need to address future generations.

Information for Decision-Making

Key to any effort to address the impact of climate change on the poor and vulnerable in cities is improved information for decision-making. Many cities presently are faced with the challenge of planning and making key decisions without sufficient information to ground them. Complicating this effort are the shifting understandings that emerge when dealing with an issue that spans multiple sectors while the pressures of urbanisation and economic and population growth cause prior plans to be outdated and quickly alter the landscape of development and risk. This fact was underlined by Mr. Emani Kumar of the International Council for Local Environmental Initiatives (ICLEI-Local Governments for Sustainability), who noted the need for knowledge at the city level to deal with the impacts of present and future change.

Mr. G.K. Bhat (TARU) noted that, through engagement with Surat and Indore, they found that climate informa-

tion, such as projections of precipitation and temperatures, is critical to gaining decision maker buy-in. Efforts to learn who are the most vulnerable and what people's capacities are led to more confident directing of efforts at the city level (see Box 5: Tools and Methodology for Vulnerability Analysis- Surat and Indore).

Dr. Vikas Desai (RCH, SMC) presented Surat's recent history with climate and disaster-linked disease, how knowledge was used to address the issue and the successful results. She described how the health department is now using climate projection knowledge, resulting from their work with the Asian Cities Climate Change Resilience Network (ACCCRN), to address potential future impacts by reassessing their mosquito monitoring program for key climate variables of low temperatures and humidity.

The speakers from cities repeatedly stressed upon the importance of the knowledge of climate change and vulnerability for decision-making as well as that of available capacities and resources within the city. Dr. Shiraz Wajih (GEAG) highlighted the importance of climate knowledge as well as a need for knowledge management. Mr. V.P. Kulshrestha (IMC) spoke on the importance of knowledge since, "for the cities, dealing with future climate variability and uncertainties seems a challenging task."

Challenges and Solutions

The need for better information for decision-making often ends with a call for more precision in climate projections. Ostensibly, this is a call to know what the impacts of climate change will be in order to assess the costs and benefits and properly engineer for the future. However, given that downscaled climate projections will always contain a relatively high degree of uncertainty, there is a need to build a capacity to understand that uncertainty and how to work with it. We certainly cannot plan as we have in the past using historical knowledge, as was pointed out by Dr. Shailesh Nayak (MoES) in his special address, when he stated that we cannot rely as we have on the last 50 years of climate data to provide the baseline on which we design our infrastructure.

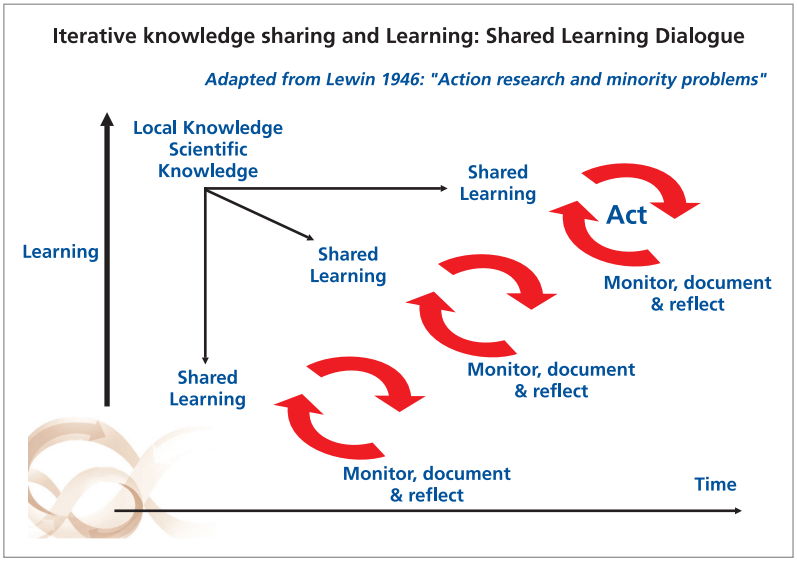

Figure 7: The Shared Learning Process whereby local and global knowledge are brought together through directed, iterative interaction. Source: Presentation by Dr. Marcus Moench, Director, ISET

Instead, due to the uncertainties and complexities and its cross-cutting nature, addressing the climate change knowledge problem means following an approach of deeper engagement at the local level, with a broad base of stakeholders with whom interaction is promoted, knowledge is shared and awareness built (such as the SLD process, Figure 7)

In Indore under the ACCCRN project, as described by Mr. V.P. Kulshrestha (IMC), much initial effort was focused on bridging communication silos between the stakeholders for those sectors and populations seen as having the greatest risk from climate change. This was done through a shared learning process whereby multiple groups were initially introduced to the concepts of climate change and cross-sector impacts. These were followed up by vulnerability assessments, pilot studies and multi-stakeholder meetings in which this new knowledge was presented for discussion and contextualization, resilience planning and decision-making on the action points.

Box 6: Integrating Climate Change Aspects in City Planning – Gorakhpur

Considering the mentioned risk, the resilience strategy for Gorakhpur has incorporated an integrated course of action to address a combination of institutional, behavioural, social and technical issues that undermine the ability of interlinked urban systems to meet the basic needs of Gorakhpur's residents, particularly the poor, and respond flexibly as climate change occurs. Gorakhpur's urban systems are, however, complex and many of the impacts of climate change cannot fully be predicted. As a result, an evolutionary strategy for building resilience in the city has been developed. It focuses first on problems that are clearly related to climate change, are immediate, tangible and of concern for the residents and managers of the city. The strategy then emphasizes the growth of capacity to address the multiple technical, institutional, social, cultural and other dimensions of these problems and, later, of additional problems and the additional capacities required to address them. To create a ripple effect that builds resilience over time in multiple arenas, the strategy advocates utilizing targeted interventions that build knowledge, provide demonstrated examples, assist the development and build the capacity of organizations and create pressure for change at behavioural, institutional and political levels.

In resilience strategy, emphasis has been given to effective implementation of Master Plans, which are statutory documents meant to guide the growth and development of a city. However, the lack of in-depth survey and data limits the effectiveness of such plans, particularly in situations where short sighted, populist decisions are made without consideration of long term sustainable development. There is a need to incorporate climate concerns into the master plans of cities and, with the help of pro-active citizenry, establish measures to unsure such plans are duly enforced.

Source: Gorakhpur Environmental Action Group (GEAG)

A similar approach was used in Gorakhpur where multiple scientific studies on various aspects of the city, such as a geohydrological study, a study on plastics use and a climatological study, were undertaken. The inclusive multi-stakeholder shared learning process was critical to the incorporation of this knowledge into the city's resilience strategies. As Dr. Shiraz Wajih (GEAG) stated, "Shared Learning Dialogues are a key participatory tool to learn from those that are at the forefront of the battle against climate change."(see Box 6: Integrating Climate Change Aspects in City Planning - Gorakhpur).

In Howrah, city officials undertook a sustained awareness programme for stakeholders, administrators and decision makers to influence local policy framing and identify local climate-linked problems and solutions. The effort was focused by clearly framing it in the health sector through a study about climate change effects on public health. The city of Howrah further intends to gain by the sharing of knowledge, experiences and expertise with cities across the world.

Despite the general need for deeper engagement for building of capacities and access to knowledge at the local level to promote planning and action, there is the potential for technological interventions to provide new avenues of action as well.

Dr. Richard Slater, Team Leader of the Department for International Development (DFID) supported Madhya Pradesh Urban Support Program (MPUSP), noted that their programme introduced a number of new technologies in their cities including satellite and GPS-based, GIS-enabled tools that for example, revealed building developments not recorded in the city plan or the exact location and speed of movement of city vehicles. This new information could be used to reduce vulnerabilities, improve planning and reduce carbon emissions and allowed city actors to pursue a clearer path of action using present governance structures

In many cities, knowledge alone may not be sufficient to nucleate action. Dr. Shiraz Wajih (GEAG), while pointing out the need to share knowledge at the community level, also highlighted the importance of establishing responsible citizen groups for instilling a sense of purpose and cause through campaigns and advocacy on conservation, especially when faced with apathy from the city government. Dr. Shiraz Wajih gave an example of successfully utilising this approach in the case of Gorakhpur, where citizen groups were given the tools needed for advocacy. Dr. Wajih described how these tools led to major investments by the government in rehabilitating urban water bodies. Dr. Noor Mohammad (AMDA, NCR) pointed out that bottom-up planning approaches and a higher degree of participation from a larger number of stakeholders would also bring about improvement in the governance.

Key Insights

There is general agreement that decision makers need additional knowledge in their effort to address climate change mitigation and adaptation issues. One means of addressing such a crosscutting issue, as was done in Gorakhpur, Indore and Surat, is to consult broadly with the many departments within government and non-government stakeholders so that all are made aware of the issue and its potential impacts on their area of interest. This effort is then followed by more in depth studies to reveal the specific systems exposed to climate change, identify the most vulnerable populations and an investigation of how these interact to increase vulnerability followed by iterative consultations and learning. Alternatively, as was experienced by Howrah, the subject might be introduced within a high priority sector. From there, it is possible to build a similar approach of learning and instilling capacity.

Beyond the actions presented by the cities, a broader need was identified: that of addressing the next generation. There is a need to communicate and educate the young on the issues of climate change, development and urbanization and the vulnerable. In stride, there is a need to build upon that to establish future professionals who will be called upon to take on the brunt of this issue.

Through a multipronged approach of awareness raising, capacity building, and action planning, a foundation of knowledge can be constructed on which what we do now can be built upon and sustained. This is truly resilience in outcome.

Potential Action Points

- There should be an increased focus on decision-making processes. This includes understanding what types of information are needed for which decisions and at which points in the decision-making process knowledge could and should be used.
- Improvements in climate modelling and other sources of climate information are important but such improvements must be accompanied by improved understanding of the inherent limitations in climate scenarios and the uncertainties they entail. One of the largest risks of investing in improved climate modelling is that climate scenarios will be treated as accurate projections of the future and will be used in an uncritical or uninformed manner for planning.
- There is need for greater use of methods and processes to translate emerging information on climate change into knowledge for local actors and then into practical courses of action. This knowledge must emphasise the uncertainties inherent in scenarios as well as the areas where projections can be made with relative assurance.
- There is need to promote methods and processes for improving cross-sector and cross-community engagement.
- There is potential for "disturbing" technologies to augment and hasten action, such as satellite informed GIS in discovering non-compliant construction.
- There is need to foster community level engagement to promote government action "from the bottom-up".

"Ownership, buy-in and participation of local stakeholders and local knowledge is critical to the success and sustainability of any action at city level"

Dr. Kirit Parikh, Chairman, Expert group on Strategy for a Low Carbon Economy, Planning Commission Committee

Multi-Stakeholder Processes

A common thread that ran throughout the Workshop was the importance of engaging multiple stakeholders in any initiative of building resilience to climate change. As many panellists and speakers observed in the workshop, a variety of constituencies need to be engaged at various levels for at least three main purposes: 1) to effectively plan initiatives that reflect the priorities of diverse stakeholders; 2) to improve governance through the provision of checks and balances and; 3) to enhance 'ownership' of initiatives by communities for ensuring sustainability.

Dr. Marcus Moench (ISET) in his presentation stated that urban areas represent a complex interplay of multiple systems and diversified groups which are interlinked and interdependent while at the same time are differently vulnerable depending upon access, exposure, etc. Therefore, planning processes of initiatives aiming to build climate change resilience need to unfold in a manner which includes from the top-down; international and national level expertise, and from the bottom-up methods; diverse points of view, a variety of opinions on intervention options and a number of different voices which come together to compose an accurate picture of the 'ground reality'.

Figure 8: Shared Learning Dialouges (SLDs) being conducted in Indore (background, source TARU) and Gorakhpur (foreground, source GEAG).

City Experiences

The experience from cities engaged in resilience building supported this approach. Mr. G.K. Bhatt (TARU), speaking in the context of Surat and Indore, outlined the critical nature of engaging with multiple stakeholders at the information gathering stage before planning for resilience building interventions even begins. He stated that gaining an in depth understanding of local institutions at the city level is key to getting any intervention right. This point was extended further in a discussion on Gorakhpur when Dr. Shiraz Wajih, (GEAG), a Gorakhpur based NGO engaged in the ACCCRN, supported this point and discussed the 'Shared Learning Dialogue' (SLD) process that they are employing to garner and share such insights from a variety of stakeholders (Figure 8).

The value of a multi-stakeholder process was also seen in the context of understanding the vulnerabilities of city populations to climate change. Bottom-up

What are SLDs?

"SLDs are iterative, transparent group discussions with local actors in communities, government agencies and specific organizations designed to bring together available information on climate change with local knowledge and perceptions. The ultimate outcome of SLD processes is not just shared understanding but includes actions for responding to climate change risks" (ACCCRN, 2009).

approaches which require a variety of views to formulate a comprehensive vulnerability reduction strategy were acknowledged as critical to the success of any resilience building strategy. At the same time, implicit in the discussions was a need to balance analyses focusing on community perceptions and local knowledge with more scientific/empirical observations. The use of satellite imagery and community level consultations to develop a comprehensive picture of the vulnerabilities of the local population was successfully used in the three ACCCRN cities and an example from Gorakhpur presented by Dr. Shiraz Wajih (GEAG). There was general agreement that a multi–stakeholder approach was also essential to map not only the vulnerabilities but also capacities of the city population to deal with these vulnerabilities. These include methods of autonomous adaptation, structure and seasonality of employment and social networks along with many others (see Box 7: The Shared Learning Process in India).

Governance and Ownership

Apart from gathering knowledge on local institutions, assessing vulnerabilities and mapping capacities, multi-stakeholder processes are also key to ensuring that an adequate governance environment for building resilience is created and maintained. The notion of 'governance' was interpreted and discussed in a number of different ways at the Workshop. One set of discussions revolved around how ownership of resilience initiatives by a variety of stakeholders is essential for sustainability and ultimately, the impact

Box 7: The Shared Learning Process in India

The ACCCRN program has approached climate resilience planning through a "shared learning" process. Shared learning is an approach for planning and problem solving in complex situations in which several key features—long term interaction, sharing of sector or group specific knowledge and experience, and learning both between and among local actors and external experts—allow stakeholders and decision makers to understand a full spectrum of vulnerabilities. This knowledge can assist decision makers in identifying possible interventions, priorities and important constraints.

Shared learning approaches are highly applicable for climate adaptation because climate is an inherently "global" issue with local consequences. Action on climate change, therefore, requires combining local knowledge with international technical resources. In contrast, many other development or research processes rely on extracting knowledge within a specialized disciplinary environment, rather facilitating the sharing of new knowledge across disciplines.

In the Indian cities of Indore, Surat and Gorakhpur, shared learning through ACCCRN is organized as a series of meeting termed "shared learning dialogues" (SLD) across scales and between stakeholders from both formal and informal sectors. It entails a series of discussions between nodal facilitators (ISET, GEAG, TARU), City Advisory Committees (CAC) and local level actors from various government agencies along with communities and specific organizations, industries, commercial establishments and health and educational institutions. The SLDs aim at developing a common understanding of climate change and urban resilience so as to plan and facilitate decisions informed by the synthesis of local and technical knowledge. It is important to note that the shared learning process in all the three cities is different depending upon the variability in geo-physical and socio economic context as well as the particular hazards that a city is facing.

Each city undertook a vulnerability assessment that was incorporated into the iterative shared learning process as an input for discussion and decision making. The vulnerability assessment was executed to develop a better understanding of the potential climate impacts and existing capacities of the communities and urban systems specific to each city. By carrying out assessments at the community level through surveys and community-specific SLDs, the vulnerability assessment also helps promote the participation, awareness and adaptive capacity building of marginalized and vulnerable groups in the urban resilience process.

The development of a common acceptable understanding of climate change and urban resilience is time consuming and requires combining insights from multiple stakeholders across scales. Therefore, CACs consisting of core stakeholders involved in planner assist to assimilate the information put forth. Because the SLD process is inclusive, iterative and participatory in nature, the findings emanating out of individual or community surveys and workshops are shared with the CAC. This process helps the group to develop a joint understanding of the meaning of resilience in their city and to prioritize key actions and projects in the context of the climate resilient planning.

Box 8: Integrating Resilience Planning with Development Planning – Indore and Surat

Addressing climate change concerns will need a multi-pronged approach that addresses (1) the development of relevant information and databases; (2) the maintenance and updating of information; (3) two-way education and dialogue between scientists and users in different sectors/policy arenas on the uses and limitations of different information (particularly climate scenarios); (4) processes to feed information into decision-making and implementation activities; and (5) reviews of information and it's uses to inform future planning and knowledge generation. Resilience planning using climate information represents a core a cyclic process that needs to enrich with each passing cycle.

At present awareness regarding the ways climate change will affect everyday life and how that relates to the major challenges urban areas already face is lacking. As a result there is little understanding of the benefits of addressing likely impacts today. Overall there is little capacity to understand climate-related vulnerabilities in urban areas or to identify potential arrays of resilience building options. This translates into a limited capacity to undertake resilience planning process. At the same time, however, as the presentation of Dr. Noor Mohammad clearly indicates, there are opportunities for reforms and financing, for urban development and poverty alleviation, under the flagship programmes of Government of India (such as JNNURM / UIDSSMT and BUSP / IHSDP) that could address both current problems and the likely impacts of climate change. To realize these opportunities there is a great need to build capacity for resilience planning; to identify, develop, test and upscale appropriate cleaner technologies for low-carbon growth; to access available finances (through development of proposals); and finally, to implement the activities identified.

To illustrate the potential advantages of Resilience Planning process, Surat has used resilience planning methodologies to identify a diverse array of soft and hard avenues for addressing the impacts of climate change. These avenues involve work in different sectors and will require the development of partnerships to among organisations at city and higher levels. To begin with, as presented by the Municipal Commissioner, Surat, the municipal corporation has taken number of steps towards increasing resilience to floods. They include a mix of hard and soft interventions: pre-monsoon preparedness; augmentation of the storm water drainage network; strengthening of river embankments; rehabilitation of vulnerable people; and review of development norms. These initiatives have been possible due to availability of relevant information on geo-spatial nature and extent of floods and a comprehensive database of (public and private) assets at risk. Review of land-use plan and flood zoning maps facilitates effective rehabilitation of poor. Equally important is the review of design of hydraulic structures (on river Tapi) in the context of challenges CC will pose. This apart, the city has identified strengthening disease surveillance and health care service delivery system as another key intervention area. On similar lines, Indore Municipal Corporation has proposed development of high resolution flood risk maps and drainage master plans while Gorakhpur city has undertaken review of city master-plan from the perspective of climate change. These are some of the start-points for integrating concerns of climate change into urban development. At the same time, the standard Regional Development Plans, and at city level the City and Sectoral plans, as flagged in panel discussion on Day-2, will need to be reviewed/ developed to incorporate climate change concerns. At core, a set of pilot projects, such as conjunctive water management in Indore, ward-level resilience plan in Gorakhpur, that singularly or collectively address the above issues will need to be developed, implemented and lessons harvested for catalysing change at the state and national levels.

of any such activity (see Box 8: Integrating Resilience planning with Development planning – Indore and Surat). These stakeholders include those who would directly benefit from such activities but could extend beyond to other key actors that mediate the dynamics of the local political environment at the city level, such as local government institutions, citizen's associations and business associations. The success of citizen participation for a common goal was amply demonstrated in Gorakhpur for the conservation of Ramgarh Lake, as presented by Dr. Shiraz Wajih (GEAG). Mike Keegan, Transport Strategy Manager of Transport for London, also supported this line of thought in his presentation by underlining how important the buy-in from the public and other stakeholders was for certain new transport projects and plans that they had executed.

This ownership by multiple stakeholders of resilience building interventions was linked to their critical role as the 'checks and balances' in a system. Dr. Jyoti Parikh (IRADe) in her presentation noted that to ensure effective governance and to increase transparency and accountability, participation of multiple stakeholders is critical. A variety of actors being engaged in a resilience building project would also lead to a closer tracking of the process and consequently hold those charged with leading the interventions more accountable to deliver what they are charged with. This point was also illustrated by Richard Slater, who was showcasing the DFID funded MPUSP project, and stated that monitoring of public construction activities by women's groups has led to a substantial improvement in the quality and timeliness of such activities. The role of recognising the private sector as an important stakeholder and possible source of finance for resilience building initiatives was also considered. Another point centred on how the involvement of various stakeholders and harnessing synergies between their

roles and functions could successfully support resilience building. This point was illustrated by Dr. Vikas Desai (RCH, SMC) who noted that a good network has been established between the health departments and allied departments of the Municipal Corporation. This network is further linked and backed by the support of academic institutions, hospital networks, private practitioners and diagnosis and research facilities.

Challenges

A number of challenges with involving multiple stakeholders were implicit in these discussions. One critical problem in engaging stakeholders in initiatives of resilience to climate change is the lack of awareness and knowledge on these issues amongst various stakeholders at the local level. This point is common to a wide range of development issues, but as climate change is a relatively new issue in the public imagination and as its impacts are so varied and experienced locally, raising awareness around this is particularly difficult. Another challenge is to make processes of stakeholder consultation genuine and therefore useful. Consultations have to be designed in a manner which allows a full and free participation of stakeholders. This hinges on multiple and cascading factors including the physical setting, the level of direction provided by moderators, time, and interpersonal politics. An important corollary to this is the issue of engaging with the urban middle and upper class in urban areas. This concern and challenge was well captured during the discussions on DFID's Support Programme for Urban Reforms (SPUR) programme in Patna, when a delegate commented that engagement and participation levels from rural areas and urban poor are far higher and better than from the urban middle and upper class residents.

A much more fundamental challenge is with the structure of policy processes themselves. Dr. Marcus Moench (ISET) reiterated this point in his talk that 'practical approaches for policy formulation were needed' and that 'this has to be a process with multiple loops of iteration built in, allowing time for monitoring, documentation, reflection and if need be, course correction'. Dr. Regina Dube (GTZ-ASEM) also highlighted the need for defining areas of potential action through participation at all levels and to adopt an integrated planning approach. Policy processes around climate change resilience also need to outline a methodology of engaging multiple stakeholders, clearly identifying entry points and/or spaces for engagement. Finally, as mentioned earlier, there are inter-linkages and dependencies between systems and services within an urban environment. Dr. Regina Dube (GTZ-ASEM) underlined the importance of interdisciplinary work and interdepartmental cooperation between Urban Local Bodies (ULBs) when she identified this as one of the key success factors. However, experience from cities is that more often than not, these urban bodies and departments plan and work in isolation. This was also reiterated by Dr. Shiraz Wajih (GEAG) who pointed out that, in the case of Gorakhpur, interdepartmental convergence remained a challenge for developing the city's resilience.

Linkages with and involvement of the national and state governments – where several programmes on urban development are planned and initiated – is also an important piece for developing urban resilience, as presented by Dr. Noor Mohammad (AMDA, NCR) and Dr. Jyoti Parikh (IRADe) in their presentations respectively. (see Box 9: Specific opportunities in programmes to build resilience and facilitate low carbon development). Mr. S. Sundar (TERI), going a step further, stated that there are national level organizations having necessary capacities and these organisations should collaborate to sensitise all the state governments (in

the country) on issues of climate change, which would pave the way for accelerated development of urban resilience

Potential Action Points

Though all cities at the workshop had engaged with and used participatory approaches to improve understanding of the context within which action would be taken, there was general agreement that overall most cities in India would benefit from further enhancement of shared learning and greater participation. Thus it was seen that:

- There needs to be a critical review and harnessing of findings from shared learning processes that may have employed. Organizations should extract process deficiencies and strengths to revise tools or review other processes existing elsewhere which may be helpful.
- Deeper familiarity with participatory approaches to addressing development issues should be promoted in the cities so as to build capacities and promote development which is context sensitive.

Box 9: Specific opportunities in programmes to build resilience and facilitate low carbon development

- JNNURM has highlighted the role of municipal financing for cities to decentralize resource allocation, and ultimately to support their resilience and low carbon development. JNNURM also has potential in its next phase to undertake some of the activities proposed under the National Mission.
- Initiatives like Rajiv Awas Yojana (RAY), which has primarily been focusing on the number of houses constructed for the urban poor, should also specify the mode in which it is achieved. These include providing directives for including 'green building' considerations. Because RAY is oriented towards urban reforms, it can be an important vehicle for mobilizing the National Strategy for Inclusive Growth as well as the National Urban Housing & Habitat Policy 2007, which aims at improving the living conditions in slums and providing low-cost and alternate housing. Specific activities envisaged under RAY include:
- Integrated development of notified and non-notified slums;
- Provision and/or improvement of access with basic services to the urban poor. These include water supply, sewerage, drainage, solid waste management, road access, community toilets, market access, livelihoods etc;
- Liaison with other schemes for the urban poor related to water, sanitation, health, education, livelihood support and infrastructure.;
- Development of low cost and affordable housing along with basic infrastructure and services.
- Some opportunities under the National Mission on Sustainable Habitats for resilience and low-carbon development include:
- Extension of the Energy Conservation Building Code;
- Urban waste management and recycling, including production of energy from waste;
- Regulatory and financial measures for enforcement of automotive fuel standards and to encourag purchasing efficient vehicles;
- Providing incentives for public transportation use;
- Preparation of city Master Plans that address sustainable development norms, environmental standards and GHG mitigation under building bye laws;
- Formulation of city development strategies including preparation of comprehensive mobility plans for both long term energy efficient and cost effective transport planning within cities.
- There is need to establish fuel economy standards in the country. Many studies have shown that doing so will result in a significant reduction in energy consumption. While the US, Europe, Japan, China and Mexico have mandated fuel economy standards, India has yet to do so. These standards are achievable and need to be introduced immediately.
- State Action Plans on Climate Change: Following the National Action Plan on Climate Change, states in India have been issued a directive from the Centre to prepare their State Climate Change Action Plans (SAPCC) in the light of identified national priorities and state specific risks and impacts. The first step towards preparation of a SAPCC is to identify state specific risks and impacts as well as prioritize areas for research and policy action in response to current and future vulnerabilities and projected impacts of climate change. SAPCC lists institutional mechanisms and time frames of operationalizing identified priority areas for the state. These State Action Plans provide a good example of, and an opportunity for, integration of urban resilience at a subnational level, within identified priority areas of the state.

Source: TERI

Climate Change Resilience and Socio-economic Equity

The Workshop has led to the distillation of a number of key components of resilience in urban areas. Apart from those discussed in the preceding sections, there was near universal consensus that for a town or city to be truly resilient in the face of a changing climate: 1) there has to be a greater degree of social and economic equity and 2) any resilience building process must include a movement towards a more equitable distribution of power and wealth in society. These arguments add to historical understandings of the cross-linkages of risk and vulnerability with issues such as poverty, marginalisation, power and equity. A number of experts touched upon this subject at the Workshop and elaborated on key themes.

At the beginning on the Workshop, Mr. A. K. Maira, a senior policy maker with the Planning Commission of India, the government agency charged with developing India's nodal forward planning mechanism; the Five-Year-Plan, spoke on issues of equity in urban areas by underlining the importance of keeping the less privileged in mind while talking of urban resilience. Framing his arguments around the critical question of "whose city is it anyway?", Mr. A. K. Maira (GoI) underlined how cities that are not 'socially sustainable' can never be environmentally sustainable.

Cities in India are growing at a rapid pace and so is the urban slum population as pointed out by various speakers in the Workshop. Experience from the cities present in the Workshop, brought out the fact that the urban slum population is also marginalised in terms of access to basic services like drinking water, sanitation, solid waste disposal and even basic housing. Dr. Santosh Kumar, (NIDM), in his presentation, stated that this urban slum population is often the one which is most vulnerable to natural hazards. Taking this argument further, Dr. Marcus Moench (ISET) said that the vulnerability of any city is directly proportional (or linked) to the quantum of marginalised populations and to the exposure (see Box 10: Vulnerability Patterns in Surat).

"Strategies/policies for urban development have to ensure that the urban centres grow in a planned manner without compromising the environmental concerns and enabling inclusive development by protecting all sections of the society"

J.B. Kshirsagar, Chief Planner, Town and Country Planning Organization, Ministry of Urban Development, Government of India

Poverty and Development

The Government of India has initiated several programmes for addressing this issue of providing basic services to the urban poor in the form of Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Urban Infrastructure Development Scheme for Small & Medium Towns (UIDSSMT) and Rajiv Awas Yojana (RAY), as mentioned by Dr. Noor Mohammad (AMDA, NCR) and many other speakers. Discussions during the workshop underscored the idea that climate change would threaten plans or processes for equitable development already underway as part of

the above programmes. Implicit in this suggestion was an understanding that, for example, the social security programmes being implemented by the government aimed at poverty alleviation and livelihood security often have less impact than planned due to additional effects of climate change, thus exacerbating vulnerabilities of the poor. Klein et al., in one of the journal papers illustrate this by showcasing the example of how the conversion of mangroves into shrimp farms (possibly as part of a livelihood security project) may generate economic gains but leave coastal communities more vulnerable to coastal hazards such as storm surges (2007). This leads to the recognition of the need to factor climate change into any new plans being developed and new policies being devised for them to be effective in the face of climate change – a central point which was reiterated by almost all speakers in many presentations during the Workshop.

Livelihood security is another important and integral element of the socio-economic profile of a city and consequently, of its resilience to climate change. This linkage was clearly showcased by Dr. Santosh Kumar (NIDM) in his presentation 'Approaches of Urban Risk Reduction' (presented mainly from the Disaster Risk Reduction perspective) as he inferred that poor people are not able to recover from disasters as well as people from other classes. A representative from Surat, an industrial city on the western coast of India, supported this point and said that this was an important factor in defining the city's resilience. Surat professes to have negligible unemployment as formal and informal systems of industrial training ensure that migrants and the local population find gainful employment in the local industries (mainly diamond cutting/polishing and textiles). Ms. S. Aparna, Indian Administrative Services (IAS), Commissioner, Surat Municipal Corporation (SMC), stated that in her view, this high employment status and better (than most other cities in India) access to basic services ensured that the city had a high degree of internal resilience. This resonates very strongly with the established body of thought on this issue. Adger writes that stable livelihoods result from sustained economic growth, which in turn leads to resilience (2000). H.E. Sir Richard Stagg also stated that,

> "There is a strong correlation between planned urban development and economic growth".

Perhaps, it is through the recognition of this interdependence between livelihoods and resilience that Gorakhpur identified the provision of 'labour intensive industrialisation' as one of the key adaptive actions for the city under the

Box 10: Vulnerability Patterns in Surat

Surat is the ninth largest city in India as well as the economic capital of Gujarat. It is home to textile industries, where approximately a third of the country's total manmade fibre is produced, and to diamond industries. According to the 2001 census, the population of Surat was 2.8 million and is estimated to have reached 4.4 million by 2010. Over the past ten years, Surat has doubled its area from112 sq. km. to 326 sq. km. The city has expanded out to the coast, changing it from being a land locked city.

From the climate change perspective, Surat is prone to floods. The inundation problems are compounded when there are large releases from the Ukai reservoir, which occur at least once every decade, and impact core and northern parts of the city. In addition, the Khadi River floods at least once every three years and inundates the poorest settlements of the city, specifically along the Tapi River. Aside from this, the pattern of rainfall has changed with more incidents of increased intensity as well as a delayed start of the monsoon season that prolongs the summer. While all this affects storm water drainage, it also increases the health risk of residents during and after floods, particularly from leptospyrosis, rheumatic fever, malaria and gastro-enteritis. Simultaneously, the sea has moved further inland increasing the salinity of groundwater.

Where climate vulnerability is concerned, of the urban population approximately 18% live in slums (0.6 million) and face specific vulnerabilities due, for example, to residence in the urban flood plain. In addition, the agricultural communities within the urban areas (especially those growing horticultural and other cash crops such as sugarcane) and those working in some industrial areas that are at risk of flooding (Hazira Industrial area) are also vulnerable. .As a result, at the city scale if one includes senior citizens, children, the homeless and other socially weaker groups as well as those living in regions or having livelihoods that face specific climate risks, the vulnerable population is little over 50% (approximately 2.5 million – a little over half of the estimated 4.4 million population of the city).

Source: Presentation of S. Aparna, Municipal Commissioner, Surat

ACCCRN initiative, as presented by Mrs. Anju Chowdhary, Honourable Mayor, Gorakhpur Municipal Corporation.

Challenges

Implicit in the above discussions were the challenges associated with working toward increased social and economic equity as a key component of any resilience building strategy. One challenge is to demonstrate why climate change is an important theme that needs to be considered by the city managers while planning and implementing development projects. Dr. Regina Dube (GTZ-ASEM) mentioned in her presentation that the city managers have to deal with many issues (e.g. gender, issues of social marginalisation, among many) related to urban services on a day-to-day basis and that it is particularly hard to get them to accept new ideas and challenges. However, some cities in India are well on their way to integrating climate change concerns into their development. Ms. S. Aparna (SMC) in her presentation mentioned that the City Development Plan of Surat has included findings from the vulnerability assessment studies (Figure 9) leading to identification of high risk or vulnerable zones in the city and consequently the vulnerable population has been relocated to safer areas in better houses.

Another key challenge to overcome involves finding effective and possibly innovative ways to engage with multiple constituencies in policy-making processes (discussed earlier in section Multi Stakeholder Processes). Additionally, effective structures of governance need to be developed that prevent the institutionalisation of large scale inequities of wealth, income and power which negatively impact the resilience of urban systems (a longer discussion of governance is included in section Urban Systems). Another enormous challenge to overcome includes industrial and labour policies of cities (where these exist and perhaps state and federal policy) to ensure that economic migrants and residents are absorbed into the workforce. These challenges, as noted in the talk by Dr. Moench (ISET) during the Inaugural Session should be approached by a series of 10% solutions rather than broad approaches and silver bullets.

Figure 9: Using GIS tool to mark vulnerable areas in Surat. Source: Presentation by Ms S Aparna, IAS, Commissioner, Surat Municipal Corporation

Additional challenges, as discussed by the participants, include certain structural issues such as the marginalisation of women in development projects and the prevalence of a 'patriarchal' mindset that cuts across all the other issues discussed in this section. Many speakers, including Dr. Marcus Moench (ISET) and Ms. S. Aparna (SMC), noted in their respective presentations that women were particularly more vulnerable mainly because of this exclusion. To address this issue of 'gender inclusiveness' in development plans, Mr. Sridhar Chiruvolu, IAS, Commissioner, Patna Municipal Corporation, said that they have made it mandatory to allot houses in the slums to the women members of the family and that they also train women for community mobilization.

Potential Action Points

Emerging from the workshop were several possible points where action could

be taken or supported that would promote greater socio-economic equity and with it climate resilience. These are:

- Strategise ways of integrating climate change in policies. One way could be through the collation and presentation of examples of impactful climate change mainstreaming initiatives to policy makers charged with the formulation of development projects for the city. These examples could be of initiatives from other parts of the country or from other parts of the developing world.
- Make recommendations on stakeholder engagement in policies and plans. This could be done by conducting a stakeholder analysis for a policy or project that is aiming to distribute risk as a step towards improved climate resilience/adaptation (or just towards the infrastructural development). Present the findings of this with a clear recommendation on who, in your opinion, needs to be included in decision making processes to the relevant authority. Advocating as a network or group is always more effective than going at it solo.

The Time is Now

Issues

India is urbanising rapidly and will continue to do so at an increasing rate in the coming decades. This fact, coupled with observations on the gaps that exist between demand and supply for basic urban services (water, sewage, sanitation, etc) and infrastructure facilities (housing, roads, etc), were predominant sentiments of the Workshop. Many speakers concluded that this unprecedented spurt in urban growth would require massive investments in cities and new paradigms of urban development. It was emphasised that such paradigm shifts must be embraced in order to equitably cater to the demands of the urban populace while also making cities and people climate resilient. With a large majority of India's urban development yet to come the one clear message resonating throughout the workshop was that the "TIME IS NOW" – for appropriate programmes, policies, and actions leading to sustainable and climate resilient urban development.

"By 2030 about 250 million additional people are going to be living in India's cities"

Ashvin Dayal, Managing Director, Asia Regional Office, Rockefeller Foundation

The India Census defines Cities in India as those urban centres having a population of more the 100,000 while cities of 1 million or more are classified as "million plus cities". Between 1991 and 2001 the number of million plus cities in India increased from 24 to 35 (MoUD, GoI, 2010). Projections of future urbanisation were presented by Mr. J.B. Kshirsagar, Chief Planner, Town and Country Planning Office, Ministry of Urban Development (MoUD) Government of India (GoI). By 2051, India will be the most populous country with 1.70 billion people, of which 48% or about 820 million will live in urban settlements. By 2051 there will be 6,500 urban settlements, 15 of which will be mega cities (greater than 10 million) and 85 of which will be million plus cities. This is in line with the trends being observed and analyzed the world over. The UN Habitat report on Global Report on Human Settlements 2009, Planning Sustainable Cities: Policy Directions (Abridged Edition) notes that by 2050, the towns and cities of the world will constitute more than 70% of the world's population and almost all of this growth will take place in the developing regions (2009).

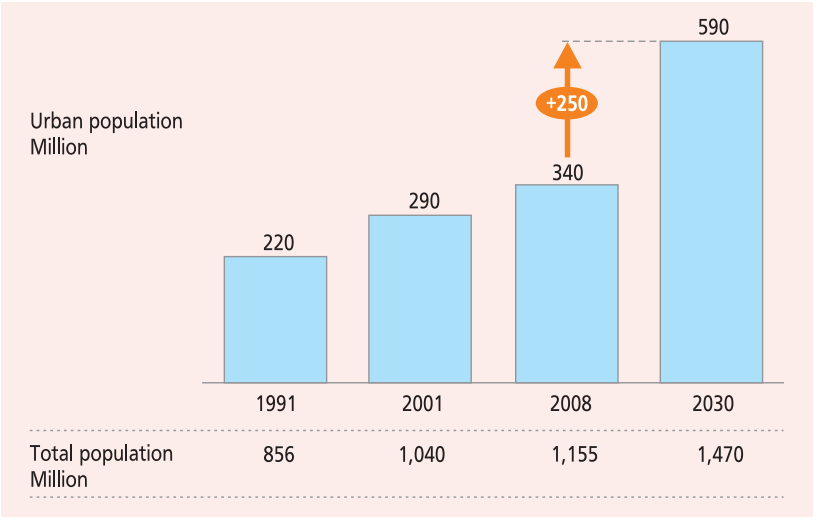

Figure 10: Cities likely to house 40 percent of India's population by 2030. Source:Presentation by Mr. Ajit Mohan, McKinsey Global Institute

Challenges

This large jump in urban population will create a huge surge in demand for basic services (e.g. drinking water, sewage, solid waste management) and infrastructure (e.g. roads, public transport and housing)(Figure 11). This is especially more challenging if we consider the current state of affairs related to the basic services and urban infrastructure of Indian cities. Presentations from almost all cities in the workshop (Indore, Howrah, Patna and Gorakhpur) highlighted that the state of infrastructure facilities and basic services (water supply, sanitation and solid waste management) in these cities is under perpetual stress. This was also corroborated in the presentation by Mr. J.B. Kshirsagar (MoUD), when he referred to the findings of the 54th round of NSSO (National Sample Survey Organization). Mr. Kshirsagar (MoUD) stated that, out of the total waste generated in the million plus cities, hardly 30% is treated before disposal. As per the Central Pollution Control Board, the wastewater generated in 300 Class-I cities (urban areas with 100,000+ population) is about 15,800 million litres per day while the treatment facilities exist for hardly 3,750 million litres per day. Further, only about 70 of these Class-I cities have partial sewerage systems and sewerage treatment facilities. There is a huge shortage of housing in the urban areas that is expected to swell with the increasing urbanisation – from a shortage of nearly 24.5 million dwelling units in 2007 to 26.5 million dwelling units by the end of the 11th Five-Year-Plan period in 2012. It was reported in the 54th round of NSSO that 43% of households in urban areas either had no latrines or no connection to a septic tank or sewerage.

Another effect of rapid urbanisation is the slowing down of the agricultural economy (Joshi H. 2010). Decreased farm productions results in migration of workers to urban areas (and vice-versa), the expansion of cities into farmland, and depletion of water levels due to urban growth. This 'push migration' results in a large influx of people with low skill sets in cities and could have potentially large implications for food security and costs. Ground experience and reports indicate that most migrants eventually end up living in slums, adding to the demand for the already stretched municipal services and resources – as presented by Mr. V. P. Kulshrestha (IMC). According to a new report by the expert committee set up by the GoI, India's slum population has gone up by 23% in the past decade and by next year the total is expected to reach 93 million (Daily News & Analysis, 2010). The report also points out that urban poverty cannot always be measured in terms of income (many slum families in Mumbai earn more than Rs10,000 a month), but in terms of living conditions and lack of basic services. In cities like Mumbai, where slum dwellers are estimated to make up more than half the population, the problem is compounded by the lack of space. The Honourable Mayor of Howrah, Mrs. Mamta Jaiswal, noted in her presentation that in the city of Howrah the drainage system has become unmanageable due to uncontrolled growth and

"... these (various Government plans and programmes) are different pieces of the same jigsaw puzzle and all of them need to fit together into an integrated whole"

A K Mehta, Joint Secretary, MoUD, GoI

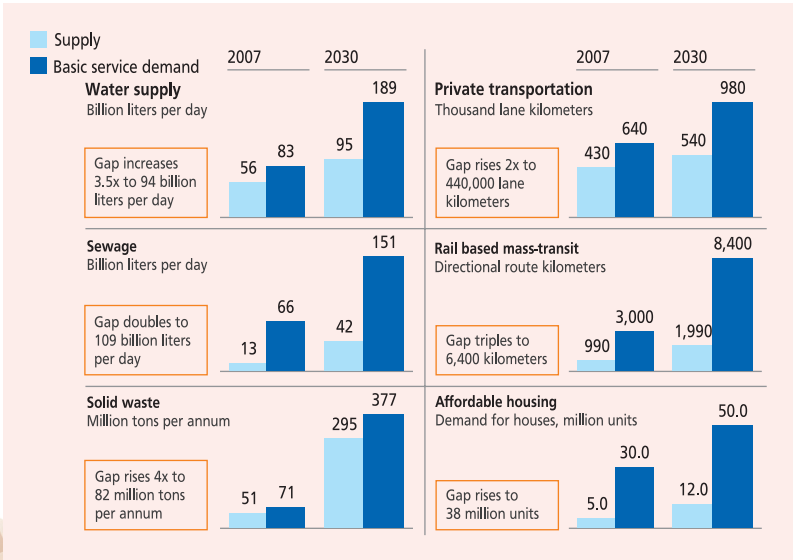

Figure 11: Quality of Urban Services by 2030
Source: Presentation by Mr. Ajit Mohan, McKinsey Global Institute

worsens during the flood season (late July to September).

Uncontrolled growth leading to increased population densities in core city areas and lack of space in low income colonies (including slums), coupled with increasing climate variability creates further problems for the 'planned' basic services of urban areas. Sudden and heavy rainfall leading to landslides and flooding, severe water logging in cities and increasing incidences of heat waves, are among the many climate related events with which cities need to contend. Dr. Shailesh Nayak (MoES) reiterated that climate variability is so large that it is difficult to pick up distinct signals. He pointed out that in the last 100 years, although the overall rainfall has not changed significantly, there is ample and clearly documented evidence that the events of heavy rainfall have increased and low and moderate events have decreased. These impacts of climate change are likely to fall disproportionately on the poor and vulnerable sections of society (see Box 11: Resilience Planning in the context of Climate Change Uncertainty).

Complex relationships also exist between this mix of hazards and the many interrelated components of urban poverty. These components include the inadequate incomes and limited asset bases of the urban poor, as well as very poor quality housing, deficiency of basic infrastructure for providing water, sanitation, drainage and garbage removal and lack of civil and political rights. This greatly increases the vulnerability of the urban poor to most environmental hazards, including those related to climate change (TARU, 2009). Hence it is important to build resilience of the urban poor along with economic development.

However, the core challenges remain the same — growing pockets of poverty (slum areas), increasing problems in provision of basic services, civic infrastructures that are perpetually under stress and governance systems that are ineffective.

Box 11: Resilience Planning in the Context of Climate Change Uncertainty

As with the vulnerability assessment, the resilience planning process took a common approach in Surat and Indore. As an entry point, the team of stakeholders participated in scenario planning exercises. Results of the vulnerability assessments and sectoral studies (identifying current and future risks in specific sectors such as flood risk management, water security, energy security, urban transport, urban environment and public health) provided key inputs to scenario planning. The scenario planning exercise entailed respectively a series of "Risk to Resilience" workshops, consultations for developing plausible urban development scenarios and identifying critical uncertainties, and consultations for developing issue matrices (for each plausible scenario) and identifying short to medium term resilience actions. Four scenarios were developed for each city, with development issues and challenges highlighted in each. Two axes on the matrices indicated economic growth and social cohesion.

Based on the scenarios that were developed, city and sector wide resilience building options were identified through consultations by overlaying the issues with climate change risks. The next step was to rank/prioritise the options based on various indicators that were weighed important by the stakeholders.

A number of the identified options are being taken forward through development of proposals, with core implementation responsibility shared across city-based organisations, such as municipal corporations, government departments, NGOs and academia, as per need. It is heartening to note that theRockefeller Foundation has indicated the proposals on early warning system for flood risk mitigation for Surat and conjunctive use of water resources for Indore as interest areas. However, support from other donors, and most importantly support under relevant programmes and plans of Government of India, is critical for the implementation of the Surat and Indore resilience strategies.

Source: Presentation by G.K. Bhat, TARU

Key Insights and Potential Action Points

Given the seriousness of the issue, the general consensus amongst the participants was that in the context of climate change resilience planning, vulnerability is the top-most priority and is non-negotiable. This sentiment was well captured by Dr. Aromar Revi (IIHS), who said, "In the long term we need to think about mitigation seriously; but for now, it is critical that we adapt."

There are some very obvious interlinkages between systems and services within an urban environment and con-

Figure 12: Example of haphazard growth of cities. Source: Presentation by Prof. Santosh Kumar, NIDM

sequently due to this highly connected nature of risks, both adaptation and mitigation policies and actions need to go hand-in-hand to address multiple sectors and dimensions. The need for an integrated approach was touched upon by Mr. A.K. Mehta, Joint Secretary, MoUD, who in his speech pointed out that there are a number of government schemes for pursuing sustainable urban development adding "... these (various Government plans and programmes) are different pieces of the same jigsaw puzzle and all of them need to fit together into an integrated whole".

Dr. Jyoti Parikh, (IRADe) was of the opinion that the rapid pace of growth of Indian cities has numerous opportunities to showcase clean development. These include inter-alia housing and transport, water supply and sanitation, energy management, health services, waste management and land use planning. Suggested adaptation strategies toward better resilience include early warning systems, enhanced public awareness, training and capacity building, risk spreading and sharing mechanisms such as insurance and infrastructural investments (e.g. stronger embankments and higher capacity drainage systems). Mitigation strategies primarily include technological interventions such as increasing fuel efficiency (or fuel switch) in industries and transport, changes in land use planning, low cost housing and green buildings, etc. (see Box 12: Issues, Challenges and opportunities for low carbon development in India). There was also strong concurrence to the suggestion by many speakers that urban transport and land use planning should be integrated.

"Nearly 70%-80% of India is yet to be built..... but the challenge for India is what and how we tackle this growth in the existing cities"

Ajit Mohan
McKinsey Global Institute

Funding for 'Urban Renewal'

The challenge of urbanization in India With the large scale of India's future urbanisation in mind, Mr. Ashvin Dayal (RF) rightly pointed out "This level of growth will require massive new levels of investment". However, finding resources for financing the kind of 'appropriate' growth of urban centres in India in the coming decades would be a challenge. This was echoed in a report by McKinsey Global Institute that points out, 'Although urban India has attracted investment on the back of strong growth, its cities are still failing to deliver even a basic standard of living for their residents after years of chronic under-investment (MGI, 2010). Mr. J.B. Kshirsagar (MoUD) also corroborated this view in his presentation that there is a huge gap in of the amount of required funds for achieving the 11th Five-Year-Plan targets in respect to urban water supply, sewerage and sewerage treatment, drainage and solid waste management, and that of available/earmarked funds. While the financing requirement has been assessed at nearly 1,300 billion rupees at the 2006 price level, the available funds for the ongoing programmes of JNNURM and UIDSSMT are around 500 billion rupees, leaving a gap of nearly 800 billion rupees. Hence, apart from the JNNURM and UIDSSMT, the resources of the state government, ULBs, financial institutions and private sector have to be leveraged to help urban areas deal with this huge growth challenge.

The 74th Constitutional Amendment Act was also referred to during the presentations and its implications were discussed. The cities present in the workshop highlighted the point that decentralization is often not effective unless there are enough resources. It was also pointed out that the local government should have enough power devolved to raise and spend resources as deemed necessary. Dr. Noor Mohammad (AMDA, NCR) suggested that the state government and the city level ULB's both must undertake reforms as stipulated under JNNURM so as to enhance city's capacity for resource generation. The case of the City of London, where they successfully transformed the transport sector in a relatively short period, was perceived as a model by several city representatives, though they also noted the reasons behind such achievement were a powerful leadership with democratic mandate, focussed organisation, stakeholder support and adequate funding (see Box 13: Transforming London: Initiatives in the Transport Sector).

The role and support of the funding agencies in the form of initial grants was discussed with consensus that although such support is strategic as an entry point or pilot project, it is not a sustainable model unless it is backed with possibilities of scaling it higher by means of additional funding tracks. Hence there is a need to scale-up from grant based models to market based models. In this context, Ms. Manju Mary George, Vice President, Intellcap, discussed the role of the private sector and the need to explore the possibilities of collaboration and engagement. While giving the example of Microfinance as one of the best businesses which shifted from grant based to market based models, she however agreed that, "Although microfinance has shown the way, a successful business model for urban resilience still hasn't emerged".

There were suggestions that the challenges of building resilient societies and cities can no longer be the responsibility only of the government. There is a definite need for participation or partnership with market forces including the involvement of traders, Small and Medium Enterprises and unorganised sectors to leverage investments for sustaining the efforts to adaptation and building urban resilience.

It is vital that the climate resilience agenda needs to be packaged in a way that is attractive to the municipal corporation. In this context the use of cost-benefit analysis as a tool to build consensus, invite participation and investments, etc. in city development projects was also discussed

Box 12: Issues, challenges and opportunities for Low Carbon development in India (using Govt of India programmes, plans and policies as foundation)

Green buildings: Construction sector addresses resource consumption-forthe entire life cycle- from extraction of materials to manufacturing, transportation, construction and operation of the infrastructure/building. Buildings form a significant part of this construction sector. Policy instruments of various types have the potential to effectively promote green buildings both directly and indirectly. India has also implemented a number of policy instruments to address energy efficiency and, to some extent, green buildings.These have had varying degrees of success. An integrated approach to implementing green buildings policies is to create both supply push and demand pull. Guiding the construction sector towards a greener and less energy intensive direction, by means of policy instruments, has its own set of challenges and barriers.Policy instruments, which have the largest potential of making an impact, building/energy codes, and their enforcement is seen as a challenge. It requires details like compliance manuals and software, forms, institutional capacities with well trained officials, effective monitoring and verification system, and above all, a strong political will for implementation.

Mitigation in the transport sector: Cities in developing countriesare experiencing an undesired trend of declining use of public transportation and non-motorized transport. The current urban transportation situation in Indian cities includes adopting high energy and carbon intensive pathways as personal modes of transportation are increasing rapidly and public transport and non-motorized transport is declining. Cities need to restructure their current pattern of transportation growth in order to bring down their CO_2 emissions. This calls for a shift from urban traffic movements to mass transport that includesthe lowest tail-pipe emissions and non-motorized systems. Cities should adopt an 'Avoid, Shift and Improve' approach in their transportation planning. The main goals should be to:

- Reduce utilization of personal modes of transport;
- Increase usage of public transportation and non motorized transport;
- Promote use of clean fuels and technologies, in addition to properly maintaining the in-use vehicular fleet.

Source: TERI

Box 13: Transforming London: Initiatives in the transport sector

In the past one decade London has witnessed a lot of change – significantly in the transport sector where more people than before are walking, cycling, and using public transport and with it, an associated impressive reduction in the number of private cars on the road. Brixton, a once depressed area of London, was showcased as an example of an area that transformed into a much more livable place as a result of this new transport strategy.

These transformations in London's transport system were achieved through a combination of actions. First was the unification of all transport related organizations in the city under the single organizational "umbrella" of the London Transport Organization (LTO). This was accomplished nearly 10-years ago when the Mayor of London city was allocated the powers to bring the various transport related organizations together. The second was the undertaking of an "unprecedented number of stakeholder consultations" with various groups such as the private sector, environmental groups, disadvantaged groups and the public at-large in order to develop a consolidated transport strategy. The third was the awarding to the Organization of high levels of funding with longer funding horizons that enabled them to undertake this transformation.

Having a single entity with strong and motivated leadership is one of the most important factors for the success of this effort. The Mayor of the city heads the Organization and is responsible for all decisions. This organization encompasses all modes of transportation in London which includes the major roads and some part of rail network within the city. This helps in developing integrated plans. For example, planning for buses is done in conjunction with that of roads. A single organization also enabled planning across different modes of transport to get to the 'right' solution.

Another initiative undertaken by the current Mayor of London was to develop in integrated fashion three strategies; strategies for transport, spatial development and the economic development. By this integration, they could develop the correct land-use plan for the transport system and vice versa. The transport strategy has six broad goals that look much beyond direct transport objectives such as the relationship between transport and the economy, quality of life and safety & security. Reducing CO2 emission levels from the transport sector by 60% by 2025 is the only target included in this strategy. One of the major outcomes expected of implementation is a significant increase in the mode share of walking, cycling and public transport.

Reducing emissions is being done by encouraging walking and cycling, use of electric vehicles, hybrid buses, new engine types, declaring low emission zones (where vehicle movement is restricted by engine type) and demand management. Demand management has focused on the introduction of congestion charges levied in certain areas like Central London to help reduce the traffic and use of private vehicles, and a public transport fares policy, like reduced fare categories, that encourages people to use these services.

Challenges being faced are that of growth and that transit options are too unevenly distributed within the city. The LTO plans to increase development of transport options in poorer parts of the city to help regenerate and redevelop such areas. For example, the 2012 London Olympics and Paralympics are planned to be held in the middle of largely unpopulated derelict industrial sites with the idea that this would help in developing this area.

The importance of considering this and other future development patterns and proper planning was showcased with an example of Canary Islands in East London where there are plans to transform a totally derelict area into a highly productive zone with about 90% of the people travelling for work there using public transport.

Source: Presentation by Mr Mike Keegan, Transport Strategy Manager, London

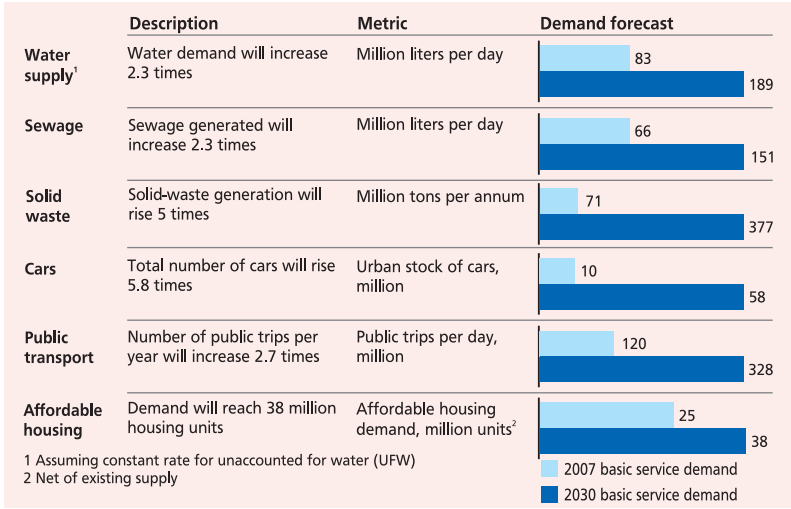

Figure 13: The massive scale of India's urbanization will create a huge surge in demand.
Source: Presentation by Mr. Ajit Mohan, McKinsey Global Institute

(see Box 14: Building Clean and Efficient cities – an ICLEI initiative).

With massive urbanisation on the horizon for India, the time to plan and set the course for climate resilience in cities is now. Large increases in urban populations mean that there will be need to provide basic services such as water and waste disposal on a much larger scale than is presently planned. With this in mind, the government has provided funding through various programmes for investing is city services. Yet the recent investment in basic services, though positive, will be insufficient to meet the basic needs of India's cities in the future. Thus, there is a need for innovative thinking and for

Box 14: Building Clean and Efficient Cities (an initiative of ICLEI South Asia)

ICLEI is a membership organization of local governments and their associations dedicated to a sustainable urban environment. ICLEI South Asia (ICLEI) is implementing the 'Urban Climate Project' in two (2) Indian cities in collaboration with National Institute of Urban Affairs (NIUA). The aim of this three (3) year project is to demonstrate implementation of large scale urban development programmes through a comprehensive and multi-sectoral clean development strategy including technical and implementation support. Under this project, 15 clean development measures would be implemented in the two selected cities through 10 interventions. The idea is to demonstrate implementation of clean and efficient energy technologies in infrastructure project and showcase the GHG emission reduction potential through these measures.

The two cities selected under Step 1 (City Selection) of the project are Rajkot in Gujarat State (western part of India) and Coimbatore in Tamilandu State (southern part of India). The city administration and other key stakeholders were consulted as part of Step 2 of building consensus on the interventions and preparing implementation plans. Step 3 of the project included carrying out an inventory of the energy consumption by type of fuel and also the GHG emission estimates from this consumption pattern. The interventions and implementation was decided based upon this analysis. Actual implementation of specific activities constituted Step 4 of the project that included soft and hard options, viz. energy audits, suggestion on policy intervention, wind-solar hybrid power plant, among many others.

It was estimated under the study that the per capita emission at Coimbatore city was about 1.37 T/yr while that at Rajkot was only 0.67 T/yr. Various implementation projects have already been completed in these two cities, while some are more are planned. They are:

1. Energy saving scheme at New Bus Stand, Coimbatore with a potential of energy savings to the tune of 136,000 kWhr/yr (completed)
2. Wind-solar PV hybrid power plant for the New Bus Stand, Coimbatore (completed)
3. Tube-wells energy audit at Coimbatore (completed)
4. Waste water reuse bye-laws for Rajkot city drafted (completed)
5. Greening guidelines for Rajkot ULBs (completed), to develop a "Green cover development plan for Rajkot city"
6. Green building codes for Rajkot city (in progress)
7. Planned interventions:
   a. Coimbatore: Energy Saving potential under JNNURM buildings
   b. Comprehensive energy policy for Coimbatore city
   c. Waste Water Reuse pilot demonstration project in Rajkot (planned)

Source: Presentation by Mr Emani Kumar, Executive Director, ICLEI South Asia

working with the private sector to leverage the current funding.

Some of the city specific actions suggested were:

- Clean Development Mechanism (CDM) projects linked to municipal function and services.
- User fee charges for basic services.
- Opportunities for private sector involvement in resilience building, including:
  - o Enhancing infrastructure
  - o Improving quality of life
  - o Increasing access to finance
  - o Generating livelihood opportunities (such as tourism)

Figure 14: Water logged slum in Gorakhpur

Urban Development in India: Policy and Programme Landscape

"The National Mission on Sustainable Habitat … is about integrating climate concerns into the way we do things [to address] urban development issues"

A K Mehta, Joint Secretary, MoUD

Climate Change will exert additional stress on existing challenges to urban development, as presented in earlier sections and discussed at the two day Workshop. In this section, we draw a canvas of current initiatives taken on by the Government of India (GoI), State Governments and urban local bodies (ULBs) for the development of related work in the Indian cities.

Recognizing the severity of climate change and its impacts on the development of the country, the top leadership in India constituted a special cell – Prime Minister's Council on Climate Change – to address this issue and provide guidance support to other National Programmes. As presented by Dr. Jyoti Parikh (IRADe), the GoI drafted the National Action Plan on Climate Change, which consists of eight missions. Six of these (National Mission on Sustainable Habitat, National Solar Mission, National Mission for Enhanced Energy Efficiency, National Water Mission, National Mission for a Green India and National mission on Strategic Knowledge for Climate Change) deal directly with issues of urban development. In regards to the issues of poverty, urban development and climate change, the National Mission on Sustainable Habitat (NMSH) stands out as the premier effort, and the Ministry of Urban Development (MoUD) is acting as a nodal point for its implementation.

Urban development is a state subject, hence all major decisions concerning legislation, financing and implementation are taken at the state level. That said, the programme, policy support and guidance are issued from the Centre and State Governments (to a lesser extent). The key initiatives in urban development fall under the purview of two main ministries. As illustrated in the presentation by Dr. Noor Mohammad (AMDA, NCR), they are: a) the Ministry of Urban Development (MoUD) and, b) the Ministry of Housing and Urban Poverty Alleviation (MoHUPA). The former is mandated with development of city infrastructure while the latter is responsible for housing and provisioning basic services for the urban poor, including slum dwellers. Apart from these, ministries such as the Ministry of Home Affairs (MHA) and Ministry of Power (which deals with energy conservation and efficiency), also have several programmes that are being implemented in urban areas.

The GoI, under the various Centrally Sponsored schemes and programmes being planned and implemented through its ministries, allocates resources to State Governments, provides finances through national financial institutions and also supports externally aided programmes for urban development in the country. The State Governments are responsible for allocating central funds to various cities in their respective states for specific sector related work. This is carried out through their Urban Development Departments and is based upon the demand from

the cities and the available resources. The cities, in turn, have particular departments for various sectors (water, energy, tourism, transport, etc.) and require implementation strategies that are context specific.

The city governments however, play a central role in planning for urban development and implementation (which includes low carbon growth pathways and adapting to climate change), with direct jurisdiction over provision of basic services and on public and private development activities in the cities. With the 74th Constitution Amendment Act (Schedule XII), the municipal governments have the sole responsibility to undertake nearly 18 core city functions.

Policies and programmes for urban development

- The 74th Constitutional Amendment Act promotes decentralization through devolution of funds, functions and functionaries to ULBs. Funding from the GoI is linked to reforms at the state level – such as implementation of the 74th Constitutional Amendment at the level of ULBs (accounting, governance and property tax reforms and internal earmarking of funds for services for poor, etc).
- The National Mission on sustainable Habitat is a policy and legal framework for promoting climate resilience for sustainable urban development and feeds into other national programmes like JNNURM. It promotes the integration of climate concerns into the City Master Plans by enhancing the energy efficiency of buildings and commercial sectors, effectively managing solid waste and supporting shifts towards public transport.
- Sectoral policies (on water, energy, transport, buildings, etc.)

In addition to National Water Policy and National Environment Policy that governs urban development, the following are key sectoral policies in the context of climate change:

- The National Urban Transport Policy (NUTP) calls upon state governments to discourage the use of personal vehicles and increase the share of public transport. The JNNURM has made funding for transport projects in cities conditional upon the proposals conforming to the NUTP.
- The Bureau of Energy Efficiency (BEE), established under the Ministry of Power, has the mandate to promote energy efficiency as well as seeks to promote awareness and establish higher energy performance levels by developing energy efficiency standards for high energy use equipment and appliances.
- Energy Conservation Building Code (ECBC) 2007 is another policy support tool developed by the BEE with an aim to reduce energy consumption in commercial buildings by setting minimum energy performance standards for building envelopes, mechanical systems and equipment, heating, ventilation and air conditioning systems, interior and exterior lighting systems, electrical power and motors.
- The National Electricity Policy 2005 stipulates that the share of electricity from non-conventional sources should be increased and that such technologies need to be promoted. The Integrated Energy Policy, 2008 aims to address energy security in the country along with meeting the energy demand from all sectors in India with safe, clean, convenient and affordable energy options.

Programmes

- Jawaharlal Nehru National Urban Renewal Mission (JNNURM) (2005-2012) seeks to create economic productivity, efficiency and equity in the 65 cities it has chosen in India. Through its two missions, JNNURM provides entry points for urban climate resilience. The first mission, 'Urban Infrastructure and Governance,' pursues reform and planned development of cities through efficient urban infrastructure and service delivery mechanisms, community participation, accountability of ULBs/ State agencies and preparation of city development plans. The second mission, 'Basic Services to Urban Poor,' supports development of slums through initiatives that are aimed at providing shelter, services and other basic amenities for the urban poor.
- In non-JNNURM cities and towns, the government is financing another programme—the Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT). This programme subsumes two erstwhile programmes – Integrated Development of Small and Medium Towns and Accelerated Urban Water Supply Programme – and aims at improving the urban infrastructural facilities and providing quality oriented basic services in cities and towns.
- Rajiv Awas Yojana (RAY) was announced in 2009 and aims at providing low cost housing along with basic infrastructure and services for the urban poor. Recognizing that the rise of slums is rooted in a lack of proper urban planning, the scheme focuses on issues that lead to the development of slums, such as a shortage of land, housing infrastructure and basic services.
- Solar Cities Programme: The government of India, under the Ministry of New and Renewable Energy, plans to develop 60 'model' cities in the country during the 11th Five Year Plan (2007-12). With this, at least 10% of the city's energy requirements will be met through renewable energy sources. This initiative is supported majorly by the central government funds, with additional support from the state government and city ULBs.
- As presented by Professor Santosh Kumar (NIDM), the GoI's Disaster Management Act (2005) provides a constitution for NDMA and State Disaster Management Authorities (SDMA), outlining holistic and integrated approaches to disaster management, including prevention, response and mitigation (MHA).

Issues and Challenges

From the above, it is clear that there are enabling policies and programmes that promote urban resilience and low carbon growth. However, the implementation of these policies and programmes at the state and city levels is driven by the degree of understanding of climate change impacts and challenges as well as the capacity to incorporate climate change concerns in urban development plans and projects, and capacity to implement and monitor. Furthermore, the support of Central Assisted programmes can be leveraged only by the states/cities that can show commitment to such goals. Below, we address key challenges and issues in implementation of policies and programmes at the state/city level:

- As presented by Dr. Shailesh Nayak (MoES), there is a need to improve capacity and enhance efforts for generating data on area specific (city scale) climate change impacts.
- Mr. V.P. Kulshrestha (IMC) pointed to a lack of awareness and understand-

ing of climate change impacts that hinder the ability of ULBs to use an integrated systems framework.

- Poor or low-level devolution of powers to ULBs as discussed by Dr. Noor Mohammad (AMDA, NCR).
- Lack of an adequate database of physical assets, such as housing, infrastructure and natural resources.
- Low recovery of ULB taxes constrains finances and inhibits the ability of ULBs and the State to share project sourcing under central assistance.
- Lack of capacity to plan, develop, implement and monitor projects in various sectors, such as water supply, sewerage infrastructure, transport and energy, which incorporate climate change concerns.
- Lack of political will at the state level for reform and decentralization, as voiced by Dr. Anju Chowdhary, Honourable Mayor of Gorakhpur.

Conclusion & Points of Entry

Discussions at the Workshop highlight that the time to act and act 'right' is now. India is urbanising rapidly. This rapid pace alone will strain conventional approaches to urban development. In conjunction with the projected impacts of climate change on fragile systems and marginal populations, the challenge is massive.

Most of urban India is yet to be built. If started now, initiatives have the chance to shape that built environment and the institutions that govern it in ways that contribute to both resilience and low carbon development. To achieve this, effective approaches need to be demonstrated, capacity and understanding need to be built and patterns of vulnerability need to be addressed. While government schemes for pursuing sustainable urban development exist, there remain major gaps in the funding needed to meet investment requirements for sustainable development. National and global funding sources to address climate change may become available, but these will only be accessible if effective ways of using it can be demonstrated. As a result, the time to act is now.

Climate resilient, low carbon approaches to urban development require knowledge. Improved data and information on the impacts of climate change are essential but on their own will be insufficient. Data needs to be translated into understanding and understanding into practical courses of action. This requires improved approaches to communicating climate information and incorporating it into plans at the city level. It also requires a much better understanding of urban systems and how they contribute both to sustainable and equitable development and climate resilience. Systems for disaster risk reduction and response, water supply, flood and drought management, temperature control, shelter, power, food, transport and communication: all these systems are in themselves vulnerable to climate change and - if appropriately designed, maintained and operated - can contribute to climate resilience. Systematic approaches to diagnosing the strength and vulnerability of institutions, organisations and physical infrastructure as climate changes are essential. Cities need to know what systems are exposed to impacts for climate change and to understand the often mundane, yet practical steps required to build resilience. Flood control systems will not work if drains are clogged because the institutions for solid waste management are ineffective. Water supply systems will not work if energy supplies are erratic and vulnerable to climate change.

Beyond systems, approaches to building resilience must benefit poor and vulnerable communities. As the eminent Planning Commission member Mr. A.K. Maira (GoI) stated, "Whose city is it anyway?" Socially marginal groups are often particularly affected by the impacts of climate change because they lack access to

the benefits generated by well governed urban systems. Furthermore, the best laid plans will never be implemented if they are incapable of generating a broad base of political support. Socially inclusive, climate resilient urban development requires incorporation of multi-stakeholder processes that, in action and in word, generate benefits for poor and marginal communities as well as the wealthy. Development of broad based and effective stakeholder engagement and planning processes that incorporate understanding of climate change, vulnerable systems and social marginality are essential.

The time then, is also now to address issues of poverty, and its intersection with vulnerability and climate change. The national government has several programs that directly or indirectly address issues of development, the environment and poverty (e.g. National Mission on Sustainable Habitat see section XXX for a more thorough listing). Through such efforts, strategies to address energy usage, transport, and the like can "build-in" mitigation while 'informed' planning can also enhance resilience.

An area of overlap is in housing for the poor. Under the national programmes like the Rajiv Awas Yojana as part of the JNNURM, there is provision of improved housing for urban poor and slum dwellers. Incorporating climate change knowledge into these programmes would translate into housing development plans that consider climate vulnerabilities of say, locations where these houses for poor are to be built (as was presented in the case of Surat city).

Learning is also essential. Effective approaches will take time to develop. A generational transition is required in the ability to work with emerging knowledge on climate, urban resilience and low carbon growth. Unless this becomes part of the day-to-day knowledge of urban planners, transport designers, water managers, politicians and vulnerable communities, it is unlikely to translate into the practical courses of action that are central to the operation of any urban area. Even at policy levels, learning is essential. To incorporate emerging knowledge and experience, policy formulation has to become an iterative process that allows time for monitoring, documentation, reflection and if need be, course correction.

We also need to look beyond the city's borders when considering climate vulnerability. For new arrivals, city cores are often crowded, expensive and potentially dangerous places to setup homes. Thus for migrants to a city, the peri-urban areas offer easier access to land and fewer threats to their lives and property. The development of and improvements in road networks and the arrival on the market of cheaper modes of private transport has enabled greater access to core city functions such as markets and livelihoods from further afield. Food, water as well as raw materials processed by the city are all brought in largely from outside city confines. Thus cities are also vulnerable to climate impacts beyond their borders, sometimes beyond the borders of their nation. An example of this comes from Manila where, upon analysis, they discovered that 20% of the city's population was dependent on inexpensive rice imported from Vietnam's Mekong Delta which is itself threatened by increasing salinity in the groundwater, temperature increases and ultimately inundation by the sea in the coming decades.

The size of a city is also important to consider. It is important to note the differences between engaging with small and medium sized cities versus the mega-cities with populations of a million or more. Million-plus cities have often been described as a series of contiguous, tightly interlinked smaller cities as realized through ward and neighbourhood. Thus mega-cities offer both the ability to act at a small scale, through ward and neighbourhood scale work, while also offering economies of scale to address issues that result in large-scale impact,

such as improved public transit systems. But the analogy of a neighbourhood as a smaller city breaks down with the added complexity of its interaction with the large scale systems of a mega-city. This added complexity can bring benefits, like livelihood diversification and more resources for improved urban services that are unavailable in cities of smaller size, but can also bring conditions such as immense slums that could not exist in isolated cities of smaller scale.

Cities of smaller size on the one hand tend to have less complexity in their various systems, be they institutional, social or infrastructural, easing somewhat the process of engaging on and enhancing climate change resilience on a city-wise basis. On the other hand, small cities often do not have the financial and human resource to leverage and due to the more tightly interlinked city-wide economic and social nature, tend to require a more well-coordinated step-by-step approach towards resilience building than in larger cities.

It is also interesting to note the importance of institutional capacity when working in the cities. Of note are the contrasts between two cities, Surat and Gorakhpur presenting at the workshop. Both the municipal commissioner and the health advisor from Surat presented on the activities underway in Surat to build climate resilience. In the Commissioner's presentation she highlighted all the proactive measures that the city presently undergoes to decrease risk and promote readiness for disaster. From dredging of open drainage canals, cleaning of manholes and drainage chambers, construction of new storm sewers to mock drills and practice rescue, Surat shows its capacity to coordinate within and between departments to instill and maintain resilience.

This capacity was further highlighted by Dr. Vikas K. Desai, Honorary Technical Advisor for Reproductive and Child Health of the Surat Municipal Corporation who presented on how the health department communicates and coordinates with the Surat Municipal Corporation during floods. Both presenters show the high levels of cross-departmental and intra-departmental communications and coordination that can be achieved when priority is given to such work.

Gorakhpur offered a contrasting example. The Honourable Mayor of Gorakhpur, Mrs. Anju Chowdhary, lamenting upon the lack of coordination between or within departments in the city government said that "…. no department wants to give any cooperation to each other", a point that had been highlighted earlier by Dr Shiraz Wajih from GEAG – a local city based NGO. A similar lack of cooperation was experienced in Indore as described in the ACCCRN vulnerability assessment (ACCCRN, 2009), where they found inadequate communication and coordination between several departments of the Indore Municipal Corporation. The experience of Surat thus is more the outlier than the norm. An outlier based on the combined influence of cultural expectations, financial capacities, and dynamic leadership that most cities in India do not possess – all at the same time. Unfortunately on the spectrum of cities needing to address climate change resilience, the vast majority will lay closer to Gorakhpur and Indore in institutional capacity and motivation. As such they (Gorakhpur and Indore), serve as excellent cases of what can nonetheless be achieved. For example, in Indore, the city government is now motivated to undertake an action research project on conjunctive water use in a local area that includes working with diverse groups of water users and suppliers – to look for solutions to chronic water shortage in the city. In Gorakhpur, notwithstanding the apathy of the ULBs, a citizens' movement was triggered through mass campaign for conservation of a local lake which also acts as natural drainage of the city.

Improving how cities respond to the

needs of the climate change agenda in their development work also requires improved efforts at benchmarking. Mr Ajit Mohan (McKinsey Global Institute) emphasized upon the importance of strengthening benchmarking, and results and analysis in urban development context towards responding better to the climate change agenda while Mr A. K. Mehta (Joint Secretary, MoUD) agreeing to the above said that such service level benchmarks would be a part of the sustainable habitat parameters as part of the National Mission on Sustainable Habitat.

Finally, it is important to recognise that socially inclusive, climate resilient approaches to urban development will require diverse forms of action. Cities are different. Individual interventions, however large they may be, on their own cannot address the multidimensional challenges required to respond to major change processes such as urbanisation and climate change. Silver bullets do not exist. Many "10% solutions" are essential. The challenge is to start.

Points of Entry

What are the practical points of entry for starting? Based on discussions at the workshop, it appears that a multilevel approach is needed:

1. Pilot activities for urban planning and to support implementation are essential to demonstrate what can be achieved. The ACCCRN program has substantial experience that can be drawn on – but to be convincing the range of cities involved needs to be expanded and the level of involvement deepened.
2. Refined methods for resilience planning, learning and stakeholder engagement need to be developed and deployed to support building resilience. Existing planning processes are weak and cities are generally at a loss regarding how to utilise information on climate. Methods developed under the ACCCRN and other programs represent a starting point but need to be refined and deployed in diverse contexts.
3. Data, information, knowledge, and the ability to utilize these in applied planning processes need to be improved. If they are to be effective, planning and implementation processes need to be informed by the best available information on climate change, the fragility and resilience of urban systems and the factors affecting social marginality.
4. Pilot implementation activities are required to demonstrate how plans can translate into action. Far too often, plans remain on the shelf. Practical methods for cross-departmental cooperation, linking plans with national and other sources of funding and building broad based political support for implementation are essential and need to be demonstrated and tested through pilot activities.
5. Learning to build capacity is essential. However well conceived initial approaches may be, strategies for socially inclusive climate resilient urban development will take time to develop. Some strategies will prove ineffective, new climate information will emerge and cities will face different challenges. If work in an initial set of cities is to catalyse large scale change, processes that support documentation and learning will be essential in order for all those involved to build capacity.
6. Links with state governments, programmes and policy processes need to be developed. Systems cross city boundaries and the scope of action for municipalities is often determined by policies and programmes framed at the state level. As a result, initial

activities at the city level need to be effectively linked with state level processes.

7. Practical links with national policy processes and programmes need to be established. Organizations such as the Planning Commission influence the policies and programmes of the multiple ministries (from power and water supply to urban development) that affect cities' access to programmes and funding. Programmes such as JNNURM and the Sustainable Habitat Mission (SHM) represent initial points of entry where the ability to access national programmes can be tested and could provide the basic funding cities require for major infrastructure or other interventions.
8. Programmes need to link with global processes by providing input on climate resilient development to the Intergovernmental Panel on Climate Change (IPCC) and other such bodies. These processes may determine future global funding flows and influence the ability of cities to access such funds. Demonstrated effective courses of action for building climate resilience and addressing the needs of vulnerable communities at the city level will represent valuable currency in global debates.
9. Donor coordination: The time is short, the challenges massive and available sources of funding limited. Donors need to avoid "reinventing the wheel" and develop cooperative activities that support governments, communities and other actors in developing effective strategies for building socially inclusive climate resilient urban areas.

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5	Mr. Navin Kumar	Secretary, MoUD
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11	Dr. Noor Mohammad	Chairman, AMDA & Member Secretary, NCR Planning Board
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The UK Department for International Development (DFID) has been supporting urban poverty reduction and urban development in India for more than 20 years. It recently concluded a highly successful partnership in Andhra Pradesh and has current partnerships in the West Bengal, Madhya Pradesh and Bihar. It recently began a national partnership with the Ministry of Housing and Urban Poverty Alleviation on the JNNURM and Rajiv Awas Yojana and is actively supporting the Ministry of Urban Development's city sanitation and service level benchmarking approaches. DFID has identified the urban habitat as a key sector for promoting low carbon development and climate resilient pathways. http://www.dfid.gov.uk/Where-we-work/Asia-South/India/

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